# ESTUDO DOS MÚSCULOS ROTADORES DA COLUNA VERTEBRAL EM PACIENTES COM ESCOLIOSE IDIOPÁTICA DO ADOLESCENTE E ANÁLISE DA EXPRESSÃO TECIDUAL DO GENE DA ENZIMA CONVERSORA DE ANGIOTENSINA I (ECA).

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# RESUMO

A escoliose idiopática do adolescente (EIA) é um desvio lateral da coluna vertebral associado a rotação vertebral cuja etiologia não está definida. Existem várias teorias propostas, mas nenhuma absolutamente conclusiva. Desde o século 19 relatou-se o acometimento da musculatura dorsal como responsável pela deformidade. Autores sugeriram que o acometimento da musculatura poderia ser primário, por meio de miopatia afetando principalmente a musculatura eretora e rotadora paravertebral, porém também foi sugerido que o padrão de acometimento da musculatura poderia ser decorrente de doença neuromuscular.

Recentemente autores procuram relacionar polimorfismos genéticos a EIA., alguns polimorfismos têm sido relacionados ao desempenho físico, por meio de influência no tecido muscular, entre eles destaca-se o gene da enzima conversora de angiotensina (ECA), com inserção (alelo I) ou deleção (alelo D) de 287 pares de base, agindo na produção de Angiotensina I, substância com ação vasoconstritora, podendo influenciar músculos com características aeróbicas (prevalência de fibras tipo I), como os eretores e rotadores da coluna vertebral.

Com a finalidade de avaliar a relação do polimorfismo do gene da ECA com o desenvolvimento da EIA, o projeto tem como objetivo analisar os achados histológicos dos músculos rotadores da coluna vertebral, coletados durante a cirurgia corretiva, quantificar a expressão gênica da ECA no tecido coletado, correlacionando com o respectivo polimorfismo.

STUDY OF SPINE MUSCLES ROTATORS SPINE IN PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS AND ANALYSIS OF GENE EXPRESSION OF TISSUE ANGIOTENSIN CONVERTING ENZYME (ACE).

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ABSTRACT

The adolescent idiopathic scoliosis (AIS) is a lateral deviation of the spine associated with vertebral rotation whose etiology is not defined. There are several theories proposed, but no absolutely conclusive. Since the 19th century it was reported the involvement of the dorsal musculature as responsible for the deformity. Authors suggested that the involvement of the muscles could be primary, by erecting myopathy mainly affecting the paraspinal musculature, but it was also suggested that the pattern of involvement of the muscles could be due to neuromuscular disease.

Genetic polymorphism is characterized by variations in non-repetitive sequences present in the genome, the most common being the single nucleotide (SNP) as well as insertion and deletion polymorphisms. Some polymorphisms have been linked to the physical performance by influence of the muscle tissue between them stands gene angiotensin converting enzyme (ACE) inhibitors, with insertion (allele I) or deletion (allele D) of 287 base pairs acting in the production of angiotensin I, substance with vasoconstrictor and may influence muscle with aerobic characteristics (prevalence of type I fibers) like the erector and rotators of the spine.

In order to assess the relationship of polymorphism of the ACE gene with the development of the AIS the project aims to analyze the histological findings of the rotator muscles of the spine collected during corrective surgery to quantify the gene expression of ACE in tissue collected correlating with the respective polymorphism.

Realizações no período:

Estudo foi realizado em pacientes com EIA, acompanhados no ambulatório de coluna vertebral, que foram consecutivamente incluídas para tratamento cirúrgico. Este trabalho foi aprovado pelo comitê de ética em pesquisa (CEP nº 0043/10), atualizado em 23/04/2014, com comprovante de cadastro institucional 427145 (ambos gravados no arquivo "comitê de ética"). Os pacientes assinaram termo de consentimento informado livre esclarecido (maiores de 18 anos) e o termo de assentimento (para os menores).

Material obtido por meio de biópsias dos músculos rotadores da coluna vertebral no intra-operatório das cirurgias para correção e artrodese da escoliose, nos lados côncavo e convexo da deformidade, para estudo histológico e da expressão proteica. A coleta das amostras de músculo foi realizada com apoio técnico dos colaboradores Délio Eulalio Martins Filho e Rafael de Paiva Luciano, durante o ano de 2014.

Foram utilizadas técnicas de rotina de coloração, a partir de Outubro de 2014, que incluiram a hematoxilina-eosina (HE) e Sudan vermelho. A avaliação das lâminas, realizada nos meses de novembro e dezembro de 2014, consistiu na análise de alguns critérios que incluiram atrofia, hipertrofia, proliferação gordurosa, presença de fibrose endo e perimisial, presença de fibras hialinas, proliferação mitocondrial, e necrose muscular, centralização nuclear, "typegrouping" e inflamação, sob orientação e apoio técnico dos colaboradores Acary Souza Bulle Oliveira e Benny Schmidt.

Os resultados desta fase mostraram fibrose muscular, tanto endomisial quanto perimisial e a involução gordurosa foram as variáveis que demonstraram significância quando comparadas nos dois lados da vértebra apical. Também são descritas as demais alterações musculares observadas, destacando-se a presença de fibras hialinas, necrose das fibras musculares e centralização nuclear, inflamação, atrofia muscular e proliferação mitocondrial e áreas delimitadas nas fibras musculares, com baixa atividade oxidativa, sugestiva de miopatia tipo "central core". Os referidos resultados foram analisados, discutidos e publicados previamente [35].

Conforme cronograma apresentado (página 12,13 e 14), iniciamos a análise da expressão do gene da ECA entre os meses de fevereiro e outubro de 2015, no Laboratório de Biofísica da UNIFESP, sob coordenação do Dr. Sandro Soares de

Almeida e orientação do Professor Ronaldo de Carvalho Araújo, analisando os resultados, com analise estatística, entre os meses de novembro de 2015 e março de 2016.

Os resultados são apresentados por meio de gráficos (página 11), com análise da expressão tecidual do gene da ECA nos fragmentos musculares biopsiados durante o procedimento mencionado, considerando o genótipo do polimorfismo do referido gene (DD, II, ID), comparando a convexidade e concavidade, não havendo diferença estatística entre os lados da curva escoliótica

O artigo para publicação foi escrito durante os meses de maio e junho de 2016, enviado para publicação na BMC Pediatrics em 30/08/2016 para análise, sendo negado para publicação somente em 06/02/18 devido a falta de 1 revisor (a justificativa está na pasta "publicações e apresentações em eventos" anexo no CD).

## III) JUSTIFICATIVA

A etiologia da EIA ainda permanece obscura. Durante muitos anos foram realizados trabalhos buscando avaliar alterações nos tecidos envolvidos com a deformidade desta doença. Com o desenvolvimento dos estudos genéticos, as pesquisas foram direcionadas para a correlação entre o fenótipo dos pacientes e os possíveis genes responsáveis.

Tal evolução ocorreu no Grupo de Coluna Vertebral do Departamento de Ortopedia e Traumatologia da UNIFESP, pois em 1998 foi realizada análise histoquímica de biópsias dos músculos rotadores da coluna em pacientes com EIA, descrevendo um padrão relacionado a doença neurogênica (Chagas et al.).

Em 2005, 2010 e 2013 (Wajchenberg et al.), este mesmo grupo descreveu respectivamente, a frequência desta doença no nosso meio, realizou estudo de ligação genética e avaliação do polimorfismo do gene da ECA e Actinina 3 em uma família com múltiplos membros acometidos pela EIA. Atualmente continuamos estudando o polimorfismo do gene da ECA, em projeto de mestrado do aluno Rafael de Paiva Luciano, com apoio da FAPESP (processo 2012/00636-0), comparando pacientes com indicação de cirurgia corretiva em relação a população não afetada.

Agora pretendemos correlacionar todos os estudos prévios, atualizando os conceitos do estudo realizado em 1998, por Chagas et al, inserindo a experiência obtida com os estudos genéticos.

## IV) DESAFIOS CIENTÍFICOS E TECNOLÓGICOS

O principal desafio desta pesquisa é a interação entre a área de atuação cirúrgica, com análise clínica, relacionando-se com ciência básica. Em trabalhos anteriores houve a possibilidade de trabalho conjunto de ortopedistas (UNIFESP) com biólogos de outro serviço (Projeto Genoma da USP), na tentativa de correlacionar a EIA com determinada região cromossômica. O projeto de pesquisa proposto atualmente iniciou-se dentro do ambiente universitário (UNIFESP) com a participação de cirurgiões especializados em coluna vertebral, médicos especialistas em doenças neuromusculares e biólogos do setor de Biofísica, acostumados com pesquisa biomolecular. Desta forma foi possível ultrapassar os desafios tecnológicos exigidos em cada uma das respectivas áreas de atuação, devido ao conhecimento adquirido e comprovado pelas publicações cientificas. A UNIFESP atende todos os requisitos científicos e tecnológicos pela proximidade das disciplinas envolvidas, permitindo que o material coletado durante o procedimento cirúrgico possa chegar rapidamente aos laboratórios de Doenças Neuromusculares e Biofísica, sem que haja dano tecidual. Seguimos, desta forma, um modelo moderno de relacionamento interdisciplinar, procurando a interação de diferentes áreas no esforço para entender melhor as possíveis causas da EIA.

Tanto o laboratório de Doenças neuromusculares como o de Biofísica possuem ampla experiência neste tipo de pesquisa, possuindo as técnicas necessárias para este trabalho.

## V) PACIENTES E MÉTODOS

Foram estudadas amostras de músculos rotadores da concavidade e convexidade, no ápice da deformidade coluna vertebral, de 21 pacientes do gênero feminino com escoliose idiopática do adolescente. O diagnóstico de EIA foi confirmado por meio da história clínica, exames físico geral, ortopédico específico e radiológico, no ambulatório de coluna vertebral do Departamento de Ortopedia e Traumatologia da Escola Paulista

de Medicina, Universidade Federal de São Paulo (UNIFESP-EPM), seguindo os seguintes critérios:

A. De inclusão

- Adolescentes (entre 10 e 19 anos)
- Indicação de tratamento cirúrgico
- Não tratados operados previamente
- Desejo de participar do estudo

B. De exclusão

- Presença de doenças que afetam o metabolismo ósseo, como hiperparatiroidismo, hipertiroidismo, diabetes melito e síndrome da má absorção
- Uso de drogas que sabidamente alteram o metabolismo ósseo, como corticosteróides, heparina, anti-ácidos contendo hidróxido de alumínio, metabólitos da vitamina D, anticoncepcionais orais, diuréticos de alça e anticonvulsivantes orais.

Coleta do material e análise histológica

Material obtido por meio de biópsias dos músculos rotadores da coluna vertebral no intra-operatório das cirurgias para correção e artrodese da escoliose, nos lados côncavo e convexo da deformidade, para estudo histológico e da expressão proteica, com aprovação pelo Comitê de Ética em pesquisa da Universidade Federal de São Paulo/Hospital São Paulo (parecer 0043/10). A coleta das amostras de músculo seguiu a técnica descrita por Schmidt et al[32]. O material foi levado ao laboratório, onde foi armazenado sob temperatura de -80°. Após realização de cortes seriados em criostato a -22°C, serão utilizadas técnicas de rotina de coloração que incluirão a hematoxilina-eosina (HE) e Sudan vermelho. A avaliação das lâminas consistiu na análise de alguns critérios que incluirão atrofia, hipertrofia, proliferação gordurosa, presença de fibrose endo e perimisial, presença de fibras hialinas, proliferação mitocondrial, e necrose muscular, centralização nuclear, "typegrouping" e inflamação.

Extração do RNA

A extração do RNA foi realizada utilizando o reagente TRIZOL® (Invitrogen Corporation, Califórnia, USA). O TRIZOL® é um reagente utilizado para o isolamento de RNA de células e tecidos e que consiste em uma solução monofásica de fenol e isocianato de guanidina.

Após homogeneização com TRIZOL®, as amostras ficaram em repouso a temperatura ambiente por 5 minutos. Em seguida, foi adicionado 200 μL de clorofórmio e os tubos agitados no vórtex por cerca de 15 segundos cada. Após repouso de 3 minutos a temperatura ambiente, as amostras foram centrifugadas a 12000 g por 15 min. a 4 °C. Com auxílio de um pipetador automático de 100 μl foi retirada a porção superior (aquosa - contém o RNA) e transferida para outro tubo. Foi utilizado 500 μL de isopropanol para precipitar o RNA (incubar por 10 minutos a temperatura ambiente). Em seguida, centrifugar a 12000 g por 10 minutos e 4°C e retirar cuidadosamente o isopropanol utilizando um pipetador. Será adicionado 1 mL de etanol 75 % para retirada do sal proveniente do Trizol e centrifugadas a 7000 g por 5 min. a 4°C . Todo o álcool foi retirado delicadamente e os tubos deverão permanecer abertos para secar totalmente (cerca de 10 minutos). O "pellet" de RNA foi diluído em água DEPC.

## Quantificação do RNA

O RNA foi quantificado por leitura espectrofotométrica no comprimento de onda de 260 nm. Em todas as leituras será observado se a absorbância obtida está dentro da faixa de linearidade da técnica (entre 0,1 e 1). A quantificação foi realizada sempre em duplicata. O grau de pureza do RNA foi determinado pela relação dos valores de leitura da absorbância a 260 e 280nm (valores próximos a 2,0 ±0,05 indicam alto grau de pureza).

## Eletroforese de RNA

A eletroforese para separação do RNA foi realizada em gel de agarose (1%). As amostras (cerca de 15 μL) serão preparadas com tampão de amostra (63 μL de água bidestilada previamente tratada com DEPC, 81 μL de formaldeído, 48 μL de glicerol + azul de bromofenol, 48 μL de MOPS 10x, 0,5 μL de brometo de etídio a 10 mg/mL). Após este tratamento, as amostras foram aplicadas no gel e iniciada a eletroforese (100 V por 60 minutos).

Após a separação por eletroforese, a visualização das bandas foi realizada por exposição do gel à luz ultravioleta.

**RT-PCR Real Time**

Uma amostra de 3μg de cada RNA foi submetida a reação de transcrição reversa com *primers* randômicos. A cada tubo foram adicionados: 3 μg do RNA total, tampão DNAse 10x e DNAse (1U/μL). Após incubação de 25 minutos a 25°C a DNAse foi inibida com EDTA (25 mM), em seguida adicionados primers randômicos (146 ng/ μL) e os reagentes tampão RT 5x, DTT (100 mM) e dNTP mix (10 mM). A enzima Tanscriptase Reversa SuperScript III foi adicionada e as amostras incubadas. A reação foi realizada utilizando termociclador Multicycler PTC-0200 (Mj Research, Inc, Walhan, MA, USA).

A expressão gênica foi avaliada por PCR em tempo real utilizando o equipamento ROTOR GENE 6000 (Corbett Research, Mortlake, Australia) e o SYBR GREEN (Invitrogen, Carlsbad, CA, EUA) como marcador para quantificação fluométrica. A expressão da GAPDH foi determinada em paralelo como controle interno (gene normalizador). A intensidade de expressão de cada gene obtida pelos valores de CT (*Threshold Cycle*) ou limiar do ciclo, onde o aumento no sinal associado à fase exponencial de amplificação do produto de PCR começa a ser detectada. O valor do CT é o número de ciclos calculados, no qual o produto do PCR atinge um limiar de deteccção. Trata-se do ciclo em que a fluorescência detectada é estatisticamente diferente do efeito de fundo (*background*). O CT é inversamente proporcional ao log do número de cópias da amostra, de maneira que quanto maior a expressão de determinado gene na amostra, menos ciclos são necessários para o alcance do CT[33].

Para a quantificação relativa dos produtos de amplificação, feita a análise de eficiência de amplificação do gene alvos e do controle interno. A eficiência de cada primer foi realizada com o cálculo da inclinação da reta (*slope*) dos pontos de CT obtidos em relação a concentração de cDNA presente na amostra, calculada de acordo com a fórmula: $E= 10^{-1/a}$ onde *a*, é o coeficiente angular da reta[34].

## RESULTADOS

Foram incluídos 21 pacientes do gênero feminino com escoliose idiopática do adolescente. A média e mediana de idade foi, 14,8 e 14 anos respectivamente, a média

do valor angular das curvas principais torácicas foi de 68º Cobb e nas curvas toracolombar/lombar de 77,5º Cobb. Os dados gerais com distribuição por idade, grau de curvaturas, classificação de Lenke e King e o genótipo da ACE encontram-se na tabela 1.

Tabela 1 - Dados gerais com distribuição por idade, grau de curvaturas, classificação de Lenke e King e o genótipo da ACE

| Série | Idade | Valor Angular da Curva | Tipo Curva Lenke | genótipo |
|---|---|---|---|---|
| 1 | 13 | T1-T6 - 58°/ T6-L1 - 90°/ L1-L4 - 25° | Lenke 2AN / King V | II |
| 2 | 14 | T5-T10 - 52° / T10-L4 - 64° | Lenke 6CN / King I | II |
| 3 | 12 | T6-T12 - 56° / L1-L5 28° | Lenke 1 / King II | ID |
| 4 | 12 | T5-T11 - 62°/ T12-L4 - 55° | Lenke 1C+ / King II | ID |
| 5 | 13 | T3-T11 - 52° / T11-L4 - 43° | Lenke 1CN / King II | ID |
| 6 | 24 | T4-T11 - 57°/ T11-L4 - 75° | Lenke 6C- / King I | ID |
| 7 | 14 | T5-L1 - 50°/ L1-L4 - 36° | Lenke 1BN / King II | ID |
| 8 | 15 | T3-T6 - 32°/ T7- L1 - 50°/ L1 - L5 25° | Lenke 2AN / King V | ID |
| 9 | 17 | T1-T3 - 18°/ T4-T11 - 63°/ T12-L4 - 34° | Lenke 1BN / King II | ID |
| 10 | 15 | T5-T11 - 70°/T12-L4 - 54° | Lenke 3CN / King II | ID |
| 11 | 21 | T4-T9 - 76°/ T9-L3 - 56° | Lenke 3CN / King II | II |
| 12 | 15 | T1-T3 14° / T4-T11 - 56°/ T11-L4 - 60° | Lenke 1CN / King II | ID |
| 13 | 13 | T3-T11 - 55° / T11-L4 - 40° | Lenke 2CN / King II | ID |
| 14 | 14 | T4-T11 53° / T11-L4 52° | Lenke 1C- / King II | ID |
| 15 | 15 | T7-L3 - 88° | Lenke 1CN / King IV | ID |
| 16 | 14 | T4-T10 - 60° / T10 - L4 - 83° | Lenke 6CN / King I | DD |
| 17 | 13 | T1-T4 - 56° / T5-T8 - 115° /T12-L4- 45° | Lenke 4CN /King II | DD |
| 18 | 13 | T5-T12 - 97° / T12-L4 - 45° | Lenke 3BN / King II | DD |
| 19 | 16 | T2-T5 - 48°/ T6-T11 - 75° / T12-L4 - 48° | Lenke 4CN / King II | DD |
| 20 | 15 | T3-T11 D - 46° / T11-L4 - 20° | Lenke 1AN / King III | DD |
| 21 | 14 | C5-T5 - 58° / T6-L1 - 90° / L1-L5 - 43° | Lenke 2C+ / King V | DD |

Os resultados, da análise histológica foram publicados previamente[35], demonstrando fibrose, tanto endomisial quanto perimisial e involução gordurosa com significância quando comparadas nos dois lados da vértebra apical. Também são descritas as demais alterações musculares observadas, destacando-se a presença de fibras hialinas, necrose das fibras musculares e centralização nuclear, inflamação,

atrofia muscular e proliferação mitocondrial e áreas delimitadas nas fibras musculares, com baixa atividade oxidativa, sugestiva de miopatia tipo “central core”[35].

Em relação a expressão tecidual da ECA, considerou-se a musculatura na concavidade (CV) e na convexidade (CX), conforme figura 1 e o polimorfismo do gene da ECA (II, ID e DD), na figura 2.

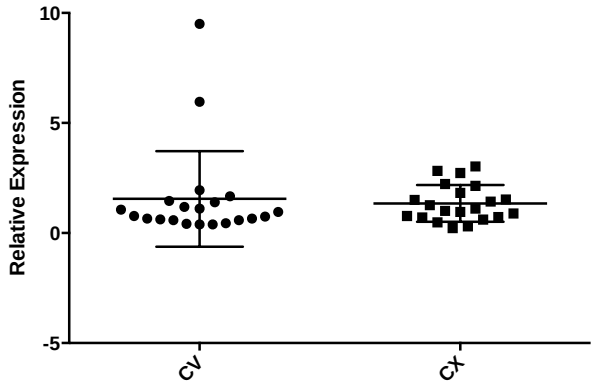


Figura 1) Expressão tecidual do gene da ECA nos multifideos na concavidade (CV) e convexidade (CX) das pacientes com escoliose idiopática.

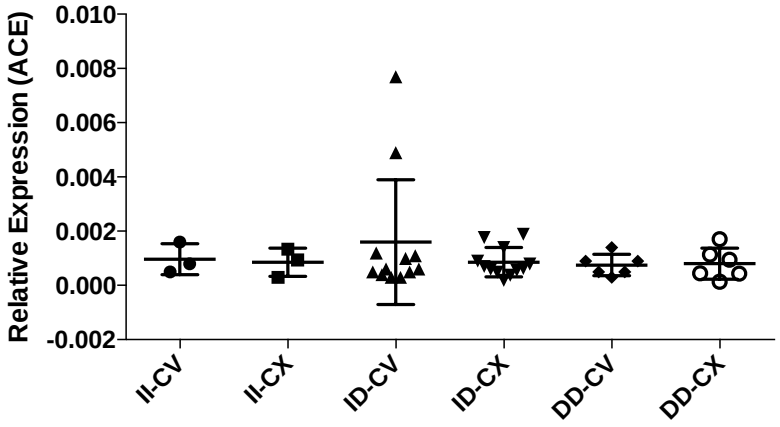


Figura 2) Expressão tecidual do gene da ECA nos multifideos na concavidade (CV) e convexidade (CX) das pacientes com escoliose idiopática em relação ao polimorfismo I/D.

Não houve diferença estatística da expressão tecidual, entre a musculatura na concavidade e convexidade, mesmo quando divididos pelo polimorfismo do gene da ECA.

VI) CRONOGRAMA DE EXECUÇAO DO PROJETO

| | Setembro/14 | Outubro/14 | Novembro/14 | Dezembro/14 | Janeiro/15 | Fevereiro/15 | Março/15 | Abril/15 | Maio/15 |
|---|---|---|---|---|---|---|---|---|---|
| Compras | **X** | **X** | **X** | | | | | | |
| Classifição e separação do material coletado | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Ensaios bioquímicos, imagem e histológicos | | | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Análise estatística | | | | | | | | | |
| Resultados | | | | | | | | | |
| Apresentação | | | | | | | | | |

| | Junho/15 | Julho/15 | Agosto/15 | Setembro/15 | Outubro/15 | Novembroro/15 | Dezembro/15 | Janeiro/16 | Fevereiro/16 |
|---|---|---|---|---|---|---|---|---|---|
| Compras | | | | | | | | | |
| Classifição e separação do material coletado | | | | | | | | | |
| Ensaios bioquímicos, imagem e histológicos | **X** | **X** | **X** | **X** | **X** | | | | |
| Análise estatística | | | | | | **X** | **X** | **X** | |
| Resultados | | | | | | | | | **X** |
| Apresentação | | | | | | | | | |

| | Março/16 | Abril/16 | Maio/16 | Junho/16 | Julho/16 | Agosto/16 |
|---|---|---|---|---|---|---|
| Compras | | | | | | |
| Classificação e separação do material coletado | | | | | | |
| Ensaios bioquímicos, imagem e histológicos | | | | | | |
| Análise estatística | | | | | | |
| Resultados | **X** | **X** | | | | |
| Redação, apresentação e publicação do trabalho | | | **X** | **X** | **X** | **X** |

VII) DISSEMINAÇÃO E AVALIAÇÃO:

A disseminação desta pesquisa é realizada no âmbito da própria Universidade (UNIFESP), nos meios acadêmicos nacionais e internacionais. Já existem outros Departamentos da UNIFESP envolvidos na pesquisa, com Doenças Neuromusculares, Biofísica e Hipertermia Maligna. Também já houve contato com o Setor de Genética da USP para desenvolvimento de novas pesquisas. A disseminação nacional e internacional ocorrerá por meio de apresentação de trabalhos científicos em Congressos, na área de Coluna Vertebral e Biologia Molecular. A avaliação do trabalho ocorrerá no meio Acadêmico e por meio das críticas das apresentações e publicações relacionadas à pesquisa.

O trabalho recebeu apoio financeiro da FAPESP, processo 2014/22251-8, com duração entre 01/03/2015 e 28/02/2017, encerrado com aprovação, conforme relatório incluso na pasta "relatórios". Foi apresentado, por meio de e-poster, no Global Spine Congress, em Milão/IT, no período de 3 a 6 de maio de 2017 (comprovação no programa do Congresso, página 70, na pasta de publicações e apresentações em congressos) e no I Encontro Unifesp de PÓS-DOUTORES realizado nos dias 29 e 30 de novembro, e 1º de dezembro de 2017, na modalidade de Apresentação de Pôster (certificado na pasta de publicações e apresentações em eventos).

O trabalho já gerou duas publicações em revistas indexadas (publicações na pasta de publicações e apresentações em eventos):

- Wajchenberg M, Martins DE, Luciano R de P, Puertas EB, et al. (2015). Histochemical analysis of paraspinal rotator muscles from patients with adolescent idiopathic scoliosis: a cross-sectional study. Medicine 94: e598.

- Luciano RP, Wajchenberg M, Almeida SS, Amorim CEN, Rodrigues LMR, Araujo RC, Puertas EB, Faloppa F. ACE /ACTN3 polymorphisms and idiopathic scoliosis. Genetics and Molecular Research 15 (4): gmr15048959, 2016.

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# Processo

## Identificação do Processo

| | |
|---|---|
| **Número do Processo** | 2014/22251-8 - Projeto de Pesquisa - Regular |
| **Situação** | Encerrado |
| **Grupo de Financiamento** | Auxílio à Pesquisa |
| **Linha de Fomento** | Programas Regulares / Auxílios a Pesquisa / Projeto de Pesquisa / Projeto de Pesquisa - Regular - Fluxo Contínuo |
| **Beneficiário** | Marcelo Wajchenberg |
| **Responsável** | Marcelo Wajchenberg |
| **Data Início** | 01/03/2015 |
| **Duração** | 24 mês(es) |

| | |
|---|---|
| **Instituição de Pesquisa/Empresa** | Escola Paulista de Medicina/EPM/UNIFESP |
| **Departamento** | Ortopedia e Traumatologia |
| **Data de Abertura** | 21/10/2014 |

## Projeto - Identificação

**Título em Português**

ESTUDO DOS MÚSCULOS ROTADORES DA COLUNA VERTEBRAL EM PACIENTES COM ESCOLIOSE IDIOPÁTICA DO ADOLESCENTE E ANÁLISE DA EXPRESSÃO TECIDUAL DO GENE DA ENZIMA CONVERSORA DE ANGIOTENSINA I (ECA).

**Título em Inglês**

STUDY OF SPINE MUSCLES ROTATORS SPINE IN PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS AND ANALYSIS OF GENE EXPRESSION OF TISSUE ANGIOTENSIN CONVERTING ENZYME (ACE).

**Classificação**

| | |
|---|---|
| **Grande Área** | Ciências da Saúde |
| **Área** | Medicina |
| **Sub-área** | Outra Subárea Medicina |
| **Especialidade** | Ortopedia e Traumatologia |

| | |
|---|---|
| **Palavras-chave** | adolescente, Enzima Conversora de Angiotensina (ECA), escoliose, Idiopática, Músculo |

## Projeto - Instituições

**Instituição de Pesquisa/Empresa Principal**

| | |
|---|---|
| **Nome** | Escola Paulista de Medicina/EPM/UNIFESP |

## Projeto - Pessoas Envolvidas

**Equipe**

| Nome | Função | Horas Semanais Dedicadas ao Projeto | Vigência | Vínculo Principal |
|---|---|---|---|---|
| Marcelo Wajchenberg | Pesquisador Responsável * | 15 | 01/03/2015 a 28/02/2017 | Escola Paulista de Medicina/EPM/UNIFESP |
| Acary Souza Bulle Oliveira | Apoio Técnico | 3 | 01/03/2015 a 28/02/2017 | Neurologia e Neurocirurgia/NEURO/UNIFESP |
| Delio Eulalio Martins Filho | Apoio Técnico | 3 | 01/03/2015 a 28/02/2017 | Sociedade Beneficente Israelita Brasileira Hospital Albert Einstein/SBIBAE/SBIBAE |

| | | | | |
|---|---|---|---|---|
| Eduardo Barros Puertas | Apoio Técnico | 4 | 01/03/2015 a 28/02/2017 | Escola Paulista de Medicina/EPM/UNIFESP |
| Flavio Faloppa | Apoio Técnico | 5 | 01/03/2015 a 28/02/2017 | Escola Paulista de Medicina/EPM/UNIFESP |
| Rafael de Paiva Luciano | Apoio Técnico | 10 | 01/03/2015 a 28/02/2017 | |
| Ronaldo de Carvalho Araújo | Apoio Técnico | 3 | 01/03/2015 a 28/02/2017 | Biofísica/BIOF/UNIFESP |
| Sandro Soares de Almeida | Apoio Técnico | 10 | 01/03/2015 a 28/02/2017 | Instituto Israelita de Ensino e Pesquisa Albert Einstein/IIEPAE/SBIBAE |

* Com Benefício Complementar

## Projeto - Descrição

**Resumo em Português**

A escoliose idiopática do adolescente (EIA) é um desvio lateral da coluna vertebral associado a rotação vertebral cuja etiologia não está definida. Existem várias teorias propostas, mas nenhuma absolutamente conclusiva. Desde o século 19 relatou-se o acometimento da musculatura dorsal como responsável pela deformidade. Autores sugeriram que o acometimento da musculatura poderia ser primário, por meio de miopatia afetando principalmente a musculatura eretora e rotadora paravertebral, porém também foi sugerido que o padrão de acometimento da musculatura poderia ser decorrente de doença neuromuscular. Estudos populacionais e familiares foram realizados para tentar identificar um padrão genético para a transmissão da doença. Com o início do Projeto Genoma em 1990, várias pesquisas na área da genética foram desenvolvidas para tentar esclarecer a etiologia de doenças, entre elas a EIA, com provável causa genética, procurando mapear os genes responsáveis, por meio de estudos de ligação genética. No entanto tais estudos apresentam limitação em relação a definição dos indivíduos afetados pela doença, pois o fenótipo é variável. Recentemente autores procuram relacionar polimorfismos genéticos a EIA. O polimorfismo genético é caracterizado por variações nas sequencias não repetitivas, presentes no genoma, sendo as mais comuns os de nucleotídeos únicos (em inglês single nucleotide polymorphism, SNPs) e também de polimorfismos de Inserção e Deleção. Alguns polimorfismos têm sido relacionados ao desempenho físico, por meio de influência no tecido muscular, entre eles destaca-se o gene da enzima conversora de angiotensina (ECA), com inserção (alelo I) ou deleção (alelo D) de 287 pares de base, agindo na produção de Angiotensina I, substância com ação vasoconstritora, podendo influenciar músculos com características aeróbicas (prevalência de fibras tipo I), como os eretores e rotadores da coluna vertebral. Com a finalidade de avaliar a relação do polimorfismo do gene da ECA com o desenvolvimento da EIA, o projeto tem como objetivo analisar os achados histológicos dos músculos rotadores da coluna vertebral, coletados durante a cirurgia corretiva, quantificar a expressão gênica da ECA no tecido coletado, correlacionando com o respectivo polimorfismo.

**Resumo em Inglês**

The adolescent idiopathic scoliosis (AIS) is a lateral deviation of the spine associated with vertebral rotation whose etiology is not defined. There are several theories proposed, but no absolutely conclusive. Since the 19th century it was reported the involvement of the dorsal musculature as responsible for the deformity. Authors suggested that the involvement of the muscles could be primary, by erecting myopathy mainly affecting the paraspinal musculature, but it was also suggested that the pattern of involvement of the muscles could be due to neuromuscular disease. Population and family studies have been conducted to try to identify a genetic standard for the transmission of the disease. With the start of the Human Genome Project in 1990, several studies in genetics have been developed to try to clarify the etiology of diseases, including the AIS, with probable genetic cause trying to map the genes responsible through linkage studies. However these studies have limitations concerning the definition of individuals affected by the disease because the phenotype is variable. Recently authors attempt to relate genetic polymorphisms to AIS. Genetic polymorphism is characterized by variations in non-repetitive sequences present in the genome, the most common being the single nucleotide (SNP) as well as insertion and deletion polymorphisms. Some polymorphisms have been linked to the physical performance by influence of the muscle tissue between them stands gene angiotensin converting enzyme (ACE) inhibitors, with insertion (allele I) or deletion (allele D) of 287 base pairs acting in the production of angiotensin I, substance with vasoconstrictor and may influence muscle with aerobic characteristics (prevalence of type I fibers) like the erector and rotators of the spine. In order to assess the relationship of polymorphism of the ACE gene with the development of the AIS the project aims to analyze the histological findings of the rotator muscles of the spine collected during corrective surgery to quantify the gene expression of ACE in tissue collected correlating with the respective polymorphism.

**Objetivos**

- Realizar estudo histológico e histoquímico dos músculos rotadores do dorso, na concavidade e convexidade, no ápice da curvatura, por meio de biópsia, em pacientes operados para correção da deformidade. - Avaliar a expressão tecidual do gene da ECA nos fragmentos musculares biopsiados durante o procedimento mencionado, considerando o genótipo do polimorfismo do referido gene (DD, II, ID) e comparando a convexidade e concavidade. - Correlacionar os resultados do estudo histoquímico com os dados sobre a expressão tecidual do gene da ECA.

**Resultados Previstos**

- Verificar alterações teciduais nos músculos rotadores do tronco em pacientes com escoliose idiopática do adolescente que podem estar relacionadas ao polimorfismo do gene da Enzima conversora de angiotensina, por meio de sua expressão gênica.

**O produto objeto do projeto é patenteável?**

Não

# R$ / US$ - Orçamento

**Orçamento**

| Benefícios | Valor (R$) | Valor (US$) |
|---|---|---|
| Capital | | |
| Material Permanente | 0,00 | 0,00 |
| Custeio | | |
| Despesas de Transporte | 0,00 | 0,00 |
| Diárias | 0,00 | 0,00 |
| Material de Consumo | 15.000,00 | 0,00 |
| Serviços de Terceiros | 0,00 | 0,00 |
| Reserva Técnica - Benefícios Complementares | 16.000,00 | 0,00 |
| Reserva Técnica - Custo de Infraestrutura Direta do Projeto | 2.250,00 | 0,00 |
| Provisão para Importação | 0,00 | 0,00 |
| Outros | 0,00 | 0,00 |
| TOTAL | 33.250,00 | 0,00 |
| Bolsas | | |
| Participação em Curso | 0,00 | 0,00 |
| Treinamento Técnico | 0,00 | 0,00 |
| TOTAL | 0,00 | 0,00 |
| TOTAL GERAL | 33.250,00 | 0,00 |

**Quotas de Bolsa**

| Modalidade / Categoria | Carga Horária | Duração (Meses) | Quantidade |
|---|---|---|---|

Nenhuma quota solicitada.

# R$ / US$ - Orçamento - Detalhamento

**Material de Consumo - Nacional**

| | |
|---|---|
| **Origem** | Brasil |
| **Classificação** | Material de Consumo |
| **Descrição** | reagentes para isolar e quantificar o RNA (expressão gênica) no tecido muscular |
| **Valor** | 10.000,00 |
| **Justificativa** | Material necessário para análise da expressão gênica da Enzima conversora de angiotensina no músculo rotador da coluna vertebral |

**Material de Consumo - Nacional**

| | |
|---|---|
| **Origem** | Brasil |
| **Classificação** | Material de Consumo |
| **Descrição** | Reagentes para análise histológica |
| **Valor** | 5.000,00 |
| **Justificativa** | Material necessário para preparação e análise histológica do tecido muscular |

**Reserva Técnica - Benefícios Complementares**

| | Nome | Papel | Valor | Vigência |
|---|---|---|---|---|
| **Beneficiados** | Marcelo Wajchenberg | Pesquisador Responsável | 16.000,00 | 01/03/2015 a 28/02/2017 |

| | |
|---|---|
| **Moeda** | R$ |
| **Valor Unitário** (anual) | 8.000,00 |
| **Data de Referência** | 21/01/2015 |
| **Valor do Benefício Complementar** | 16.000,00 |

**Reserva Técnica - Custo de Infraestrutura Direta do Projeto**

**Percentual para Reserva** 15,00 %

| | |
|---|---|
| **Técnica (País)** | |
| **Percentual para Reserva Técnica (Exterior)** | 15,00 % |
| **Dólar FAPESP** | 2,70 |
| **Valor Aumentado** | 0,00 |
| **Valor Diminuído** | 0,00 |
| **Valor da Reserva Técnica (R$)** | 2.250,00 |
| **Valor da Reserva Técnica (US$)** | 0,00 |

## R$ / US$ - Outras Fontes

**Outras Fontes**

Nenhuma outra fonte encontrada.

## Documentos

**Download de Todos os Documentos**

**1.1 Documentos Anexados na Proposta Atual (Proposta Inicial submetida em 21/10/2014)**

| Tipo de Documento | Etapa Exigida | Arquivo | Data de Anexação | Arquivo Convertido |
|---|---|---|---|---|
| Manifestação do dirigente da instituição | Análise | modelo_manifestacao_fapesp_assinado.pdf | 21/10/2014 | |
| Orçamentos dos fornecedores/representantes autorizados. | Análise | Não se Aplica | | |
| Parque de equipamentos | Análise | PARQUE DE EQUIPAMENTOS.doc | 01/08/2014 | |
| Planos de atividades individuais para cada bolsa de treinamento técnico e/ou participação | Análise | Não se Aplica | | |
| Projeto de pesquisa (auxílio) | Análise | projeto marcelo w fapesp.doc | 17/08/2014 | |
| Resultados de auxílios anteriores | Análise | Não se Aplica | | |
| Súmula curricular de cada um dos pesquisadores associados | Análise | Não se Aplica | | |
| Súmula curricular do beneficiário | Análise | Sumula_Curricular mw.docx | 25/06/2014 | |

**1.2 Outros Documentos Anexados na Proposta Atual (Proposta Inicial submetida em 21/10/2014)**

| Arquivo | Data de Anexação | Arquivo Convertido |
|---|---|---|
| vinculo unifesp.pdf | 21/10/2014 | |

**1.3 Documentos Anexados pela FAPESP na Proposta Atual (Proposta Inicial submetida em 21/10/2014)**

Nenhum documento associado.

## Observações / Manifestações

**Observações**

## Histórico de Eventos

**Histórico de Eventos**

| Descrição | Data |
|---|---|
| Processo Encerrado (Parte Científica e Administrativa) | 15/06/2017 |
| Resultado de Despacho Científico Divulgado - Relatório Científico 2 | 17/04/2017 |

| | |
|---|---|
| Emissão de Despacho Científico Concluída - Relatório Científico 2 | 17/04/2017 |
| Despacho Científico Iniciado - Relatório Científico 2 | 17/04/2017 |
| Recomendação da Coordenação de Área/Programa Concluída - Relatório Científico 2 | 17/04/2017 |
| Parecer de Assessor ad-hoc Emitido - Relatório Científico 2 | 30/03/2017 |
| Solicitação enviada a Assessor ad-hoc para emissão de parecer - Relatório Científico 2 | 29/03/2017 |
| Habilitação Iniciada - Relatório Científico 2 | 28/03/2017 |
| Submissão - Relatório Científico 2 | 27/03/2017 |
| Resultado de Despacho Científico Divulgado - Relatório Científico 1 | 11/08/2016 |
| Emissão de Despacho Científico Concluída - Relatório Científico 1 | 11/08/2016 |
| Despacho Científico Iniciado - Relatório Científico 1 | 11/08/2016 |
| Recomendação da Coordenação de Área/Programa Concluída - Relatório Científico 1 | 08/08/2016 |
| Parecer de Assessor ad-hoc Emitido - Relatório Científico 1 | 08/07/2016 |
| Solicitação enviada a Assessor ad-hoc para emissão de parecer - Relatório Científico 1 | 06/07/2016 |
| Habilitação Iniciada - Relatório Científico 1 | 05/07/2016 |
| Submissão - Relatório Científico 1 (Reformulação) | 04/07/2016 |
| Resultado de Despacho Científico Divulgado - Relatório Científico 1 | 30/05/2016 |
| Emissão de Despacho Científico Concluída - Relatório Científico 1 | 30/05/2016 |
| Despacho Científico Iniciado - Relatório Científico 1 | 30/05/2016 |
| Recomendação da Coordenação Adjunta Concluída - Relatório Científico 1 | 23/05/2016 |
| Recomendação da Coordenação de Área/Programa Concluída - Relatório Científico 1 | 02/05/2016 |
| Parecer de Assessor ad-hoc Emitido - Relatório Científico 1 | 18/04/2016 |
| Solicitação enviada a Assessor ad-hoc para emissão de parecer - Relatório Científico 1 | 12/04/2016 |
| Indicação de Assessor ad-hoc Concluída - Relatório Científico 1 | 11/04/2016 |
| Solicitação devolvida pelo Assessor ad-hoc sem emissão de parecer - Relatório Científico 1 | 29/03/2016 |
| Solicitação enviada a Assessor ad-hoc para emissão de parecer - Relatório Científico 1 | 04/03/2016 |
| Habilitação Concluída - Relatório Científico 1 | 29/02/2016 |
| Submissão - Relatório Científico 1 | 27/02/2016 |
| Assinatura da FAPESP Registrada - Contrato Inicial | 10/03/2015 |
| Assinatura do Outorgado Registrada - Contrato Inicial | 10/03/2015 |
| Análise da Minuta Concluída - Contrato Inicial | 24/02/2015 |
| Preparação da Minuta Concluída - Contrato Inicial | 13/02/2015 |
| Verificação da habilitação com resultado "Habilitado" - Contrato Inicial | 13/02/2015 |
| Aceite da Concessão com resultado "Aprovado" | 22/01/2015 |
| Resultado de Despacho Científico Divulgado - Proposta Inicial | 21/01/2015 |
| Emissão de Despacho Científico Concluída - Proposta Inicial | 21/01/2015 |
| Preparação de Despacho Científico Concluída - Proposta Inicial | 21/01/2015 |
| Pré-Preparação de Despacho Científico Concluída - Proposta Inicial | 19/01/2015 |
| Despacho Científico Iniciado - Proposta Inicial | 19/01/2015 |
| Recomendação da Coordenação Adjunta Concluída - Proposta Inicial | 08/01/2015 |
| Recomendação da Coordenação de Área/Programa Concluída - Proposta Inicial | 05/01/2015 |
| Parecer de Assessor ad-hoc Emitido - Proposta Inicial | 13/12/2014 |
| Solicitação enviada a Assessor ad-hoc para emissão de parecer - Proposta Inicial | 08/12/2014 |
| Indicação de Assessor ad-hoc Concluída - Proposta Inicial | 08/12/2014 |
| Habilitação Concluída - Proposta Inicial | 23/10/2014 |
| Submissão da Solicitação - Proposta Inicial | 21/10/2014 |

São Paulo, 5 de fevereiro de 2010

Ilmo(a) Sr(a

CEP Nº: **0043/10**

Pesquisador(a): DAVID DEL CURTO

Disciplina/Departamento: Ortopedia e Traumatologia

Pesquisadores associados: Marcelo Wajchenberg; Delio Eulálio Martins, Eduardo Barros Puertas (orientador)

**Parecer Consubstanciado do Comitê de Ética em Pesquisa da Universidade Federal de São Paulo/Hospital São Paulo**

TÍTULO DO ESTUDO: Estudo da mioglobina nos músculos rotadores da coluna vertebral em pacientes com escoliose idiopática do adolescente : 2ª via do parecer em 17/02/2014

CARACTERÍSTICA PRINCIPAL DO ESTUDO: Estudo laboratorial molecular e histopatológico de material de biópsia

RISCOS ADICIONAIS PARA O PACIENTE: Risco mínimo, desconforto moderado, com procedimento de biópsia de músculo rotador da coluna

OBJETIVO DO ESTUDO: Avaliar as alterações da mioglobina em amostras dos músculos rotadores da coluna vertebral de pacientes com Escoliose Idiopática do Adolescente (EIA), sua expressão gênica e protéica, e tentar identificar alguma correlação com o desenvolvimento e gravidade da deformidade, e com alterações no estudo histopatológico do material, tendo como base amostras de músculos de indivíduos não afetados

RESUMO: Serão avaliados pacientes com EIA, acompanhados no ambulatório de coluna vertebral do Departamento de Ortopedia e Traumatologia da Unifesp. Serão estudadas amostras de músculos rotadores da coluna vertebral desses pacientes e comparadas com amostras dos mesmos músculos de pacientes com escoliose neuromuscular, e de pacientes vítimas de fratura da coluna tóraco-lombar, sem escoliose submetidos a cirurgia para tratamento dessas lesões nesses 3 grupos de pacientes. As amostras coletadas, uma parte será submetida para estudo da expressão protéica pelo método Western blotting no Laboratório de Fisiologia Renal e Termometabolismo da Fisiologia da Unifesp e outra parte para estudo histopatológico realizado no Setor de Doenças Neuromusculares do departamento de Neurologia e Neurocirurgia da Unifesp. Será realizada a extração de RNA, quantificado e identificada a expressão gênica por RT-PCR em tempo real.

FUNDAMENTOS E RACIONAL: A hipótese a ser testada é que a modificação da expressão gênica da mioglobina é um dos fatores determinantes para o surgimento e progressão da escoliose idiopática.

MATERIAL E MÉTODO: Descritos os procedimentos laboratoriais que serão realizados

TCLE: Apresentado adequadamente

DETALHAMENTO FINANCEIRO: Sem financiamento externo

CRONOGRAMA DO ESTUDO: 24 meses

**PRIMEIROS RELATÓRIOS PARCIAIS PREVISTOS PARA : 31/1/2011 e 26/1/2012**

O Comitê de Ética em Pesquisa da Universidade Federal de São Paulo/Hospital São Paulo ANALISOU e APROVOU o projeto de pesquisa referenciado.

1. Comunicar toda e qualquer alteração do projeto e termo de consentimento livre e esclarecido. Nestas circunstâncias a inclusão de pacientes deve ser temporariamente interrompida até a resposta do Comitê, após análise das mudanças propostas.
2. Comunicar imediatamente ao Comitê qualquer evento adverso ocorrido durante o desenvolvimento do estudo.
3. Os dados individuais de todas as etapas da pesquisa devem ser mantidos em local seguro por 5 anos para possível auditoria dos órgãos competentes.

Atenciosamente,

Prof. Dr. José Osmar Medina Pestana
Coordenador do Comitê de Ética em Pesquisa da
Universidade Federal de São Paulo/Hospital São Paulo



Rua Botucatu, 572 - 1o andar - CEP 04023-062 - São Paulo/Brasil

São Paulo, 23 de Abril de 2014

COMPROVANTE DE CADASTRO INSTITUCIONAL (427145)

| | | | |
|---|---|---|---|
| CPF: | 135.613.948-50 | Característica: | Retrospectivo/Prospectivo |
| Título do projeto: | ESTUDO DOS MÚSCULOS ROTADORES DA COLUNA VERTEBRAL EM PACIENTES COM ESCOLIOSE IDIOPÁTICA DO ADOLESCENTE E ANÁLISE DA EXPRESSÃO TECIDUAL DO GENE DA ENZIMA CONVERSORA DE ANGIOTENSINA I (ECA). | | |
| Pesquisador: | MARCELO WAJCHENBERG | | |
| Celular: | (11)991594084 | e-mail: | marcelow@einstein.br |
| Disciplina/Depto: | ORTOPEDIA E TRAUMATOLOGIA | Campus: | São Paulo |
| Obj. Acadêmico: | Pós-doutorado | Aquisição de patente: | Não |
| Patrocínio: | Ausente | Patrocinador: | |
| Orientador: | MOISÉS COHEN | e-mail: | |
| Chefe de Depto: | MOISÉS COHEN | e-mail: | m.cohen@uol.com.br |

Resumo:

A escoliose idiopática do adolescente (EIA) é um desvio lateral da coluna vertebral associado a rotação vertebral cuja etiologia não está definida. Existem várias teorias propostas, mas nenhuma absolutamente conclusiva. Desde o século 19 relatou-se o acometimento da musculatura dorsal como responsável pela deformidade. Autores sugeriram que o acometimento da musculatura poderia ser primário, por meio de miopatia afetando principalmente a musculatura eretora e rotadora paravertebral, porém também foi sugerido que o padrão de acometimento da musculatura poderia ser decorrente de doença neuromuscular. Estudos populacionais e familiares foram realizados para tentar identificar um padrão genético para a transmissão da doença. Com o início do Projeto Genoma em 1990, várias pesquisas na área da genética foram desenvolvidas para tentar esclarecer a etiologia de doenças, entre elas a EIA, com provável causa genética, procurando mapear os genes responsáveis, por meio de estudos de ligação genética. No entanto tais estudos apresentam limitação em relação a definição dos indivíduos afetados pela doença, pois o fenótipo é variável.

Recentemente autores procuram relacionar polimorfismos genéticos a EIA. O polimorfismo genético é caracterizado por variações nas sequencias não repetitivas, presentes no genoma, sendo as mais comuns os de nucleotídeos únicos (em inglês single nucleotide polymorphism, SNPs) e também de polimorfismos de Inserção e Deleção. Alguns polimorfismos têm sido relacionados ao desempenho físico, por meio de influência no tecido muscular, entre eles destaca-se o gene da enzima conversora de angiotensina (ECA), com inserção (alelo I) ou deleção (alelo D) de 287 pares de base, agindo na produção de Angiotensina I, substância com ação vasoconstritora, podendo influenciar músculos com características aeróbicas (prevalência de fibras tipo I), como os eretores e rotadores da coluna vertebral. Com a finalidade de avaliar a relação do polimorfismo do gene da ECA com o desenvolvimento da EIA, o projeto tem como objetivo analisar os achados histológicos dos músculos rotadores da coluna vertebral, coletados durante a cirurgia corretiva, quantificar a expressão gênica da ECA no tecido coletado, correlacionando com o respectivo polimorfismo.

## Orçamento Financeiro

| Descrição do item | Quantidade | Valor unitário |
|---|---|---|
| 1. reagentes para coloração de laminas(tecidomuscular) | 100 | 5000,00 |
| 2. reagentes (primers) para extração e detecção de RNA (ECA) | 42 | 5000,00 |
| | Total | R$ 710.000,00 |

# Genetic *ACE* I/D and *ACTN3* R577X polymorphisms and adolescent idiopathic scoliosis

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**ABSTRACT.** The etiology of adolescent idiopathic scoliosis remains unknown. Angiotensin-converting enzyme and α-actinin-3 polymorphisms influence the characteristics of muscle fibers. The aim of this study was to examine the association between idiopathic scoliosis and genetic polymorphism of angiotensin-converting enzyme and α-actinin-3. Ninety-seven females with scoliosis, and 137 healthy, age-matched control females were studied. The presence of polymorphisms was determined by PCR. A $\chi^2$ test was used to analyze differences, and odds ratios were estimated. The frequencies of *ACE* genotypes in the scoliotic group were 46.4% DD, 45.4% ID, and 8.2% II, while in the control group they were 40.1% DD, 43.8% ID, and 16.1% II (P = 0.197). The D allele had a frequency of 69.1% in patients with idiopathic scoliosis and 62% in the control group (P = 0.116). The

frequencies of *ACTN3* genotypes in females with scoliosis were 31.8% RR, 49.4% RX, and 18.8% XX, while in the control group they were 35% RR, 49% RX, and 16% XX (P = 0.810). The frequency of the R allele was 56.4% in the scoliotic group and 59.6% in the control group (P = 0.518). There was no statistically significant association between angiotensin-converting enzyme or α-actinin-3 polymorphisms and the presence of adolescent idiopathic scoliosis in females.

**Key words:** Scoliosis; Polymorphism; Angiotensin-converting enzyme; Alpha-actinin 3; Muscle fiber.

## INTRODUCTION

The Scoliosis Research Society defines adolescent idiopathic scoliosis (AIS) as a lateral spinal curvature greater than or equal to 10° on plane radiographs, associated with a rotational deviation, without any identifiable underlying secondary cause (Ocaka et al., 2008). The etiology of idiopathic scoliosis remains unknown, and currently, the multifactorial theory is favored by a majority (Alden et al., 2006). Some studies show that genetic predisposition is a determinant in the etiology of this disease (Ogilvie et al., 2006). Several chromosomal regions have been linked to AIS (Wise et al., 2000; Alden et al., 2006; Ogilvie et al., 2006; Ocaka et al., 2008). Currently, studies of genetic polymorphisms are carried out on patients with scoliosis in an attempt to identify protein variations that might be related to this disease (Aulisa et al., 2007; Takahashi et al., 2011; Jiang et al., 2013; Chen et al., 2014).

Since the 19th century, theories have associated AIS with muscular changes, suggesting that the distortion of the spine could be caused by a paravertebral muscle imbalance (Meier et al., 1997; Mannion et al., 1998; Wajchenberg et al., 2015). The histochemical pattern of multifidus and longissimus muscles in the lumbar region of normal subjects (20-30 years-old), defined by Thorstensson and Carlson (1987), showed that type I muscle fibers were predominant (57-62%). Johnson et al. (1973) observed that these muscles, including the soleus, tibialis anterior, adductor pollicis, diaphragm, and extraocular, have a higher energy demand than others, and primarily use aerobic metabolism, which is characteristic of type-I fibers.

The human genome contains at least 214 variant gene sequences and genetic markers associated with physical performance and health-related fitness phenotypes (Macarthur and North, 2005). Wajchenberg et al. (2013) evaluated polymorphisms in two of these genes, angiotensin-converting enzyme (*ACE*) and α-actinin-3 (*ACTN3*), in a family with multiple members suffering from AIS. This family had a higher prevalence of the *ACE* deletion (D) allele, compared with the insertion (I) allele. The *ACE* polymorphism (I/D variant) is the most widely studied genetic variant in the context of elite athlete status and performance-related traits, involving the deletion or insertion of 287 bp within intron 16. Previous studies by our group have shown that the DD genotype leads to greater plasmatic ACE activity than the II or ID genotypes (Almeida et al., 2010).

Expression of the *ACTN3* gene is also associated with muscular efficiency. *ACTN3* is a specific isoform expressed only in fast-twitch, type-II muscle fibers. The *ACTN3* polymorphism at position 1747 is located in exon 16, and leads to the following possible genotypes: homozygous null (XX), heterozygous (XR), and homozygous (RR), which leads to maximum expression of the ACTN3 protein. The homozygous null genotype (XX) causes no noticeable phenotype or histological changes, suggesting that the presence of this ACTN3

protein variant is not essential to muscle fiber function. However, this variant plays a role in muscle structure and alters the function of the type-II muscle fibers (North et al., 1999; Bray et al., 2009). The aim of this study was to examine the association between AIS and the genetic polymorphisms of *ACE* and *ACTN3*.

## MATERIAL AND METHODS

### Subjects

This study received ethics approval of Ethics Committee of the Federal University of São Paulo / São Paulo Hospital (ERC 1256/10). A total of 234 females, aged 10-35 years, were studied between 2010 and 2013. Ninety-seven patients with AIS, with a Cobb angle above 20° were recruited from the spine group of Hospital of Universidade Federal de São Paulo (Brazil). Scoliosis curve severity was measured by the Cobb method on posteroanterior radiographs of the whole spine. Cases of secondary scoliosis with known etiology were excluded from the current study, including congenital scoliosis, neuromuscular scoliosis, or scoliosis with connective tissue abnormalities. A total of 137 healthy female blood donors were used as controls. Control subjects were clinically examined by experienced orthopedic surgeons to rule out any potential spinal deformity. All subjects and/or their parents authorized their participation in the study using the Informed Consent Form that was filed and approved by the Ethics and Research Committee of University Hospital of São Paulo (ERC 1256/10).

### DNA extraction

Genomic DNA was extracted from circulating leukocytes using a blood DNA extraction kit (Charge Switch gDNA Blood Kit, Invitrogen, Waltham, MA, USA).

### *ACE* genotyping

The *ACE* I/D polymorphism was identified by polymerase chain reaction (PCR). Briefly, primers (ECAS: 5'-CTGGAGACCACTCCCATCCTTTCT-3' and ECAR: 5'-GATGTGGCCATCACATTCGTCAGAT-3') flanking the polymorphic region outside of the Alu insert in intron 16 were used to amplify a portion of the *ACE* gene. The amplified product was analyzed by gel electrophoresis to determine the presence or absence of I and D alleles. Because the D allele is preferentially amplified in heterozygotes, each DD genotype was confirmed by a second independent PCR with another primer pair (ECAint: 5'-GTCTCGATCTCCTGACCTCGTG-3' and ECAS: 5'-CTGGAGACCACTCCCATCCTTTCT-3') that amplified the sequence specific to the I allele (Charbonneau et al., 2008; Almeida et al., 2010; Amorim et al., 2013).

### *ACTN3* R577X genotyping

Genotyping of the *ACTN3* R577X polymorphism was performed using two specific primers (Actn3f: 5'-CAG CTGGAGGATGGCCTGG-3' and Actn3r: 5'-GTC CAG GTATTT CTC TGCCAC C-3') that amplified the polymorphic region; these primers were used to classify individuals as RR, RX, or XX. The following reagents were used for genotyping by PCR: 10 µL DNA, 2.5 µL PCR buffer (10X), 1.25 µL $MgCl_2$ (50 mM), 1.0 µL dNTPs (10 mM), 0.5 µL

each primer (Actn3f and Actn3r), 0.5 µL Taq DNA polymerase (5 U/µL), Invitrogen, and 5 µL autoclaved MilliQ $H_2O$ for a total reaction volume of 25 µL. The following conditions were used for PCR: 95°C for 7 min, followed by 35 cycles of 95°C for 45 s, 60°C for 45 s, 72°C for 45 s, and 95°C for 45 s, with a final step at 72°C for 10 min followed by 4°C indefinite hold. The amplified fragments were analyzed by electrophoresis on a 4% agarose gel containing SYBR® Safe DNA gel stain (0.2 mg/mL, Invitrogen). After checking PCR products for DNA integrity and amplification, digestion was performed at 37°C for 2 h using a mixture of 8 µL DNA (approximately 6 mg) from the PCR, 1 µL REACT 3 buffer (10X), and 1 µL *Dde*I restriction enzyme (10 U/µL). The result was analyzed by electrophoresis on a 3% agarose gel containing SYBR® Safe DNA gel stain, as before (North et al., 1999; Clarkson et al., 2005).

### Statistical analysis

Genotyping and allelic frequency were analyzed in each group, and odds ratios were estimated with 95% confidence intervals using simple logistic regression. The association between groups was verified using a $c^2$ test. Statistical tests were performed with a significance level of 5%; results were analyzed using SPSS version 17.0 for Windows.

## RESULTS

### Patient characterization

The average age of patients with AIS was 18.5 years, and the average age of menarche was 12 years. Of the patients with AIS, 88.7% were Caucasian, and 17.5% had family members with AIS; 55.7% underwent surgical treatment, and 56.7% had a Cobb angle greater than 50°. Most patients with AIS had a right thoracic curve (80.5%), and 44.3% were type III, according to the King classification system (King et al., 1983). The average age of control subjects was 20.7 years.

### *ACE* genotyping

The frequency of each *ACE* genotype in the AIS group was determined to be 46.4% DD, 45.4% ID, and 8.2% II; in the control group, 40.1% were DD, 43.8% ID, and 16.1% II. Although the frequency of the DD genotype was higher in patients with AIS, it was not significant (P = 0.197). In the isolated allele analysis, the frequency of the D allele was 69.1% in patients with AIS and 62% in the control group (P = 0.116).

The sample odds ratio revealed that subjects with the DD genotype were 2.25 times more likely to develop the disease than those with the II genotype. The risk of developing AIS was two-fold higher for heterozygotes than for those homozygous for the II genotype. Although the risk of developing AIS was 37% higher in those with the D allele, these results were not statistically significant (Table 1).

### *ACTN3* genotyping

We genotyped the *ACTN3* polymorphism in 85 of the patients with AIS; the DNA yield from the other 13 patients was too low to genotype both *ACE* and *ACTN3* genes. The frequency of each *ACTN3* genotype was determined to be 31.8% RR, 49.4% RX, and 18.8%

XX. In the control group, 130 volunteers were genotyped; 35% were found to be RR, 49% RX, and 16% XX. There was no statistically significant difference between the groups in this analysis (P = 0.810). In the isolated allele analysis, there was no statistically significant difference between patients with AIS, where the R allele made up 56.5% of the total allele distribution, and the control group, with 59.6% (P = 0.518). Odds ratio analysis of the *ACTN3* gene in both groups did not demonstrate a genetic profile of susceptibility (Table 2).

**Table 1.** ACE genotyping results and odds ratio.

| | Group | | | | OR | 95%CI | | P* |
|---|---|---|---|---|---|---|---|---|
| | Control | | AIS | | | | | |
| | N | % | N | % | | | | |
| ACE genotyping | | | | | | | | 0.197 |
| II | 22 | 16.1 | 8 | 8.2 | 1.00 | | | |
| ID | 60 | 43.8 | 44 | 45.4 | 2.02 | 0.82 | 4.95 | |
| DD | 55 | 40.1 | 45 | 46.4 | 2.25 | 0.92 | 5.53 | |
| Allele | | | | | | | | 0.116 |
| I | 104 | 38.0 | 60 | 30.9 | 1.00 | | | |
| D | 170 | 62.0 | 134 | 69.1 | 1.37 | 0.93 | 2.02 | |

*Bivariate logistic regression. AIS = adolescent idiopathic scoliosis; ACE = angiotensin I converting enzyme; OR = odds ratio; CI = confidence interval; N = absolute number; II = insertion homozygous; ID = heterozygous; DD = deletion homozygous.

**Table 2.** *ACTN3* genotyping results and odds ratio.

| | Group | | | | OR | CI (95%) | | P* |
|---|---|---|---|---|---|---|---|---|
| | Control | | AIS | | | | | |
| | N | % | N | % | | | | |
| ACTN3 genotyping | | | | | | | | 0.810 |
| RR | 46 | 35 | 27 | 31.8 | 1.00 | | | |
| RX | 63 | 49 | 42 | 49.4 | 1.14 | 0.61 | 2.10 | |
| XX | 21 | 16 | 16 | 18.8 | 1.30 | 0.58 | 2.91 | |
| ACTN3 allele | | | | | | | | 0.518 |
| R | 155 | 59.6 | 96 | 56.5 | 1.00 | | | |
| X | 105 | 40.4 | 74 | 43.5 | 1.14 | 0.77 | 1.68 | |

*Bivariate logistic regression. AIS = adolescent idiopathic scoliosis; ACTN3 = Actinin 3; OR = odds ratio; CI = confidence interval; N = absolute number; RR = homozygous; RX = heterozygous; XX = null homozygous.

## DISCUSSION

Studies suggest that genetic factors are critical in the pathogenesis of AIS; however, the inheritance pattern is not yet fully known. This disease is marked by its phenotypic complexity, and the range of possible prognoses includes an increase in spinal curve magnitude, stabilization, and resolution with growth (Kouwenhoven et al., 2006; Jiang et al., 2012). A wide phenotypic variation is characteristic of multifactorial diseases. Most consist of polygenic factors, delineating an individual's susceptibility to developing disease (Meier et al., 1997; Ogilvie et al., 2006).

In the current etiological study, we examined two genetic factors that may influence changes in the paraspinal muscles described in patients with AIS (Chagas et al., 1993). We investigated chromosomal loci that may facilitate the development and progression of AIS, in agreement with the polygenic disease hypothesis. In a genealogical study, Wynne-Davies (1968) concluded AIS was a multifactorial disease with a polygenic inheritance pattern, by identifying probands and characterizing their families.

Wise et al. (2000) reflected on the difficulty of mapping DNA changes in polygenic diseases using binding studies. The authors agreed that AIS has a pattern of autosomal dominant inheritance. They maintained the same study design, and mapped several chromosomes (6, 10q, 18q) in the families of AIS probands.

Polymorphisms related to AIS already identified include those encoding structural proteins of the extracellular matrix, including matrilin-1 (Chen et al., 2009), matrix metalloproteinases and their inhibitors (Jiang et al., 2012), and dipeptidyl peptidase (Qiu et al., 2008), and those related to bone metabolism, including calmodulin (Zhao et al., 2009) and the vitamin D receptor gene (Suh et al., 2010). Recently, somatotrophic polymorphisms and the androgen axis were considered potential candidates in the pathogenesis of AIS, including the estrogen receptor, estrogen receptor-coupled G-proteins (growth factors and insulin), and the growth hormone receptor gene (Inoue et al., 2002; Yang et al., 2009; Zhao et al., 2009; Peng et al., 2012). Moreover, a genome-wide association study in Japan identified three single nucleotide polymorphisms on chromosome 10q24.31, likely associated with AIS. These polymorphisms are located in the region containing the LBX1 gene, expressed in the central nervous system and skeletal muscle (Takahashi et al., 2011; Jiang et al., 2013).

Our investigation of DNA sequencing related to AIS susceptibility examined the muscular imbalance theory as a primary factor in AIS pathophysiology, since no previous studies have been conducted that relate genes involved in muscle fiber traits to this disease. The paraspinal musculature plays a role in trunk support and movement, and undergoes significant changes in patients with a trunk deformity. The multifidus muscles are spine rotators with a histochemical pattern of predominantly type-I fibers (57-62%). These fibers are resistant to fatigue and have a predominantly aerobic metabolism (Thorstensson and Carlson, 1987).

Previous histopathological studies of patients with AIS demonstrated that all muscular biopsies showed changes to the paraspinal muscles. The decrease in the prevalence of type-I muscle fibers on the concave side of the scoliotic curve is a major change described in the literature. In addition, atrophy, and core presence, also occur in these muscles in patients with AIS. However, there is disparity in the literature as to whether these changes are the cause or an effect of the deformity (Chagas et al., 1993*;* Meier et al., 1997; Luciano et al., 2015; Wajchenberg et al., 2015).

Our analysis of genotypic frequencies showed the DD genotype and D allele were highest in patients with AIS, in agreement with results reported by Wajchenberg et al. (2013) in a family with multiple members with AIS. We also observed that the incidence of the II genotype in healthy individuals was twice that in patients with AIS. According to the literature, the I/D polymorphism not only affects plasmatic ACE activity but also determines its concentration in tissues (e.g., skeletal muscle). Apparently, the interaction between local and serum renin-angiotensin systems, and metabolic adaptation of the muscle fiber type, occurs according to the individual's genotype (Reneland et al., 1999). In a previous study, the DD genotype and presence of the D allele were associated with high concentrations of ACE and reduced levels of bradykinin, which lowered glucose uptake and muscle blood flow, impairing muscle groups made predominantly of type I muscle fibers, such as the spinal erector and multifidus (Zhang et al., 2003). On the other hand, the aerobic metabolism requirement of these muscles favors the presence of the I allele, which behaves as a protective factor, and may be most frequently found in healthy individuals. Furthermore, odds ratio analysis of our sample showed that individuals with the DD genotype were 2.25 times more likely to develop AIS. Therefore, physicians should be cautious when interpreting a patient's risk of disease

development, considering the polygenic character of AIS, as well as the genetic and epigenetic factors that can alter the risk of developing a deformity.

The genetic profile analysis of *ACTN3* in both groups studied herein did not show statistically significant differences. *ACTN3* is a fast-twitch-specific isoform expressed only in type-II muscle fibers. A common *ACTN3* polymorphism that has been identified in humans leads to the loss of a detectable protein product in the muscles of individuals homozygous for the X allele (R577X). The *ACTN3* null genotype (XX) causes no discernable phenotype or histological abnormality in the muscles.

Our results were limited by the number of patients, and in future, multicenter studies will be necessary to prove this hypothesis. Furthermore, these results also require validation in other populations, since the current results may be specific to the ethnic-racial group studied. The study of gene expression of the renin-angiotensin system in the paraspinal musculature of patients with AIS could clarify the possible adaptive processes of skeletal muscle fiber in the scoliotic spine.

Overall, results of this study showed no statistically significant association between the *ACE* and *ACTN3* polymorphisms studied, and the presence of AIS in females.

## Conflicts of interest

The authors declare no conflict of interest.

## ACKNOWLEDGMENTS

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**Date:** 06 Feb 2018
**To:** "Marcelo Wajchenberg" marcelow@einstein.br
**From:** "BMC Pediatrics - Editorial Office" Catherine.Olino@biomedcentral.com
**Subject:** Decision on your submission to BMC Pediatrics -BPED-D-16-00446

BPED-D-16-00446
Tissue expression of angiotensin I - converting enzyme (ACE) gene in the rotator muscles of patients with adolescent idiopathic scoliosis
Marcelo Wajchenberg; Delio Eulalio Martins, PhD; Rafael de Paiva Luciano, MD; Ronaldo de Carvalho Araujo, PhD; Beny Schmidt, PhD; Acary Bulle de Souza Oliveira, PhD; Eduardo Barros Puertas, PhD; Sandro Soares de Almeida, PhD; Flavio Faloppa, PhD
BMC Pediatrics

Dear Dr Wajchenberg,

Thank you for considering BMC Pediatrics for your manuscript "Tissue expression of angiotensin I - converting enzyme (ACE) gene in the rotator muscles of patients with adolescent idiopathic scoliosis". I am sorry to inform you that despite much effort we have been unable to obtain an appropriate second referee for your manuscript in a timely manner. We have received one report on your submission, however we have been unable to obtain a second report. Unfortunately, we are unable to make an editorial decision on the report we have received. As your manuscript has already been significantly delayed we believe it is unfair to hold on to the manuscript further and we are closing your file, so that you may submit it elsewhere.

We understand that this decision may cause frustration to you and your co-authors and we sincerely apologise for this inconvenience.

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Best wishes,

The BMC Pediatrics Editorial Team, on behalf of
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Reviewer reports:
Paul Gerdhem (Reviewer 1): Thank you for letting me review 'Tissue expression of angiotensin I - converting enzyme (ACE) gene in the rotator muscles of patients with adolescent idiopathic scoliosis', which I read with great interest. The main findings are that tissue expression of ACE measured as mRNA expression from the paravertebral muscles does not differ between the convex and the concave side in patients with idiopathic scoliosis.
Major comments
I have some concerns with the paper. I have difficulty understanding the rationale for doing the study. One of the references mentioned by the authors (Wajchenberg et al, Acta Ortop Brasil, 2013) is, at least to my opinion, not very convincing, just showing a possibly higher prevalence of a variant of the ACE gene in a large family with a large number of individuals with scoliosis, but as far as I understand, not showing linkage between the variant and scoliosis.
The current study, overall, instead investigates gene expression. If the authors are convinced that ACE is important, could there be other pathways involved that should have been measured instead of just ACE itself?
If ACE expression is of importance in idiopathic scoliosis, I'd suggest that the first step would have been to compare patients and controls. Just comparing the convex and concave side would probably make it extremely difficult to find any difference. The anatomical variation in expression between a concave and convex side could be non-existent.
Sample size- is there any specific rationale for just using 21 patients? The authors sampled muscle biopsies from 21 patients, with as I understand it, different types of curves. The conclusion in the abstract is not supported by the study findings- that ACE expression is not important for the development of idiopathic scoliosis has not been studied, only that there is no difference between expression when comparing the concave and the convex side.
Variation close to the LBX1 gene is today the probably the most validated finding of association with idiopathic scoliosis but is not mentioned in the paper. LBX1 is also expressed in muscle tissue. The introduction mentions several genetic association studies, of which some have not been validated. The manuscript does otherwise not deal with genetic association studies and therefore, the introduction could be shortened and more focus on and explain why the authors wanted to study the expression of ACE, to convince the reader why this study is important. While studying the references mentioned, again I'm not convinced why ACE expression should be specifically studied.
Minor comments
Was the sampling standardized? Is there a variation in mRNA expression with different sampling sites on the same

patient? Were the sampling conditions exactly the same? Was mRNA expression varying with age of the patients?
Abstract, methods section: it is here mentioned something about a predominance of fatty and fibrous muscle on the concave side of the deformity. I think this part of the sentence must be clarified or deleted, since it does not seem to have a relation with the results, or methodology.
Figure legends and Table legends does not completely explain abbreviations.

If improvements to the English language within your manuscript have been requested we recommend that you address this before submitting to another journal. We recommend that you either get your manuscript reviewed by someone who is fluent in English or, if you would like professional help, you can use any reputable English language editing service. We can recommend our affiliates Nature Research Editing Service (http://bit.ly/NRES_BS) and American Journal Experts (http://bit.ly/AJE_BS) for help with English usage. Please note that use of an editing service is neither a requirement nor a guarantee of publication. Free assistance is available from our English language tutorial (https://www.springer.com/gb/authors-editors/authorandreviewertutorials/writinginenglish) and our Writing resources (http://www.biomedcentral.com/getpublished/writing-resources). These cover common mistakes that occur when writing in English.

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# Histochemical Analysis of Paraspinal Rotator Muscles From Patients With Adolescent Idiopathic Scoliosis

## *A Cross-Sectional Study*

*Marcelo Wajchenberg, PhD, Delio Eulalio Martins, PhD, Rafael de Paiva Luciano, MD, Eduardo Barros Puertas, PhD, David Del Curto, MD, Beny Schmidt, PhD, Acary Bulle de Souza Oliveira, PhD, and Flavio Faloppa, PhD*

**Abstract:** Morphological, biochemical, and histopathological alterations in the paraspinal skeletal muscle of patients with adolescent idiopathic scoliosis (AIS) have been extensively reported. We evaluated rotator muscle fibers from the apex vertebra of AIS patients through histological and immunohistochemical analysis.

A population of 21 female AIS patients who underwent corrective surgery between 2010 and 2013 had biopsies taken from the paraspinal muscle in the convex and concave sides of the thoracic curve apical vertebra. Serial sections were stained following routine protocols for hematoxylin and eosin (HE), Sudan red, Gomori trichrome, NADH, ATPase, and cytochrome oxidase. We assessed muscular atrophy and hypertrophy, fatty proliferation, endomysial and perimysial fibrosis, the presence of hyaline fibers, mitochondrial proliferation, muscular necrosis, nuclear centralization, and inflammation. Two independent professionals evaluated the slices.

The thoracic curves had an average Cobb angle of 68 degree. Comparative analysis of the concave and convex sides was performed with McNemar test at a significance level of 5%. Results showed significant differences in both endomysial and perimysial fibrosis and fatty involution between the two sides of the apex vertebra.

Paraspinal muscles in the concave side of the scoliosis apex had significantly more fibrosis and fatty involution. However, both sides showed signs of myopathy, muscular atrophy due to necrosis, presence of hyaline fibers, and mitochondrial proliferation.

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**Abbreviations**: AIS = adolescent idiopathic scoliosis, ATPase = adenosine triphosphatase, HE = Hematoxylin and Eosin, IS = idiopathic scoliosis, NADH = Nicotinamide adenine dinucleotide.

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## INTRODUCTION

The set of conditions named idiopathic scoliosis (IS) encompasses any lateral curvature of the vertebral column associated to the rotation of vertebral bodies, and with no known cause.[1] Depending on the age of onset, IS might be infantile (0–3 years of age), juvenile (4–9), or adolescent (10 to adulthood).[2]

The etiology and pathogenesis of IS have long been objects of study. As early as 1882, Adams autopsied several cadavers with scoliosis, describing their deformities. He suggested that vertebral bone distortions preceded secondary muscular alterations, opposing contemporary authors who saw scoliosis primarily as a paraspinal muscle disorder.[3] Since then, several factors have been proposed as potential causes for IS including abnormal growth patterns, structural tissue deficiency found in specific conditions and syndromes, asymmetrical growth of trunk and limbs, alterations in the sagittal vertebral column, and environmental factors such as food quality. Previous studies have also indicated that the disease might develop from a combination of genetic traits and environmental factors.[2,4]

Later studies showed an association between morphological, histopathological, and biochemical alterations in paraspinal muscles specifically in adolescent IS (AIS). The most frequently reported abnormalities referred to increased type I fibers in the convex side and loss of type II fibers in the concave side of the curvature,[5,6] elevated concentrations of intracellular glycogen and lipids,[7] structural changes in the sarcolemma and the myotendinous junction[8,9]; alterations in muscle enzymatic activity[10]; and increased intracellular calcium concentrations.[11]

Despite this extensive literature, the etiology of AIS remains obscure. Studies focused on muscular alterations often meet with difficulties in sample collection, and others usually have a bias toward the neuropathic aspects of the disease. To shed light on the subject and evaluate the hypothesis that the disease is primarily myopathic, we have analyzed in detail profound biopsies of the rotator muscles in the apex of the deformity through histological and immunohistochemical analyses.

## MATERIALS AND METHODS

The present study was conducted through biopsy analysis from 21 female AIS subjects with normal body mass index and no associated comorbidities. Patients were all surgically treated and followed at the same outpatient facility from May 2010 to June 2013 with a mean age of 14.8 years (Table 1). The work was approved by the Committee on Research Ethics (no. 639.087) of our Institution and all patients or legal guardians, in the case of minors, voluntarily signed an informed consent form.

**TABLE 1.** Characteristics of the Patients' Scoliotic Curves

| | | Cobb Angles | | Lenke Classification | | | |
|---|---|---|---|---|---|---|---|
| **Patient** | **Age, y** | **Thoracic** | **Lumbar** | **Type** | **Lumbar Modifier** | **Sagittal Modifier** | **King** |
| 1 | 14 | 60 | 83 | 6 | C | N | I |
| 2 | 13 | 115 | 45 | 4 | C | N | II |
| 3 | 13 | 97 | 45 | 3 | B | N | II |
| 4 | 13 | 90 | 25 | 2 | A | N | V |
| 5 | 12 | 56 | 28 | 1 | A | N | III |
| 6 | 16 | 75 | 48 | 4 | C | N | II |
| 7 | 12 | 62 | 55 | 1 | C | + | II |
| 8 | 13 | 52 | 43 | 1 | C | N | II |
| 9 | 24 | 57 | 75 | 6 | C | − | I |
| 10 | 14 | 50 | 36 | 1 | B | N | II |
| 11 | 15 | 46 | 20 | 1 | A | N | III |
| 12 | 15 | 50 | 25 | 2 | A | N | V |
| 13 | 14 | 52 | 64 | 6 | C | N | I |
| 14 | 17 | 63 | 34 | 1 | B | N | II |
| 15 | 15 | 70 | 54 | 3 | C | N | II |
| 16 | 21 | 76 | 56 | 3 | C | N | II |
| 17 | 14 | 90 | 43 | 2 | C | + | V |
| 18 | 15 | 56 | 60 | 1 | C | N | II |
| 19 | 13 | 55 | 40 | 2 | C | N | II |
| 20 | 14 | 53 | 52 | 2 | C | N | II |
| 21 | 14 | 55 | 41 | 1 | C | N | II |

During corrective surgeries, biopsies from rotator muscles in both sides of the scoliosis apex vertebra were obtained from all patients. Muscle biopsy followed the procedure described by Schmidt et al,[12] and extracted samples were protected in gauze and refrigerated. Samples were immediately taken to the laboratory, where they were placed over a cork, embedded in gum tragacanth, and covered in talc. Samples were then immersed in liquid nitrogen for 20 s, and the blocks were stored at −80°C. After serial cryostat sectioning of the blocks, standard staining techniques included hematoxylin and eosin (HE), Sudan red, Gomori trichrome, cytochrome oxidase, ATPase and NADH.

Samples were analyzed for muscular atrophy and hypertrophy, fatty proliferation, endomysial and perimysial fibrosis, presence of hyaline fibers, mitochondrial proliferation, muscular necrosis, nuclear centralization, type grouping, presence of central core myopathy, and inflammation (Table 2). Two independent professionals evaluated each parameter, and there were no cases of disagreement between the two regarding the analyses. Necrosis, atrophy, hypertrophy, fatty involution, and endomysial, perimysial, and hyaline fibroses were classified as: absent; scarce (<25%); mild (<50%); moderate (<75%); and severe (>75%). Incidence of a determined condition was considered as the sum of moderate and severe cases for each sample.

## RESULTS

Table 1 summarizes data from patients included in the study, and includes age distribution, average Cobb angles, and Lenke and King classification. Only four cases (19%) presented with the main curvature in the lumbar region; among them, patient 9 was the only one to have hypokyphosis (Cobb angle <10°). Hyperkyphosis (Cobb angle >40°) was detected in two patients (9.5%). The average Cobb angle was 68° for the main thoracic curve and 77.5° for the thoracolumbar and lumbar curves.

Comparative analysis of the concave and convex sides of each sample was performed with McNemar test at a significance level of 5%. Relative frequencies found and *P* values are presented in Table 2. Endomysial and perimysial fibrosis as well as fatty involution were significantly greater in the concave side of the apex vertebra (Table 2 and Figure 1). We were also able to identify other alterations, albeit with no significant differences between curvature sides. These included hyaline fibers, muscle necrosis, and nuclear centralization (Figure 2); inflammation, muscular atrophy, and mitochondrial

**TABLE 2.** Histopathological Alterations in the Paraspinal Skeletal Muscle of Patients With Adolescent Idiopathic Scoliosis

| | **Concavity (%)** | **Convexity (%)** | ***P*** |
|---|---|---|---|
| Necrosis | 42.8 | 23.8 | 0.125 |
| Muscular atrophy | 52.3 | 38.0 | 0.453 |
| Muscular hypertrophy | 42.8 | 28.5 | 0.453 |
| Fatty involution | 85.7 | 47.6 | 0.039* |
| Endomysial fibrosis | 81.0 | 47.6 | 0.016* |
| Perimysial fibrosis | 85.7 | 52.4 | 0.039* |
| Hyaline fibers | 85.7 | 71.4 | >0.999 |
| Inflammatory tissue | 14.3 | 9.5 | >0.999 |
| Core | 76.2 | 66.7 | 0.625 |
| Mitochondrial proliferation | 71.4 | 61.9 | 0.500 |
| Type I fibers | 89.5 | 88.1 | 0.110 |
| Nerves | 90.5 | 81.0 | 0.500 |
| Nuclear centralization | 61.9 | 47.6 | 0.375 |

* $P < 0.05$.

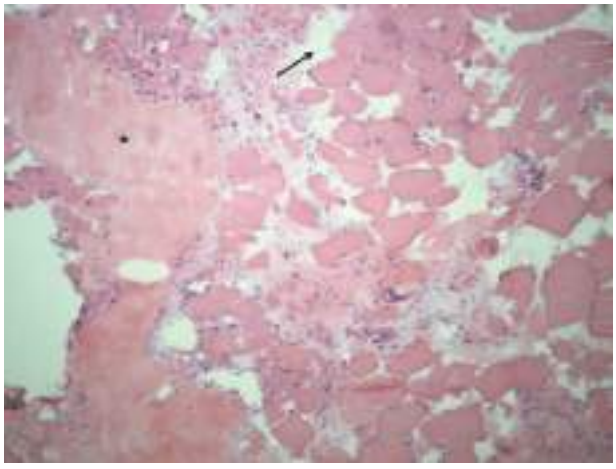

**FIGURE 1.** Hematoxylin and eosin stain of rotator muscle tissue from an adolescent idiopathic scoliosis patient showing areas of endomysial and perimysial fibrosis as well as fatty proliferation.

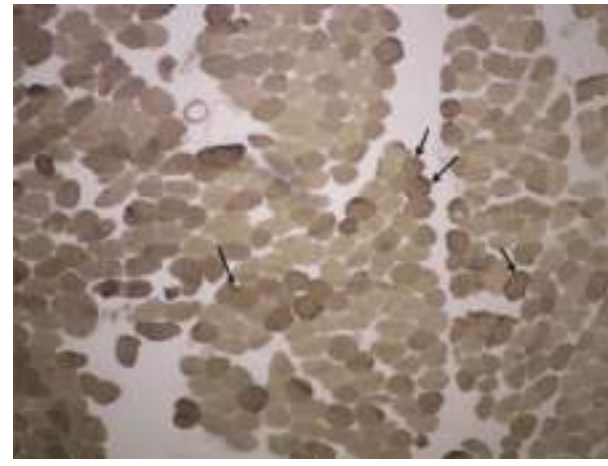

**FIGURE 3.** Cytochrome oxidase stain of rotator muscle tissue from an adolescent idiopathic scoliosis patient showing muscular atrophy and mitochondrial proliferation.

proliferation (Figure 3); and low-oxidative areas in the muscle fibers suggestive of central core myopathy (Figure 4).

## DISCUSSION

The etiology and pathogenesis of IS have yet to be unveiled. Currently, there are several parallel and overlapping hypotheses involving genetic, structural, and environmental factors. An environmental role becomes evident in studies that show only a partial fit of curvatures between homozygote twins, which can vary with disease severity.[13] A few previous studies propose an association between AIS and muscular disorders. Since 1882, Adams attempted to connect primary dorsal torsion, including gibbosities, with a secondary alteration in the paraspinal muscles of IS patients. IS becomes more evident after puberty during adolescence, when patients show greater axial growth. The progression of deformities characteristic of IS makes it essential that we further understand the disorders that rotator paraspinal muscles undergo during the disease. The best way to assess these disorders is through biopsies taken during surgery. Previous studies conducted with percutaneous biopsies or through electromyography could not adequately isolate the proper muscle fibers.

We analyzed muscle fibers, bilaterally, in the deformity apex of AIS patients who underwent biopsy during corrective surgery. Fibrosis and fatty involution were significantly greater in the concave side of the scoliosis. Both sides showed muscular atrophy, necrosis, hyaline fibers, mitochondrial proliferation, and areas suggesting central core lesion. In our samples, we could not find evidence of a primarily neurogenic disease as previously reported by Chagas et al,[14] who found fascicle-type grouping in IS patient biopsies.[14]

Our findings, along with previous studies, suggest that AIS might be related to congenital myopathies. This type of hereditary myopathy is characterized by precocious muscular alterations starting in infancy, with stable or slowly progressing effects.[15] Congenital myopathy morbidity is associated with the involvement of respiratory muscles, adding to the orthopedic

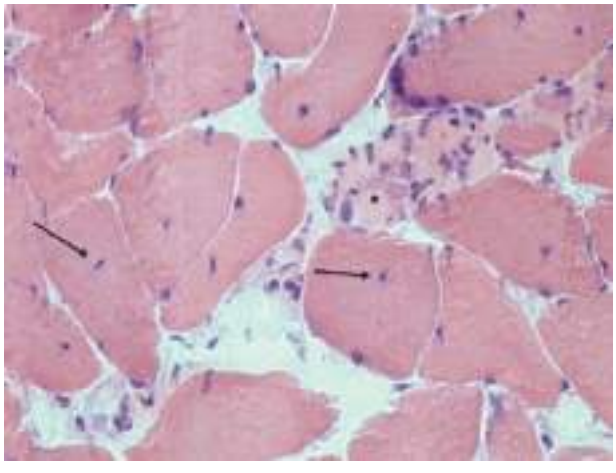

**FIGURE 2.** Hematoxylin and eosin stain of rotator muscle tissue from an adolescent idiopathic scoliosis patient showing areas of muscular necrosis and nuclear centralization.

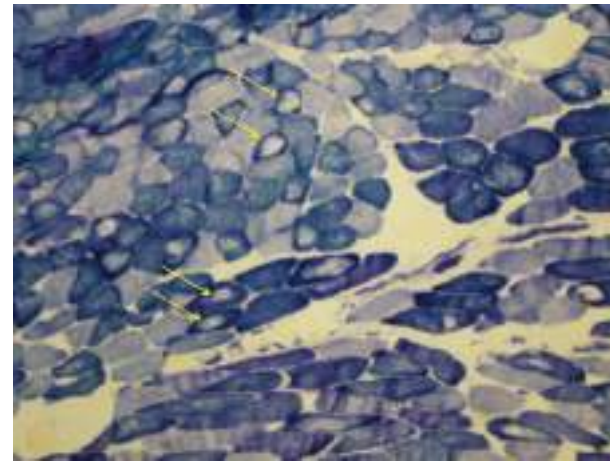

**FIGURE 4.** NADH stain of rotator muscle tissue from an adolescent idiopathic scoliosis patient showing central core lesion of the muscle fiber.

problems such as scoliosis and contractures. In the last decade, there have been significant advances in the identification of genetic myopathies, although several poorly defined diseases still remain with no known association to a specific genetic mutation. Central core disease, first described in 1956 by Shy and Magee,[16] is a congenital dominant autosomal myopathy with rare recessive cases described. The original study reported a family case in which the dominant trait was described as muscle fibers with an abnormal central zone, lacking in oxidative enzymes. These characteristics were significantly observed in our samples.

It is worth mentioning that patients in need of surgery, such as the ones in our study, might have a more severe deformity on average. In turn, this may result in more advanced myopathies and greater damage to the concave side, causing the characteristic IS torsion. These ideas can only be validated as more samples are analyzed and comparisons are made with biopsies from healthy individuals.

Furthermore, we cannot deduce from our data alone that the observed myopathies are primary and have a causal relationship with the disease. Other muscle groups might also come into play, as reported by Sahgal et al, who performed biopsies of the gluteus muscles.[17] Further studies are needed, therefore, to probe into genetic factors and systemic muscular diseases that might trigger the observed abnormalities in the paraspinal rotator muscles.

All procedures performed in studies were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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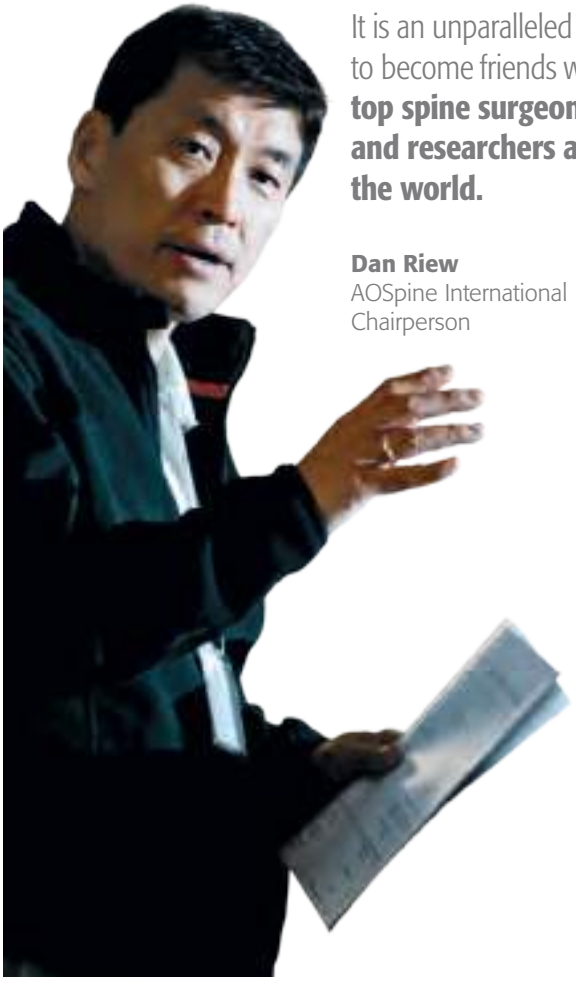
Gain access to numerous privileges, including the most advanced educational programs, a worldwide network of professionals, and the highest quality of research carried out by experts and key opinion leaders in spine care.

**AOSpine is the largest organization for spine surgeons in the world.**



It is an unparalleled opportunity to become friends with and visit **top spine surgeons, educators, and researchers all over the world.**

**Dan Riew**
AOSpine International Chairperson

### Education
Never stop learning, never stop improving

### Research
Research that matters, improving patient care

### Networking
Join the best professionals in the field

### Advantages
A membership with lots of privileges

50% DISCOUNT
For students and residents

**Advancing spine care worldwide**

For further information on the latest benefits available, please visit:
www.aospine.org/membership

# Table of Contents

Global Spine Congress 2017

# Welcome

Welcome to the **Global Spine Congress 2017** (GSC)! It is the 6th annual meeting for AOSpine, showcasing the very latest approaches to spine care.

The GSC provides an outstanding forum to exchange ideas, network with fellow spine professionals, and learn about the latest research, techniques, and technologies in spine surgery.

The GSC is the most important academic annual meeting and one of the biggest gatherings of the global spine community.

This year, the GSC will feature a unique scientific program, with parallel sessions covering more than 25 topics, and showcase all the latest technologies and cutting-edge innovations in spine surgery. The Scientific Program of the event will include precourses, AOSpine Symposia, Society Symposia, and peer reviewed abstracts—scheduled to be presented as oral or E-posters presentations, as well as AOSpine members-only sessions on various topics. We are delighted to state that for this year's event, a total of 1,048 abstracts were submitted. This is the highest number of abstracts ever submitted for the GSC!

We are convinced that the presented scientific program will encourage lively discussions among participants and generate new ideas to help advance spine care. We hope you will find it a valuable and rewarding experience.

Finally, we would like to extend our sincere appreciation and gratitude to the spine societies, moderators, speakers, sponsors, and exhibitors, whose contributions help to make this global event possible.

We are very much looking forward to this outstanding event and its exclusive approach to exchanging knowledge.

# Organizing Committees

## Executive Committee

Global Spine Congress 2017

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Congress
Chairperson

**Daniel K. Riew**
Congress
Co-Chairperson

**Michael Grevitt**
Congress
Co-Chairperson

**Claudio Lamartina**
Regional
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**Giuseppe Barbagallo**
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**Alessandro Ducati**
Local
Chairperson

**Giovanni Barbanti Brodano**
Local
Co-Chairperson

**Lawrence Lenke**
Scientific
Co-Chairperson

**Ziya Gokaslan**
Scientific
Co-Chairperson

# Organizing Committees

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**Claudio Lamartina** (Italy)—Regional Chair
**Giuseppe Barbagallo** (Italy)—Regional Co-Chair
**Alessandro Ducati** (Italy)—Local Chair
**Giovanni Barbanti-Bròdano** (Italy)—Local Co-Chair

## Regional Representatives

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**Switzerland:**
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**South Africa:**
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# Organizing Committees

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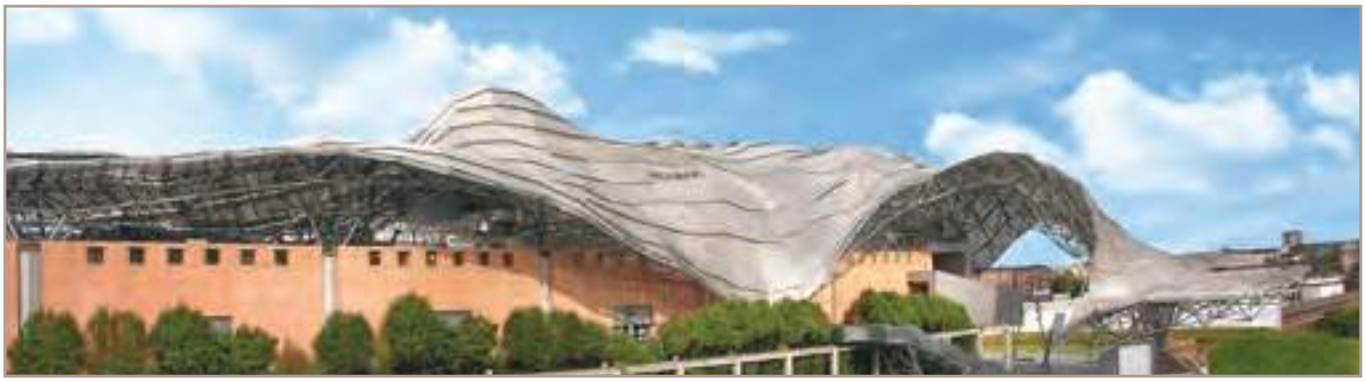
YH Yau (Australia)
Yasutsugu Yukawa (Japan)
Ratko Yurac (Chile)
Alberto Zerbi (Italy)

# Venue and Registration

## MiCo Milano Congressi

MiCo – Milano Congressi
Pedestrian access to GSC 2017
North Wing Entrance – Gate nr 14-15
Address – Via Gattamelata nr 5, Milano

**www.micomilano.it**



The Global Spine Congress 2017 takes place at MiCo Milano Congressi, one of Europe's largest and most famous convention centers. Designed by architects Mario Bellini and Pierluigi Nicolin, this brand new complex houses an exceptional space, together with modern equipment, the full range of technologies, and comfortable spacious areas.

The venue is conveniently located downtown Milan with a parking lot for more than 1,100 cars and direct access to Milan's new subway line 5.

# Registration

### Registration Desk opening times

The Registration Desk, located on the first floor of the MiCo Milano Congressi, is open during Congress days according to the following schedule:

| | |
|---|---|
| **Wednesday, May 3** | **10:30–18:30** |
| **Thursday, May 4** | **07:30–19:30** |
| **Friday, May 5** | **07:00–19:00** |
| **Saturday, May 6** | **07:30–13.30** |

### Pre-paid registration

An email will be sent to individual participants upon completion of the registration process. This confirmation must be presented at the registration desk on-site at the congress in order to receive the congress kit and access badge.

### On-site registration

On-site registration is possible from Wednesday, May 3 to Saturday, May 6. Both credit cards (AMEX, VISA and MASTERCARD) and cash are accepted on-site.


For the Congress, reduced rates on hotel accommodation are available close to the Congress Venue. For any questions or logistics information, please contact the Organizing Secretariat:

Organizing Secretariat
OIC srl
Viale G. Matteotti, 7
50121 Florence, Italy
Tel +39 055 5035 1
Fax +39 055 5035 230
registrationGSC2017@oic.it

AOSPINE

# AOSpine Member Assembly

The AOSpine International Board cordially invites you to join the Member Assembly on May 4, 2017 from 07:30 to 08:00.

It is an excellent opportunity to learn more about AOSpine, meet old and make new friends, and network with the world's most outstanding spine surgeon community.

We look forward to seeing you there!

Global Spine Congress
2017

# Follow us live on Twitter during the Global Spine Congress

# @AOSpine #gscmilan2017

AOSPINE

# Registration

## Registration fee

| | ON-SITE April 25–May 6, 2017 |
|---|---|
| Aospine Member Physician [1] | € 750 |
| Aospine Member Medical/Research Student, Resident, Fellow [2] | € 220 |
| Aospine Member Physician Assistant and Nurse Practitioner | € 375 |
| Non-Member Physician | € 890 |
| Non-Member Medical/Research Student, Resident, Fellow [2] | € 290 |
| Non-Member Physician Assistant And Nurse Practitioner | € 510 |
| Delegate From Low Income Country [3] | € 600 |
| Industry Representative [4] | € 885 |
| Accompanying Person [5] | € 36 |

| | |
|---|---|
| Precourses [6] | € 170 |
| Day Rate AOSpine Member: Thursday/Friday | € 350 |
| Day Rate Non-Member: Thursday/Friday | € 485 |
| Day Rate AOSpine Member: Saturday | € 175 |
| Day Rate Non-Member: Saturday | € 285 |

## Delegate registration fee includes:

- Full access to the scientific sessions and exhibition (precourses not included)
- Admission to the lunch symposia (organized by the industry)
- Congress bag with final program and further scientific material
- The AOSpine mobile application, including program and abstract book
- Invitation to the Exhibition Opening (Thursday, May 4, from 18:00-19:30)
- Coffee service
- Certificate of attendance
- Name badge

## Accompanying person registration fee includes:

Invitation to the Exhibition Opening
(Thursday, May 4, from 18:00-19:30)

## Badge

Each participant receives a name badge upon collecting the congress kit at the Registration Desk. The badge is the official congress accreditation and must be worn at all times. Badges are colour-coded as follows:
Blue – AOSpine Member
Yellow – Exhibitor
Green – Accompanying Person

## Ribbons

Member ribbons as well as other ribbons (Participant, Council members, Commission members, etc) will be available at the AOSpine booth. Feel free to pass by and pick up your ribbon!

## Registration terms

Please read the following registration terms and conditions carefully before registering. Please note that debits to your credit card will appear as O.I.C. Srl Florence (Italy) on the registration statement.

1. **AOSpine Members receive a EUR 130.– discount on the registration fee.** To benefit from the discount, you will need to become an AOSpine Member before registering. Membership status will be verified by AOSpine. Be aware if your membership is not updated, the "Non-member fee" will be applied.
2. To qualify for the medical/research student fellows/residents registration fee, a letter of proof from the training program director needs to be sent to: registrationGSC2017@oic.it, or shown at the Registration Desk.
3. World Bank classification 2016. Please visit: www.gsc2017.org to access the list of eligible countries.
4. Industry representatives: Non-clinical professionals, with interests in the spine field, but not treating patients.
5. The accompanying person registration fee includes a badge for the Exhibition Opening (Thursday, May 4, 2017).
6. Only congress registered participants can register for precourses.

## Registration Desk and Organizing Secretariat

For any questions or logistics information, please contact:

O.I.C. Srl
Viale G. Matteotti, 7
50121 Florence, Italy
Phone: +39 055 50351
Fax: +39 055 5001912
infoGSC2017@oic.it

AOSPINE

# Discover the latest AOSpine Sacral Classification System at the Global Spine Congress

Get your toolkit* at the **AOSpine booth!**

Here's what users have to say about the AOSpine Classification System:

**"It's easy to use, easy to remember, and reliable."**

**"It puts together morphologic characteristics and really helps with treatment decision-making."**


Download your toolkit anytime on the AOSpine website

www.aospine.org/classification

*Also get your Thoracolumbar and Subaxial toolkits at the AOSpine booth.

# General Information (from A-Z)

## AOSpine booth

Discover the leading global community of spine surgeons by visiting the AOSpine booth. Here, we will be pleased to talk to you and answer any questions you may have about AOSpine and give you further information about AOSpine Education, Research and Community Development. Visit the booth for further details about our activities.

Opening times:

**Thursday, May 4, 2017 from 08:00 to 19:30**

**Friday, May 5, 2017 from 08:00 to 19:00**

**Saturday, May 6, 2017 from 08:00 to 13:30**

## Barcode scanning

Participants could be asked by staff from industries at exhibit booths to provide their personal contact data through barcode scanning.

In this way, information about name, surname, country, and e-mail address will be given out to companies on an individual, voluntary basis.

Please do not allow scanning of your badge by industry representatives without your direct consent.

For ITALIAN CME accreditation purposes, participants will be asked from congress staff at meeting room doors for barcode scanning upon entrance and exit of each session. This system is necessary to certify the attendance of those interested to apply for CME accreditation. Please do not allow scanning of your badge if you are not interested in ITALIAN CME credits.

## Beverages and food

At the event venue, there is a snack bar close to the exhibition and a number of restaurants and kiosks near to MiCo congress venue.

## Certificate of attendance

The certificate of attendance is provided to each participant upon registration in the congress kit.

## Coffee breaks

A coffee service is available in the exhibition area during the whole day.

## Congress App

The AOSpine GSC mobile application is available for download. It includes the following items and many other practical tools:

- Program
- Abstracts publication
- Real time updating on scientific sessions
- Exhibitors
- Congress venue maps

Available for iOS and Android devices, it requires:

- an iOS device running 7.0 or greater; iPad users please select 'iPhone Only' App in the App Store
- an Android device running 4.0 or greater

Scan the QR codes to get it from your app store!

**Apple iOS:**

**Android:**

For any other devices the web App is available at www.gsc2017.org/app

## Continuing Medical Education accreditation

The 'Global Spine Congress 2017' is accredited by the European Accreditation Council for Continuing Medical Education (EACCME) to provide the following CME activity for medical specialists. The EACCME is an institution of the European Union of Medical Specialists (UEMS), www.uems.net.

The 'Global Spine Congress 2017' is designated for a maximum of (or 'for up to') 17 hours of European external CME credits. Each medical specialist should claim only those hours of credit that he/she actually spent in the educational activity.

Through an agreement between the European Union of Medical Specialists and the American Medical Association, physicians may convert EACCME credits to an equivalent number of AMA PRA Category 1 Credits™. Information on the process to convert EACCME credit to AMA credit can be found at www.ama-assn.org/go/internationalcme.

Live educational activities, occurring outside of Canada, recognized by the UEMS-EACCME for ECMEC credits are deemed to be Accredited Group Learning Activities (Section 1) as defined by the Maintenance of Certification Program of The Royal College of Physicians and Surgeons of Canada.

**The online CME questionnaire will be available at: www.gsc2017.org/cme from May 7 to 28, 2017.**

Please note that the registration code, printed on your badge, will be required to access the CME questionnaire.

AOSPINE

# Discover the latest recommendations from the AOSpine Knowledge Forum Tumor

A wealth of evidence-based treatment recommendations for spine oncology, all in the Focus Issue II, published in Spine–October 15, 2016–Volume 41–Issue 20S.

**To find out more about how to access the Focus Issue and other membership benefits, visit the AOSpine booth.**


We hope that these recommendations are helpful to the clinicians who are faced with managing these challenging patients.

TOPICS

- **Introduction to Focus Issue II in Spine Oncology: Evidence-based Medicine Recommendations for Spine Oncology**
  Charles G. Fisher, Laurence D. Rhines, Chetan Bettegowda, Niccole M. Germscheid, Ilya Laufer, Nicolas Dea, Mark H. Bilsky, Jorrit-Jan Verlaan, Jeremy J. Reynolds, Daniel M. Sciubba, Richard Williams, Tamir Ailon, Yoshiya J. Yamada, Peter P. Varga, Stefano Boriani, Ziya L. Gokaslan, and Arjun Sahgal
- **Benign Tumors of the Spine: Has New Chemotherapy and Interventional Radiology Changed the Treatment Paradigm?**
  Raphaële Charest-Morin, Stefano Boriani, Charles G. Fisher, Shreyaskumar R. Patel, Norio Kawahara, Ehud Mendel, Chetan Bettegowda, and Laurence D. Rhines
- **Management of Locally Recurrent Chordoma of the Mobile Spine and Sacrum: A Systematic Review**
  Tamir Ailon, Radmehr Torabi, Charles G. Fisher, Laurence D. Rhines, Michelle J. Clarke, Chetan Bettegowda, Stefano Boriani, Yoshiya J. Yamada, Norio Kawahara, Peter P. Varga, John H. Shin, Arjun Sahgal, and Ziya L. Gokaslan
- **Molecular Markers and Targeted Therapeutics in Metastatic Tumors of the Spine: Changing the Treatment Paradigms**
  C. Rory Goodwin, Nancy Abu-Bonsrah, Laurence D. Rhines, Jorrit-Jan Verlaan, Mark H. Bilsky, Ilya Laufer, Stefano Boriani, Daniel M. Sciubba, and Chetan Bettegowda




**www.aospine.org**

# General Information (from A-Z)

## Crediti formativi—ECM Italia

I crediti formativi ECM saranno certificati dal Provider OIC (2836) secondo la nuova regolamentazione approvata dalla Commissione Nazionale per la Formazione Continua il 13 gennaio 2010 e s.m.i.

Si ricorda la determinazione assunta dalla Commissione Nazionale Formazione Continua, del 15 dicembre 2016, alla luce della quale ogni partecipante potrà maturare 1/3 dei crediti formativi, ricondotti al triennio di riferimento (150 totali per il triennio 2017-2019), mediante reclutamento diretto da parte dello sponsor.

L'accreditamento del Congresso sarà effettuato per l'intero evento (dal 4 al 6 maggio) in un'unica soluzione.

**I crediti assegnati al Congresso (evento Nr. 191125 ed.1) sono 5,7** e sono rivolti a Medici Specialisti in Medicina Fisica e Riabilitazione, Medicina Termale, Neurochirurgia, Ortopedia e Traumatologia e Radiodiagnostica, ed a Infermieri e Fisioterapisti.

Si ricorda che avranno diritto ai crediti ECM solo coloro che saranno presenti almeno all'90% dell'intero programma scientifico congressuale accreditato, dal 4 al 6 maggio— escluse le sessioni Members-only, Member Assembly, Member Representative Election.

**La rilevazione delle presenze avverrà tramite l'utilizzo di scanner elettronici posizionati presso l'ingresso delle Sale dove si svolgono le sessioni accreditate. Si raccomanda vivamente ai partecipanti di recarsi presso la postazione e di far registrare ogni ingresso e ogni uscita. L'assenza di una sola delle timbrature necessarie determinerà l'impossibilità di assegnazione dei crediti.**

Per completare l'acquisizione dei crediti il partecipante dovrà compilare l'apposita certificazione di autoapprendimento nonché il questionario di valutazione dell'evento sul sito **www.gsc2017.org/cme** disponibile **dal 7 maggio al 28 maggio 2017**, unitamente ai propri dati anagrafici e all'eventuale reclutamento da parte di uno Sponsor.

**Per accedere alla sezione crediti formativi ECM sul sito è indispensabile inserire il codice di registrazione stampato sul badge nominativo consegnato in sede congressuale.**

Ricordiamo che sarà obbligo e cura del partecipante interessato ai crediti ECM di completare detto percorso. I certificati saranno inviati dal Provider dopo aver provveduto alla verifica di entrambi i parametri.

Soltanto i relatori che abbiano svolto una relazione nell'ambito del programma scientifico accreditato per almeno 1/2 ora continuativa potranno richiedere i crediti docenti in ragione di 1 credito per ogni 1/2 ora. Gli interessati potranno rivolgersi al Desk segreteria.

Ricordiamo che i relatori potranno accedere ai crediti in qualità di discenti, fermo restando il rispetto dei parametri di presenza e l'accesso alla procedure sopra indicati.

Non sono previsti crediti per tutti gli altri relatori e per i moderatori partecipanti all'evento.

## Disclaimer

AOSpine, the organizer of the Global Spine Congress, and OIC srl, the Organizing Secretariat, will not be held liable for personal injuries or for loss or damage to property incurred by participants or guests at the congress. Participants and guests are encouraged to take out insurance to cover loss incurred in the event of cancellation, medical expenses, or damage to, or loss of personal belongings when traveling.

AOSpine International and OIC srl cannot be held liable for any disruption of the Global Spine Congress proceedings arising from natural, political, social, or economic events or other unforeseen circumstances beyond its control. Registration of a participant or guest confirms acceptance of this condition.

The materials presented at the meeting sessions are made available for educational purposes only. The material is not intended to represent the only (or optimal) methods or procedures appropriate for the medical situations discussed, but rather is intended to present an approach, view, statement, or opinion of the presenters or faculty that may be helpful to others who face similar situations.

Official photographers will be present at this event, therefore, please note that any photographs taken at the meeting may be used in future AOSpine publications, on the AOSpine web site, or in other materials.

Other picture taking and video or audio recording of lectures and sessions are strictly prohibited.

## E-posters

GSC posters will be presented in electronic format as E-posters available at the computers located in the exhibition area.

Posters are all available in the AOSpine GSC app.

Registration to the event is mandatory for all presenters.

## Exhibition

A trade show exhibition is being held during the event providing the opportunity to show the latest innovative techniques to maximize interaction between participants and sponsor representatives.

Coffee stations are available in the exhibition area during the whole day and computer workstations are located within this area for E-posters consultations.

AOSPINE

Education

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# General Information (from A-Z)

## Exhibition hours

**Thursday, May 4, 2017 from 08:00 to 19:30**
**Friday, May 5, 2017 from 08:00 to 19:00**
**Saturday, May 6, 2017 from 08:00 to 13:30**

## Industry Symposia

A number of industry Instructional Course Lectures (ICLs) that include food will be held on Thursday to Friday (check program for exact time and location).

## Language

The official language of the Global Spine Congress is English.

## Learning objectives

Upon completion of this program, participants should be able to:

- Discuss the latest developments in basic research for spinal disorders
- Recognize and outline the latest developments in clinical treatments for spinal disorders
- Describe the appropriate patient selection and diagnostic methods for spine surgery
- Outline evidence that justifies clinical outcomes of patient treatments

## Lost and found

Lost and found items can be recovered at the Registration Desk.

## Mobile phone and camera use

The use of mobile phones and cameras is not permitted during the scientific sessions. Participants are kindly requested to keep their mobile phones turned off during the scientific sessions.

## No smoking policy

Smoking is not permitted at any time. In accordance with the local regulations, this event follows a strict non-smoking policy.

## Scientific paper sessions

There will be 52 scientific paper sessions scheduled over the course of the meeting, covering the main spine topics with original podium presentation. More than 350 peer reviewed abstracts by the Program Committee will be presented in 4-minute presentations. Each session will have a 15-minute discussion.

As the scientific program consists of parallel sessions, speakers are required to respect the allotted time given for their presentations. This will contribute to the smooth running of the scheduled sessions. Registration to the Global Spine Congress is mandatory for oral presenters.

## Speakers center

This office is located close to the exhibition and plenary (Red) room.

During the following times, staff and equipment will be available for speakers to deliver their PowerPoint presentations:

| | |
|---|---|
| **Wednesday, May 3** | **10:30–18:30** |
| **Thursday, May 4** | **07:30–19:30** |
| **Friday, May 5** | **07:00–19:00** |
| **Saturday, May 6** | **07:30–13.30** |

Only computer projection is available in the meeting rooms and it is not possible to directly use personal laptops at the podium. PowerPoint presentations (Windows or Apple) on USB pens, memory sticks or personal laptops must be delivered to the slide preview desk as follows:

- **Presenters with PowerPoint presentations on USB pen:** report to the slide preview desk at least one hour before the session or the day before in case of early morning presentations.
- **Presenters with presentations on personal laptop and/or using MACINTOSH/APPLE**: report to the slide preview desk at least two hours before the session or the day before in case of early morning presentations in order to convert the file into Windows format and/or download the presentation onto the main system.
- **Presenters with video presentations:** MP4 video extension (codec H264) format with the name of the presenting author must be delivered to the slide preview desk at least two hours before the session or the day before in case of early morning presentations.

The indicated timings allow a smooth uploading of all presentations to the central computerized network and a swift transmission to the assigned meeting rooms. Staff members at the slide preview desk are also available to help those speakers wishing to rehearse their presentations.

## Symposia

There will be 22 scientific symposia during the three day meeting, covering the latest research and topics in spine surgery. The symposia consist of didactic lectures presented by international speakers followed by a discussion session.

## Target audience

The meeting is targeted at all spine surgeons, orthopedic and neurosurgeons, researchers, or anyone aiming to further improve their knowledge in the latest developments, current concepts, and the future of spine care.

## WiFi

WiFi is available for congress participants throughout the convention area; please check network and password at the Registration Desk.

AOSPINE

Education

# Calling all AOSpine Past Fellows!

## We have exclusive sessions and activities just for you at the Global Spine Congress.

| | |
|---|---|
| **Friday 5th May** | Past Fellows only sessions<br>ROOM YELLOW 2 |
| **10:30–11:30** | AOSpine Past Fellows<br>Research Session |
| **11:30–12:30** | Past Chairpersons of AOSpine<br>Encouraging Leaders |
| **19:00–20:00** | Reception for Past Fellows |

AO Foundation
DAVOS COURSES 2017

AOSPINE

# December 11-13, 2017
Davos, Switzerland

## Education

# DAVOS COURSES

Over three days, our distinguished, worldwide faculty members will share with you their highly advanced knowledge and experiences in the field of spine surgery.

At the AOSpine Davos Courses 2017, you can select one of the following educational courses:

1. **Degenerative** (Cervical and Lumbar)
2. **Deformity** (Adult and Pediatric)
3. **Trauma** (Cervical, Thoracolumbar, and Sacral)
4. **MISS Instrumentation and Vertebroplasty**
5. **MISS Microscopic Decompression**

Furthermore, you can customize your own afternoon Davos Courses experience by joining:

- A range of seminars and lectures
- Industry workshops
- "The Good-The Bad-The Ugly—A Case that Taught Me a Lesson" discussion

**The AOSpine Davos Courses 2017 are targeted for participants working at the Advanced and Master's Level, with surgical experience from 3–15 years.**

AOSPINE Curriculum

Find more information on our website, and register from May 2017 onwards.

**www.aodavoscourses.org**

# MiCo Milano Congressi Floor Plan

## North Wing Entrance, Via Gattamelata, NR5, Gate 14/15


## Global Spine Congress has been endorsed by:

**SINch**
Società Italiana di Neurochirurgia

**SICV&GIS**
Società Italiana di Chirurgia Vertebrale—Gruppo Italiano Scoliosi

## EVENTO CERTIFICATO

**SIOT**
Società Italiana Di Ortopedia E Traumatologia

# Wednesday, May 3, 2017

| | | Room: Yellow 2 | Room: Yellow 1 | Room: Yellow 3 |
|---|---|---|---|---|
| 10:30-13:30 | | | | |
| 13:30-18:00 | Participant registration | Precourse I<br>Knowledge Forum<br>Tumor<br>  <br>Evidence based approach to spinal tumor cases | Precourse II<br>Knowledge Forum<br>Deformity<br>  <br>Complications in surgery for spinal deformity in the child and the adult | Precourse III<br>Knowledge Forum<br>Trauma and Spinal Cord Injury<br>   <br>Spinal trauma and SCI: advancements and controversies |

## KEY

- Paper sessions
- AOSpine Members-only sessions

  These sessions are for members only.
  Join AOSpine today at: www.aospine.org/membership

  Member Privilege
- Breaks and industry lunch symposia
- Symposia
- Precourse (pre-registration required)

# Thursday, May 4, 2017

AOSPINE MEMBERS-ONLY SESSIONS

Member Privilege

| | Room: Red | Room: Blue 2 | Room: Yellow 1 | Room: Yellow 3 | Room: Yellow 2 | Room: Blue 1 |
|---|---|---|---|---|---|---|
| 07:30-08:00 | | | | | | Member Assembly |
| 08:00-09:00 | AOSPINE Opening symposium 2020 Vision: new horizons in AOSpine education | | | | | |
| 09:00-09:15 | Congress opening | | | | | |
| 09:15-10:00 | ADOLESCENT SCOLIOSIS 1 | CERVICAL LAMINOPLASTY | LUMBAR ADJACENT SEGMENT PATHOLOGY | MINIMALLY INVASIVE SPINE SURGERY LUMBAR | 8 in 8: 8 Pearls of Practice From my Region | |
| 10:00-10:30 | Break | | | | | |
| 10:30-11:15 | ADULT DEFORMITY 1 | NAVIGATION | LUMBAR DISC HERNIATION | BASIC SCIENCE GROWTH FACTORS | AOSpine Research and how to get involved | |
| 11:15-12:00 | TUMOR 1 | TRAUMA CERVICAL 1 | NOVEL TECHNOLOGIES AND DIAGNOSTICS | SURGICAL OUTCOMES | | |
| 12:00-13:30 | Industry lunch symposium | Industry lunch symposium | Industry lunch symposium | | | |
| 13:30-14:30 | Sagittal Alignment and Indirect Decompression: is it possible? Symposium hosted by: AOSpine past chairs AOSPINE | Cervical Deformity: Evaluation and Management | Globalization research network: from bench to beyond regions Symposium hosted by: AOSPINE LATIN AMERICA | Wound and Soft Tissue management in spine Symposium hosted by: AOSPINE AO Foundation | | |
| 14:30-15:00 | LUMBAR SPONDYLOLISTHESIS | NOVEL TECHNOLOGIES AND SACRAL JOINT FUSION | ENDOSCOPIC AND MINIMALLY INVASIVE SPINE SURGERY | BASIC SCIENCE SPINAL CORD INJURY | | |
| 15:00-15:30 | Break | | | | | |
| 15:30-16:15 | LUMBAR SURGERY COMPLICATIONS | TRAUMA LUMBAR | NOVEL CONCEPTS | BASIC SCIENCE DISC REGENERATION | How to write and review a paper  | |
| 16:15-17:00 | SPINE INFECTIONS 1 | MINIMALLY INVASIVE SPINE SURGERY 1 | NOVEL TECHNOLOGIES 1 | OSTEOPOROTIC FRACTURES | | |
| 17:00-18:00 | The next steps—thinking globally Symposium hosted by: NASS NORTH AMERICAN SPINE SOCIETY | What distinguishes a single discipline versus a multidisciplinary approach to spinal deformity surgery Symposium hosted by: | Nuances of minimally invasive surgery (MIS): lumbar degeneration and deformity Symposium hosted by: American Association of Neurological Surgeons | Complications in cervical spine surgery: causes, management techniques, and prevention Symposium hosted by: CERVICAL SPINE RESEARCH SOCIETY FOUNDED 1973 | | |
| 18:00-19:30 | Welcome reception and official exhibition opening | | | | | |

# Friday, May 5, 2017

AOSPINE MEMBERS-ONLY SESSIONS

Member Privilege

| | Room: Red | Room: Blue 2 | Room: Yellow 1 | Room: Yellow 3 | Room: Yellow 2 | Room: Blue 1 |
|---|---|---|---|---|---|---|
| 07:00-08:00 | | | | | | Member Representative Election |
| 08:00-09:00 | Sacrolliac Joint Fusion: Surgical Controversies | Incremental correction techniques in pediatric spinal deformity<br><br>Symposium hosted by:<br>AOTK | Surgeon to Surgeon Scientist | Early onset scoliosis management in countries with limited resources | | |
| 09:00-10.00 | ADOLESCENT SCOLIOSIS 2 | CERVICAL MYELOPATHY | LUMBAR SURGERY 1 | SPINE INFECTIONS 2 | Global teachers—how to teach in different cultures | |
| 10:00-10:30 | Break | | | | | |
| 10:30-11:30 | DEFORMITY | CERVICAL SURGERY | SPINE TRAUMA | NON OPERATIVE MEDICAL TREATMENTS | AOSpine Past Fellows Research Session | |
| 11:30-12:30 | ADOLESCENT SCOLIOSIS 3 | CERVICAL MYELOPATHY IMAGING | THORACOLUMBAR TRAUMA | SPINE BIOLOGICS | Past Chairpersons of AOSpine: Encouraging Leaders | |
| 12:30-14:00 | | Industry lunch symposium | | Industry lunch symposium | | |
| 14:00-15:00 | Sagittal imbalance: when and why to stop correction?<br><br>Symposium hosted by:<br>AOSPINE EUROPE | Updates on graft and biomaterials in lumbar spine surgery<br><br>Symposium hosted by:<br>Knowledge Forum Degenerative/ Biologics | Neurotrauma in the developing world: every little bit helps<br><br>Symposium hosted by:<br>AOTrauma Alliance Foundation | Mismatches between imaging and clinical findings | | |
| 15:00-15:30 | MINIMALLY INVASIVE SPINE SURGERY LATERAL LUMBAR FUSION | SURGICAL COMPLICATIONS | TUMOR 2 | BIOMECHANICS | | |
| 15:30-16:00 | Break | | | | | |
| 16:00-16:45 | ADULT DEFORMITY 2 | CERVICAL SURGERY COMPLICATIONS | LUMBAR SURGERY 2 | TRAUMA CERVICAL 2 | Prevention and patient-led care in the New Health Economy | |
| 16:45-17:45 | New technologies<br><br>Symposium hosted by:<br>EUROSPINE | Treatment standards in spine surgery—the German perspective<br>Symposium hosted by:<br>DWG | Infections in spine surgery<br><br>Symposium hosted by: | Management of odontoid fractures<br><br>Symposium hosted by:<br>SFCR | | |
| 18:00-19:00 | Cadaver Lab<br>Industry sponsored symposium | | | | | |

# Saturday, May 6, 2017

AOSPINE MEMBERS-ONLY SESSIONS

Member Privilege

| | Room: Red | Room: Blue 2 | Room: Yellow 1 | Room: Yellow 3 | Room: Yellow 2 |
|---|---|---|---|---|---|
| 08:00-09:00 | Postoperative Problems in Spine Surgery patients | Craniovertebral junction pathologies<br>Symposium hosted by: AOSPINE ASIA PACIFIC | Spinal infections<br>Symposium hosted by: AOSPINE MIDDLE EAST | A pain in the neck—surgical advances in canine cervical diseases<br>Symposium hosted by: AOVET | |
| 09:00-10:00 | DEFORMITY CERVICAL | MINIMALLY INVASIVE SPINE SURGERY 2 | LUMBAR STENOSIS | SURGICAL COMPLICATIONS DEFORMITY | AOSpine Subaxial Classification System—Training and testing |
| 10:00-10.30 | Break | | | | |
| 10:30-11:30 | ARTHROPLASTY CERVICAL | ADULT DEFORMITY 3 | TUMOR 3 | NOVEL TECHNOLOGIES 2 | AOSpine Sacral Classification System—Training and testing |
| 11:30-12:30 | | What's the Place of Lateral Approach In a Spine Surgeon's Toolbox?<br>Symposium supported by: Society of Lateral Access Surgery<br>SOLAS Society of Lateral Access Surgery | Latest AOSpine clinical practice guidelines: degenerative cervical myelopathy and traumatic spinal cord injury<br>Symposium hosted by: Knowledge Forum Spinal Cord Injury<br>  | Improving surgical quality in spinal deformity<br>Symposium hosted by: AOSPINE NORTH AMERICA | |
| 12:30 - 13:30 | Awards and closing ceremony Global Spine Congress 2018 announcement<br>AOSPINE<br>Closing symposium Minimally invasive intervertebral support strategies in the lumbar spine | | | | |

# AOSpine Members-Only Sessions

AOSpine offers its members a wide range of privileges, including exclusive access to members-only sessions at the Global Spine Congress

## 8 in 8: 8 Pearls of Practice from My Region

**Moderator:** Klaus Schnake
**Speakers:** Lali Sekhon, Jaime Segura, Zdenek Klezl, Yong Hai, Youssry El Hawary

Thursday, May 4, 09:15–10:00

Come and learn about the pearls of running an effective practice, best strategies to improve patient satisfaction, efficiency in the office and OR from the Community Development leaders of the various AOSpine regions.

## AOSpine Research and How to Get Involved

**Moderators:** S Rajasekaran, Bryan Ashman
**Speakers:** S. Rajasekaran, Asdrubal Falavigna, Mike Grevitt

Thursday, May 4, 10:30–12:00

Session run by AOSpine Key opinion leaders about AOSpine Research 'The Way forward', Clinical Research for AOSpine Members, Bench to Bed-side Research, Globalization of Research in AOSpine and Integrating Research and Education in AOSpine.

## How to Write and Review a Paper

**Speakers:** Jeff Wang, Jens Chapman, Karsten Wiechert

Thursday, May 4, 15:30–17:00

Global Spine Journal Editors-in-Chief discuss tips and techniques on how to write, research, and review scientific papers.

## Global Teachers—How to Teach in Different Cultures

**Moderator**: Bryan Ashman
**Speakers:** Mohammad El Sharkawi, Chung Chek Wong, Emre Acaroglu, Juan Emmerich

Friday, May 5, 09:00–10:00

Join us for a special faculty development session looking specifically at teaching and cultural boundaries.

## AOSpine Past Fellows Research Session

**Moderator:** Emre Acarolgu
**Speakers:** Past Fellows

Friday, May 5, 10:30–11:30

Networking session providing a platform for researchers to share their current projects and proposals, encouraging further development and collaboration.

## Past Chairpersons of AOSpine: Encouraging Leaders

**Moderators:** Luiz Vialle, Jeffrey Wang
**Speakers:** John Webb, Max Aebi, Luiz Vialle, Jeffrey Wang

Friday, May 5, 11:30–12:30

Learn from the leaders of the AOSpine organization! Join this session run by Past Chairpersons of AOSpine, discussing how to become a leader, what the benefits of mentorship are, how to progress through an organization such as AOSpine and much more!

## Prevention and Patient-Led Care in the New Health Economy

**Speaker:** Dominik Hotz

Friday, May 5, 16:00–16:45

How can we enable a world in which prevention is at forefront of care, where patients are empowered to 'own their health', and where treatment pathways are customized to individual needs. A new strategic approach is required.

## AOSpine Subaxial Classification System—Training and Testing

**Speakers:** Cumhur Oner, Greg Schroeder

Saturday, May 6, 09:00–10:00

Presentation of the Subaxial Classification System and an opportunity to review cases with feedback from the presenters.

## AOSpine Sacral Classification System—Training and Testing

**Speakers:** Cumhur Oner, Greg Schroeder, Carlo Bellabarba

Saturday, May 6, 10:30–11:30

Running the validation of the classification, presenting several cases to the attendees, which will evaluate and vote for the classification of the presented case.

## Not an AOSpine member?

Join online today or at the GSC Registration desk to be able to attend the exclusive Members-Only sessions.

**AOSpine Members-Only sessions are limited to 75 people (first-come, first-served basis)**

# Guest Spine Societies

The congress offers symposia on Thursday, Friday, and Saturday, organized by guest spine societies from different countries. Participants can meet some of these guest societies' representatives and learn more about their local activities by visiting their booths, which are located in the exhibition area. AOSpine cordially welcomes the following guest spine societies:

## Spine Society Symposia on Thursday

**Symposium Hosted by North American Spine Society**
The next steps—thinking globally

**Symposium Hosted by Scoliosis Research Society**
What distinguishes a single discipline versus a multidisciplinary approach to spinal deformity surgery

**Symposium Hosted by American Association of Neurological Surgeons**
Nuances of minimally invasive surgery (mis): lumbar degeneration and deformity

**Symposium Hosted by Cervical Spine Research Society combined with European Section of Cervical Spine Research Society**
Complications in cervical spine surgery: causes, management techniques, and prevention

## Spine Society Symposia on Friday

**Symposium Hosted by EUROSPINE**
New technologies

**Symposium Hosted by Deutsche Wirbelsäulengesellschaft**
Treatment standards in spine surgery—the German perspective

**Symposium Hosted by Società Italiana di Chirurgia Vertebrale—Gruppo Italiano Scoliosi**
Infections in Spine Surgery

**Symposium Hosted by Société Française de Chirurgie Rachidienne**
Management of Odontoid Fractures

**Symposium Hosted by AOSpine and European Association of Neurosurgical Societies**
Sagittal imbalance: when and why to stop correction?

## Spine Society Symposium on Saturday

**Symposium Supported by Society of Lateral Access Surgery (SOLAS)**
What's the place of lateral approach in a spine surgeon's toolbox?

# Awards Ceremonies

Global Spine Congress 2017

## The Global Spine Congress will culminate in an Awards Ceremony.

On **Thursday, May 4, 2017**, the following awards will be presented:

AOSPINE **Member Assembly**

### Germán Ochoa Traveling Fellowship

Germán Ochoa Traveling Fellowship: To honor Germán Ochoa's unparalleled dedication to AOSpine, the Fellowship offers a unique opportunity for a senior AOSpine faculty member to spend up to 4 weeks at a spine center of their choice.

### International Educator of the Year Award

International Educator of the Year Award: The award distinguishes a long standing and highly respected member of the AOSpine Community who has demonstrated sustained and significant contribution to educational excellence.

On **Saturday, May 6, 2017**, the following awards will be presented:

Global Spine Congress 2017

### Global Spine Congress 2017–Best Paper Award

The best paper will be chosen on-site by the award committee

### Global Spine Congress 2017–Best E-poster Award

The best e-poster will be chosen on-site by the award committee

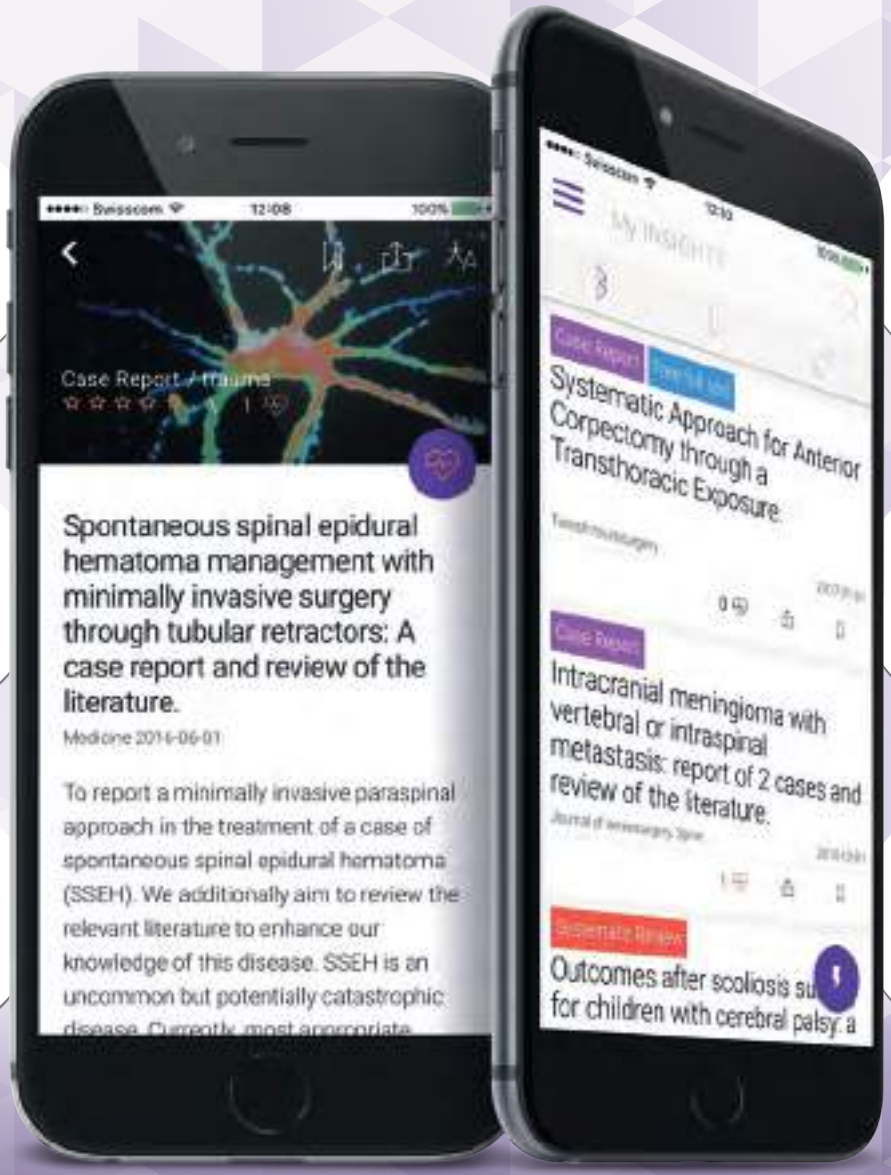
### Global Spine Journal–Best Paper Award

Global Spine Journal awards the top two papers of 2016. These papers are awarded based on downloads, citations, as well as the quality of the writing and research.

### Global Spine Journal–Best Reviewer Award

Global Spine Journal awards the top reviewers of 2016. The criteria are based on the amount of reviews completed during the year as well as the reviewer's average score.

# INSIGHTS
SPINE

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Global Spine Congress 2017

# Wednesday

## May 3, 2017

# Wednesday Program Schedule

10:30-18:00 Participant Registration

| 13:30-18:10 | Precourse I—Knowledge Forum Tumor<br>Spine Tumor Rounds: Evidence based approach to spinal tumor cases (Room: Yellow 2) | **Moderator:**<br>Charles Fisher |
|---|---|---|
| | **Metastatic Spine Disease** | |
| 13:30-13:40 | Introduction | Charles Fisher |
| 13:40-14:00 | Lung cancer metastasis to T-spine | Áron Lazáry |
| 14:00-14:20 | Metastatic RCC to lumbar spine | Arjun Sahgal |
| 14:20-14:40 | Thyroid cancer metastasis to thoracic spine | Jorrit-Jan Verlaan |
| 14:40-15:00 | Melanoma met to TL spine | C. Rory Goodwin |
| 15:00-15:20 | Colon cancer met to thoracic spine with Bilsky grade 1c compression | Ziya Gokaslan |
| 15:20-15:40 | Metastatic breast cancer with cord compression | Ilya Laufer |
| 15:40-16:00 | Metastatic prostate cancer to cervical spine with history of prior XRT | Daniel Sciubba |
| 16:00-16:10 | Break | All |
| | **Primary Spine Tumors** | |
| 16:10-16:30 | Giant cell tumor of lumbar spine | Raphaële Charest-Morin |
| 16:30-16:50 | Recurrent chordoma of mobile spine | Tamir Ailon |
| 16:50-17:10 | Osteoid osteoma of thoracic spine | Laurence Rhines |
| 17:10-17:30 | Mobile spine chondrosarcoma of cervical spine | Nicolas Dea |
| 17:30-17:50 | Aneurysmal bone cyst of lumbar spine | Stefano Boriani |
| 17:50-18:10 | Sacral chordoma/total sacrectomy | Jeremy Reynolds |

# Wednesday Program Schedule



10:30-18:00 Participant Registration

| 13:30-18:00 | Precourse II—Knowledge Forum Deformity Complications in surgery for spinal deformity in the child and the adult (Room: Yellow 1) | **Moderators:** See below |
|---|---|---|
| | **Definition and Incidence of Complications in Spine Surgery** | **Moderator:** Sigurd Berven |
| **13:30-13:38** | Defining complications/adverse events/failure to achieve surgical goals. Why is it important | Lawrence Lenke |
| **13:38-13:46** | Classifying Complications | Sigurd Berven |
| **13:46-13:56** | Quality and Value Metrics in Spine Surgery | David Polly |
| **13:56-14:10** | Questions/Discussion | Sigurd Berven |
| **14:10-14:20** | Complications in Surgery for Early Onset Scoliosis | Marco Brayda Bruno |
| **14:20-14:30** | Case Presentation EOS | Benny Dahl |
| **14:30-14:40** | Questions/Discussion | Benny Dahl |
| **14:40-14:50** | Complications in Surgery for Adolescent Scoliosis | Munish Gupta |
| **14:50-15:00** | Case Presentation AIS | André Andujar |
| **15:00-15:10** | Questions/Discussion | André Andujar |
| **15:10-15:20** | Complications in Surgery for Adult Deformity | Christopher I. Shaffrey |
| **15:20-15:30** | Case Presentation Adult Deformity | Yong Qiu |
| **15:30-15:40** | Questions/Discussion | Yong Qiu |
| **15:40-16:00** | Break (20 minutes) | All |
| | **Impact of Complications** | **Moderator:** Darrel Brodke |
| **16:00-16:10** | Impact on Health-related Quality of Life: Adolescent | Manabu Ito |
| **16:10-16:20** | Impact on Health-related Quality of Life: Adult | Eric Klineberg |
| **16:20-16:30** | Impact on Health Care Utilization Requirements (Length of Stay/reop/readmit) | Ferran Pellise |
| **16:30-16:40** | Impact on Cost and Value of Care | Stephen Lewis |
| **16:40-16:55** | Case Example with Discussion | Darrel Brodke |
| | **Strategies for Avoiding Specific Complications** | **Moderator:** David Polly |
| **16:55-17:05** | Identifying Risk Factors for Perioperative Complications—Risk Stratification | Christopher Ames |
| **17:05-17:15** | Prediction and Prevention of Mechanical Complications | Ahmet Alanay |
| **17:15-17:25** | Preoperative Optimization Strategies | Robert Hart |
| **17:25-17:35** | Strategies to Avoid Neural Injury in Deformity Surgery | Praveen V. Mummaneni |
| **17:35-17:45** | Strategies to Avoid Readmission and Reoperation | Khaled Kebaish |
| **17:45-18:00** | Questions/Discussion | David Polly |

10:30-18:00 Participant Registration

| 13:30-18:00 | Precourse III—Knowledge Forum Trauma a Spinal Cord Injury Spinal Trauma and SCI: Advancements and Controversies (Room: Yellow 3) | **Moderators:** Michael Fehlings Cumhur Oner Alex Vaccaro |
|---|---|---|
| **13:30-13:45** | Controversies in spinal trauma | Gregory Schroeder |
| **13:45-14:00** | Controversies in SCI | Brian Kown |
| **14:00-14:15** | Classification and injury severity in spinal trauma and SCI | Brian Kwon |
| **14:15-14:30** | The role of clinical modifiers in treatment decisions | Klaus Schnake |
| **14:30-14:45** | PLC injuries—Imaging and its importance | Sh. Rajasekaran |
| **14:45-15:30** | Discussion / cases presentation | Jens Chapman, Michael Fehlings, Cumhur Oner |
| **15:30-16:00** | Break | |
| **16:00-16:15** | Measurement of outcomes in spinal trauma and traumatic SCI | Cumhur Oner |
| **16:15-16:30** | Timing of surgery | Jefferson Wilson |
| **16:30-16:45** | Neuroprotective treatment in SCI | Michael Fehlings |
| **16:45-17:00** | Anticoagulation prophylaxis | James Harrop |
| **17:00-17:15** | Imaging | Bizhan Aarabi, Shekar Kurpad |
| **17:15-18:00** | Discussion / cases presentation | Michael Fehlings, Cumhur Oner |

Global Spine Congress 2017

# Thursday

## May 4, 2017

## 07:30-08:00 AOSpine Members Assembly (Room: Blue 1)

Member Privilege

| | | |
|---|---|---|
| 07:30-07:35 | Welcome and State of AOSpine | D. Riew |
| 07:35-07:40 | AOSpine Community Development | K. Schnake |
| 07:40-07:45 | AOSpine Education - including German Ochoa Award and Educator of the year award | M. Grevitt |
| 07:45-07:50 | AOSpine Research | S. Rajasekaran |
| 07:50-07:55 | Global Spine Congress | Jeffrey Wang |
| 07:55-08:00 | Q and A | All |

| | | |
|---|---|---|
| 08:00-09:00 | AOSpine Opening Symposium—2020 Vision: new horizons in AOSpine education (Room: Red) | **Moderator:** Michael Grevitt |
| 08:00-08:05 | Introduction | Michael Grevitt |
| 08:05-08:15 | Blended learning and the 'flipped classroom' | Steven Theiss |
| 08:15-08:25 | Being the best teachers | Juan Emmerich |
| 08:25-08:35 | MIS training and simulation | Roger Härtl |
| 08:35-08:45 | Making Fellowships relevant to members needs | Emre Acaroglu |
| 08:45-08:55 | Building relationships: AOSpine Mentorship | Jeffrey Wang |
| 08:55-09:00 | Summary | Michael Grevitt |

| | |
|---|---|
| 09:00-09:15 | Congress Opening (Room: Red) |

## 09:15-10:00 AOSpine Members-only session—8 in 8: 8 Pearls of Practice from My Region (Room: Yellow 2) Moderator: Klaus Schnake

Speakers: Klaus Schnake, Lali Sekhon, Jaime Segura, Zdenek Klezl, Youssry El Hawary, Yong Hai

Member Privilege

### 09:15-10:00 Paper Sessions

| **09:15-10:00** | | ADOLESCENT SCOLIOSIS 1 (Room: Red) | **Moderators:** Mohammad El Sharkawi Norman Chutkan |
|---|---|---|---|
| 09:15-09:20 | A001 | Radiographic Results of Selecting the Touched Vertebra as the Lowest Instrumented Vertebra in Lenke Type 1 (Main Thoracic) and Type 2 (Double Thoracic) Curves at a Minimum 5-year Follow-up | **L. Lenke**, P. Newton, R. Lehman, M. Kelly, D. Clements, T. Errico, R. Betz, A. Samdani, K. Blanke, Harms Study Group |
| 09:20-09:25 | A002 | Shoulder balance in Lenke type 1 scoliosis treated by convex manipulation: the role of osteotomies | **L. Oggiano**, S. Sessa, G. La Rosa |
| 09:25-09:30 | A003 | Sagittal Cervical Compensation in Adolescent Idiopathic Scoliosis | U. Guler, **M. Ozalay**, K. Eyvazov, A. Senkoylu, S. Beyaz, S. Pehlivan |
| 09:30-09:35 | A004 | Intrathecal Morphine Reduce Blood Loss During Idiopathic Scoliosis Surgery. | **N. Sekouris**, K. Soultanis, L. Flouda |
| 09:35-09:40 | A005 | Spinal Growth in Patients with Juvenile Idiopathic Scoliosis Treated with Boston Brace | **J. Heemskerk**, S. Wijdicks, R. Castelein, M. Altena, D. Kempen |
| 09:40-09:45 | A006 | Verticality perception in adolescents with idiopathic scoliosis | N. Antoniadou, E. Samoladas, **S. Stavridis**, V. Hatzitaki PF |
| 09:45-10:00 | | Discussion | All |

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| 09:15-10:00 | | CERVICAL LAMINOPLASTY (Room: Blue 2) | Moderators: Giuseppe Barbagallo Jens Chapman |
|---|---|---|---|
| 09:15-09:20 | A007 | Correlation between posterior migration of spinal cord and cervical spine curvature after cervical laminoplasty | A. Darnis, C. Scemama, **H. Pascal-Moussellard** |
| 09:20-09:25 | A008 | C4/5 foraminal stenosis predicts C5 palsy after expansive open-door laminoplasty | **H. Lee**, Jae-Sung Ahn, K. Lee |
| 09:25-09:30 | A009 | A MRI Characterization of the Dorsal Cervical Cord Migration Behaviour in Laminectomy versus Hybrid Open-Door Laminoplasty | **G. Liu**, J. Ng, J. Tan |
| 09:30-09:35 | A010 | A metanalysis of cervical laminoplasty techniques: are mini-plates superior? | A. Humadi, T. Chao, **D. Fisher**, A. Barmare |
| 09:35-09:40 | A011 | Comparison between radiological and clinical outcomes of laminoplasty with a titanium miniplate for cervical myelopathy | Jae-Sung Ahn, Ho-Jin Lee, **K. Lee** |
| 09:40-09:45 | A012 | Open-door Laminoplasty for multilevel cervical spondylotic myelopathy and OPLL using titanium reconstruction miniplate and screws | **K. Ahsan Md**, M. Awwal, S. Khan, N. Zaman, M. Haque, Z. Zahangiri |
| 09:45-10:00 | | Discussion | All |

| 09:15-10:00 | | LUMBAR ADJACENT SEGMENT PATHOLOGY (Room: Yellow 1) | Moderators: Asdrubal Falavigna Karsten Wiechert |
|---|---|---|---|
| 09:15-09:20 | A013 | Comparative analysis of risk factors for adjacent segment disease after lumbar spinal fusion—More than 10 year-follow-up | **J. Soh**, J. Lee, Byung-Joon Shin PF |
| 09:20-09:25 | A014 | Incidence of adjacent segment disease following posterior lumbar interbody fusion Vs postero-lateral fusion—A snapshot with 5 years follow up | S. Khan, **F. Ashouri,** K. Aneiba |
| 09:25-09:30 | A015 | Paraspinal muscle, facet joint, and disc problems: risk factors for adjacent segment degeneration after lumbar fusion | **S. Kuh**, Dal-Sung Ryu |
| 09:30-09:35 | A016 | Minimally invasive PLIF did not have advantage over conventional PLIF in the incidence of adjacent segment pathology | **T. Miwa**, T. Ohwada, H. Sakaura, Y. Kuroda |
| 09:35-09:40 | A017 | Lumbar Fusion with topping off: A failed implant | **S. Oikonomidis**, J. Siewe, R. Sobottke |
| 09:40-09:45 | A018 | Spino-Pelvic Malalignment In Adjacent Segment Disease Developing After Lumbar Fusion | **S. Masevnin**, D. Ptashnikov, D. Michailov, O. Smekalenkov, N. Zaborovskii, O. Lapaeva |
| 09:45-10:00 | | Discussion | All |

| 09:15-10:00 | | MINIMALLY INVASIVE SPINE SURGERY LUMBAR (Room: Yellow 3) | Moderators: Paul Thng Claudius Thomé |
|---|---|---|---|
| 09:15-09:20 | A019 | Long term fusion rates and predictors for reoperation in patients with and without preoperative degenerative lumbar spondylolisthesis following minimally invasive decompression for lumbar spinal stenosis | **N. Moayeri**, Y. Rampersaud, M. Pahuta PF |
| 09:20-09:25 | A020 | Minimally invasive transforaminal lumbar interbody fusion with intraoperative CT-based spinal navigation: a prospective cohort of 40 cases | **P. Scarone**, A. Venier, K. Huscher, D. Di Stefano, S. Presilla, T. Robert, M. Reinert |
| 09:25-09:30 | A021 | Clinical and radiological outcomes of InterFuse-S, a new modular PLIF, in patients with lumbar disc herniation | **R. Reinas**, D. Kitumba, Ó. Alves |
| 09:30-09:35 | A022 | Minimally invasive transforaminal lumbar interbody fusion and instrumentation (MIS-TLIF) for the treatment of lumbar isthmic spondylol isthesis: Minimum 2-years follow-up with clinical and radiological outcomes | **D. Wang** |
| 09:35-09:40 | A023 | Pure lateral and oblique lateral inter-body fusion for treatment of lumbar degenerative disk disease: comparison of two different techniques | **M. Miscusi**, S. Forcato, F. Polli, A. Ramieri, M. Cimatti, G. Costanzo, A. Raco |
| 09:40-09:45 | A024 | The benefits of minimally invasive posterior lumbar interbody fusion in degenerative lumbar spondylolisthesis | **M. Vorsic**, G. Bunc, J. Ravnik, T. Velnar |
| 09:45-10:00 | | Discussion | All |

| 10:00-10:30 | | Break | |
|---|---|---|---|

10:30-12:00 AOSpine Members-only session—AOSpine Research and How to Get Involved (Room: Yellow 2) Moderators: Sh. Rajasekaran, Bryan Ashman
Speakers: Sh. Rajasekaran, Asdrubal Falavigna, Michael Grevitt, Bryan Ashman

Member Privilege

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## 10:30-11:15 Paper Sessions

| 10:30-11:15 | | ADULT DEFORMITY 1 (Room: Red) | Moderators: Benny Dahl, Mohammad El-Sharkawi |
|---|---|---|---|
| 10:30-10:35 | A025 | External validation of MiSLAT algorithm and role of XLIF in management of adult degenerative deformity of spine | **S. Munigangaiah**, M. Ockendon, B. Balain |
| 10:35-10:40 | A026 | Do different types of UIV instrument impact acute Proximal Junctional Failure (acute PJF) following adult spinal deformity surgery?; PS vs. hook | **A. Matsumura**, T. Namikawa, M. Kato, A. Yabu |
| 10:40-10:45 | A027 | Towards Global Standardisation of Measuring Outcomes in Adult Spinal Deformity Surgery | **S. Faraj**, M. Van Hooff, R. Holewijn, D.W. Polly, N. Germscheid, T. Haanstra, M. De Kleuver |
| 10:45-10:50 | A028 | Outcomes in primary adult deformity surgery: What happens to patients who are lost to follow-up? | D. Beckerman, **S. Berven**, L. Racine, T. Sharf, S. Burch, V. Deviren, B. Tay, M. Callahan, S. Hu |
| 10:50-10:55 | A029 | Complication rate in adult deformity surgical treatment—safety of the posterior osteotomies | **G. La Maida**, A. Della Valle, M. Ferraro, F. Locatelli, B. Misaggi |
| 10:55-11:00 | A030 | Adult Spinal Deformity over 70 Years of Age: A Two-Year Follow-up Study | C. Karabulut, S. Ayhan, S. Yuksel, **V. Nabiyev**, F. Pellise, A. Vila-Casademunt, A. Alanay, F. Perez Grueso, F. Kleinstuck, I. Obeid, European Spine Study Group (ESSG) |
| 11:00-11:15 | | Discussion | All |

| 10:30-11:15 | | NAVIGATION (Room: Blue 2) | Moderators: Satish Rudrappa, Patrick Hsieh |
|---|---|---|---|
| 10:30-10:35 | A031 | Comparison peri-operative factors during minimally invasive pre-psoas lateral interbody fusion of the lumbar spine using either navigation or conventional fluoroscopy | Y. Zhang, I. White, E. Potts, Jean-Pierre Mobasser, **D. Chou** |
| 10:35-10:40 | A032 | Cervical pedicle screw instrumentation—analysis of placement accuracy with O-arm based navigation | **S. Chachan**, H. Rahmatullah, W. Loo, S. Kumar |
| 10:40-10:45 | A033 | Computer assisted robotic Surgery in the Octogenarians a case controlled study | **J. Schroeder**, A. Hasharoni, E. Itzhayek, L. Kaplan PF |
| 10:45-10:50 | A034 | Surgical Outcomes of Robotic-Guidance vs. Freehand Instrumentation—A Retrospective Review of 705 Adult Degenerative Spine Patients Operated in Minimally Invasive (MIS) and Open Approaches | **A. Cannestra**, T. Sweeney, K. Poelstra, S. Schroerlucke |
| 10:50-10:55 | A035 | Spinal intra-operative three-dimensional navigation: correlation between clinical and absolute engineering accuracy | **D. Guha,** R. Jakubovic, S. Gupta, N. Alotaibi, A. Kapadia, J. Klostranec, V. Yang |
| 10:55-11:00 | A036 | Intraoperative computed tomography versus ISO-C 3D C-arm for navigated spinal instrumentation | N. Hecht, M. Czabanka, H. Yassin, **P. Vajkoczy** |
| 11:00-11:15 | | Discussion | All |

| 10:30-11:15 | | LUMBAR DISC HERNIATION (Room: Yellow 1) | Moderators: John Webb, Yoshiharu Kawaguchi |
|---|---|---|---|
| 10:30-10:35 | A037 | Clinical and Radiological Factors Affecting Motor Recovery Following Neurological Deficit in Lumbar Disc Herniation | V. Krishnan, **S. Rajasekaran**, S. Aiyer, R. Kanna, A. Shetty |
| 10:35-10:40 | A038 | Treatment of Pain due to nerve root compression: irrational, ineffective and inefficient | **S. Phang**, J. Hobart, T. Germon |
| 10:40-10:45 | A039 | Clinical and Radiological Factors Associated with Development of Motor Deficit in Lumbar Disc Prolapse: A Prospective Analysis of 70 Consecutive Cases with Neurological Deficit | V. Krishnan, **S. Rajasekaran**, S. Aiyer, R. Kanna, A. Shetty |
| 10:45-10:50 | A040 | Management of Symptomatic Lumbar Disk Herniation: an International Perspective | **P. Gadjradj**, M. Arts, M. Van Tulder, W. Rietdijk, W. Peul, B. Harhangi |
| 10:50-10:55 | A041 | Rare presentation of disc prolapse—Lumbar Intradural disc herniation | **A. Sharma**, V. Singh, V. Pai |
| 10:55-11:00 | A042 | Is there a Standard of Magnification in Lumbar Discectomy? A propensity scoring study | **F. Brooks**, E. Aghayev, Y. Yau |
| 11:00-11:15 | | Discussion | All |

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| 10:30-11:15 | | BASIC SCIENCE—GROWTH FACTORS (Room: Yellow 3) | **Moderators:** Mauro Alini, Jong Beom Park |
|---|---|---|---|
| 10:30-10:35 | A043 | Histological analysis of bone regeneration with different doses of rhBMP-2 in an ovine lumbar interbody fusion model | **C. Hohaus**, J. Seeger, H. Meisel, K. Siegrist |
| 10:35-10:40 | A044 | A comparison of the efficacy of adipose-derived vs. bone marrow-derived stem cells in combination with a clinical-grade bone graft substitute in a rat model of spinal fusion | **C. Holmes**, W. Ishida, B. Elder, J. Locke, T. Witham |
| 10:40-10:45 | A045 | The osteogenic effects of photo-immobilization of bone morphogenetic protein-2 using different carrier systems in in a rat calvarial defect model | **Kwang-Sup Song**, D. Ham |
| 10:45-10:50 | A046 | A comparison of syngeneic iliac crest and femoral allografts with iliac crest autograft in the rat model of spinal fusion | B. Elder, **C. Holmes**, W. Ishida, J. Locke, T. Witham |
| 10:50-10:55 | A047 | The effects of topical intraoperative administration of vancomycin or tobramycin on fusion rates in a rat model | W. Ishida, C. Holmes, B. Elder, J. Locke, **T. Witham** PF |
| 10:55-11:00 | A048 | Effect of Oxy133, an osteogenic oxysterol, and rhBMP2 on new bone formation in rat posterolateral fusion model | **Z. Buser**, S. Drapeau, F. Stappenbeck, J. Wang Renata C. Pereira, F. Parhami |
| 11:00-11:15 | | Discussion | All |

## 11:15-12:00 Paper Sessions

| 11:15-12:00 | | TUMOR 1 (Room: Red) | **Moderators:** Emre Acaroglu, Alexander Disch |
|---|---|---|---|
| 11:15-11:20 | A049 | Patterns of Failure of Fixation In Metastatic Spinal Tumour Disease | **D. Sonawane**, A. Singahla, A. Zaw, B. Tan, N. Kumar |
| 11:20-11:25 | A050 | Symptomatic Spinal Metastasis: A systematic literature review of the preoperative predictive factors for survival, neurological, functional and quality of life outcomes in surgically treated patients | **A. Nater**, A. Martin, A. Saghal, D. Choi, M. Fehlings |
| 11:25-11:30 | A051 | Stereotactic body radiotherapy followed by surgical stabilization for patients with unstable spinal metastases: First-in-man study according to the IDEAL recommendations | **A. Versteeg**, J. Van Der Velden, W. Eppinga, N. Kasperts, S. Gerlich, H. Verkooijen, E. Servalli, J. Hes, M. Van Vulpen, C. Oner, Jorrit-Jan Verlaan |
| 11:30-11:35 | A052 | Selective endovascular embolization in pediatric patients with hyper-vascular mono-segmental thoracic and lumbar spine tumors | D. Malamashin, M. Komissarov, **A. Mushkin** |
| 11:35-11:40 | A053 | Retrospective analysis of preoperative embolization of patients with primary and secondary spinal tumors | **A. Dubskikh**, A. Tarkhanov |
| 11:40-11:45 | A054 | Surgical treatment of spinal cord intramedullary tumors in adult | **N. Konovalov**, I. Shevelev, I. Pronin, Y. Kushel, A. Nazarenko, A. Golanov, P. Zelenkov, R. Onoprienko, D. Asyutin, V. Korolishin, B. Zakirov, M. Martynova, S. Timonin |
| 11:45-12:00 | | Discussion | All |

| 11:15-12:00 | | TRAUMA CERVICAL 1 (Room: Blue 2) | **Moderators:** Frank Kandziora, Cumhur Oner |
|---|---|---|---|
| 11:15-11:20 | A055 | An Economic Case for the Surgical Treatment of Type-II Odontoid Fractures in the Elderly: A Markov Cost-Utility Analysis based on the Prospective AOSpine Geriatric Odontoid Fracture Study | **J.R. Wilson**, J. Harrop, G. Schroeder, A. Vaccaro, J. Smith, P. Arnold, M. Fehlings PF |
| 11:20-11:25 | A056 | Bicortical facet screws as a new option for posterior C2 fixation: anatomical study and clinical experience. | **A. Rusconi**, E. Freitas-Olim, C. Barrey |
| 11:25-11:30 | A057 | Halo Vest Immobilization and Surgical Fusion for Pediatric Cervical Spine Injuries | T. Purvis, R. De La Garza-Ramos, N. Abu-Bonsrah, **C.R. Goodwin**, Mm L. Groves, M.C. Ain, D.M. Sciubba |
| 11:30-11:35 | A058 | Trends in Incidence and Treatment of Odontoid Fractures | S. Yasmeh, W. Pannell, A. D'Oro, J. Wang, Z. Buser, **R. Hah** |
| 11:35-11:40 | A059 | Application of AOSpine subaxial cervical spine injury classification system as predictor of injury severity and neurological outcome in simple and complex cases | **B. Aarabi**, A. Vaccaro, G. Schroeder, C. Oner, N. Akhtar-Danesh |
| 11:40-11:45 | A060 | Complex Type II odontoid fractures—our management | **V.R. Tukkapuram,** S. Rudrappa |
| 11:45-12:00 | | Discussion | All |

| 11:15-12:00 | | NOVEL TECHNOLOGIES AND DIAGNOSTICS (Room: Yellow 1) | **Moderators:** Jaime Segura, Shekar Kurpad |
|---|---|---|---|
| 11:15-11:20 | A061 | 9.4T MRI complements the Pfirrmann grade through better differentiation of the NP/ AF | **I. Sher**, C. Daly, T. Goldschlager, D. Oehme, R. Chandra, P. Ghosh |
| 11:20-11:25 | A062 | Horizontal rod and band: A novel surgical technique for isthmic repair | G. Ristori, **Maryem-Fama Ismael Aguirre**, M. Damilano, C. Formica, C. Lamartina, P. Berjano |
| 11:25-11:30 | A063 | Intraoperative neurophysiological monitoring in cervical myelopathy | **P. Cortes Garcia,** P. Perez Lorensu, B. Deniz Rodriguez |
| 11:30-11:35 | A064 | Predictive accuracy of Surgimap™ Surgical planning for sagittal imbalance: a cohort study | **F. Langella**, C. Riccardo, A. Vesnaver, M. Ismael, M. Pejrona, J. Villafañe, C. Lamartina, P. Berjano |
| 11:35-11:40 | A065 | Evaluation of techniques to determine rotational alignment of the vertebral body in minimally invasive spine surgery: A CT analysis of lumbar spine symmetry | **A. Kumar**, A. Su, V. Sundaram, A. Doshi, S. Qureshi |
| 11:40-11:45 | A066 | Extra foraminal selective nerve root block—a novel technique for management of lumbar radiculopathy | N. Babu, **Arun-Kumar Viswanadha**, S. Raju, A. Priyadarsini |
| 11:45-12:00 | | Discussion | All |

| 11:15-12:00 | | SURGICAL OUTCOMES (Room: Yellow 3) | **Moderators:** Carlos Tucci, Abdulaziz Al-Mutair |
|---|---|---|---|
| 11:15-11:20 | A067 | Incidence and influence of depression and anxiety on clinical outcome before and one year after spine surgery for degenerative disc disease | **E. Shiban**, Y. Shiban, J. Thiel, U. Hoffmann, J. Lehmberg, B. Meyer |
| 11:20-11:25 | A068 | AOSpine Needs Assessment at the Spine Surgery Department, University Hospital Basel | **G. Jost**, M. Cunningham, S. Schaeren PF |
| 11:25-11:30 | A069 | Successful Lumbar Surgery Results in Long-Term Improvement in Psychological Well-Being | **C. Mancuso**, R. Duculan, F. Cammisa, A. Sama, A. Hughes, D. Lebl, F. Girardi |
| 11:30-11:35 | A070 | Habitual Smoking in the Young Employees, Alcohole Intake, Depressive Mood and Non-Sedentary Work Demand have Associations with LBP—A Survey of Employed Workers in a Medical Factory of Japan- | **K. Okuyama** |
| 11:35-11:40 | A071 | The relationship between gastric esophageal reflux disease and spinal sagittal alignment in elderly patients | **Y. Nakamura**, S. Asano, M. Kanai, T. Fujii, K. Tajima |
| 11:40-11:45 | A072 | Cross-cultural adaptation and validation of the Turkish version of the Core Outcome Measures Index for low back pain | **E. Çetin**, E. Çelik, E. Acaroglu, H. Berk PF |
| 11:45-12:00 | | Discussion | All |

| 12:00-13:30 | | Industry Lunch Symposia | |
|---|---|---|---|

| 13:30-14:30 | Symposium hosted by AOSpine past chairpersons—Sagittal Alignment and Indirect Decompression: is it possible? (Room: Red) | **Moderators:** K. Daniel Riew, Jeffrey Wang |
|---|---|---|
| 13:30-13:32 | Introduction | K. Daniel Riew |
| 13:32-13:44 | Sagittal Alignment and Indirect Decompression: is it possible? With MISS | Max Aebi |
| 13:44-13:56 | Sagittal Alignment and Indirect Decompression: is it possible? With ALIF | Max Aebi |
| 13:56-14:08 | Sagittal Alignment and Indirect Decompression: is it possible? With TLIF | Luiz Vialle |
| 14:08-14:20 | Sagittal Alignment and Indirect Decompression: is it possible? With LLIF | Jeffrey Wang |
| 14:20-14:30 | Discussion | All |

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| 13:30-14:30 | Symposium—Cervical Deformity: Evaluation and Management (Room: Blue 2) | **Moderators:** Justin Smith Christopher Ames |
|---|---|---|
| 13:30-13:42 | Clinical and Radiographic Assessment of Cervical Deformity | Philippe Bancel |
| 13:42-13:54 | Surgical Planning and Techniques for the Treatment of Cervical Deformity | K. Daniel Riew |
| 13:54-14:00 | Discussion/questions | Philippe Bancel / K. Daniel Riew |
| 14:00-14:12 | When Cervical Deformity Needs an Osteotomy Elsewhere First | Christopher Shaffrey |
| 14:12-14:24 | Complications and Management in Cervical Deformity Surgery | Heiko Koller |
| 14:24-14:30 | Discussion/questions | Christopher Shaffrey / Heiko Koller |

| 13:30-14:30 | Symposium hosted by AOSpine Latin America—Globalization Research Network: From bench to beyond regions (Room: Yellow 1) | **Moderator:** Juan Emmerich |
|---|---|---|
| 13:30-13:40 | Introduction | Jeffrey Wang |
| 13:40-13:55 | Building a Research | Jose Maria Jiménez |
| 13:55-14:10 | Barriers and solutions of PRO Registries | Asdrubal Falavigna |
| 14:10-14:25 | The experience of running a research project | Emiliano Vialle |
| 14:25-14:30 | Discussion | All |

| 13:30-14:30 | Symposium hosted by AOSpine and AO Foundation—Wound and Soft Tissue Management in Spine (Yellow 3) | **Moderator:** Luiz Vialle |
|---|---|---|
| 13:30-13:35 | Welcome and Introduction | Luiz Vialle |
| 13:35-13:45 | Soft Tissue Management: modern concepts | Daniel Gelb |
| 13:45-13:55 | Spine Surgery Bleeding: management options | Emiliano Vialle |
| 13:55-14:05 | Wound Infection: prevention and management | Michael Grevitt |
| 14:05-14:15 | MISS and Bleeding: how to control? | Nestor Taboada |
| 14:15-14:25 | Discussion | All |
| 14:25-14:30 | Closing | Luiz Vialle |

14:30-15:00 Paper Sessions

| **14:30-15:00** | | LUMBAR SPONDYLOLISTHESIS (Room: Red) | **Moderators:** Frank Kandziora Yu Liang |
|---|---|---|---|
| 14:30-14:35 | A073 | Decompression Versus Fusion for Grade I Degenerative Spondylolisthesis: A Meta-Analysis | J. Juaregui, S. Koenig, M. Shasti, L. Brown, Steven C. Ludwig, **D. Gelb**, K. Banagan, E. Koh |
| 14:35-14:40 | A074 | Re-admission, Re-operation, and Patient Reported Outcomes after Lumbar Fusion Surgery for Spondylolisthesis in 480 Patients from the QOD Registry | **E. Bisson**, M. Bydon, S. Glassman, K. Foley, J. Slotkin, E. Potts, M. Shaffrey, D. Coric, J. Knightly, P. Park, A. Asher, Kai-Ming Fu, M. Virk, A. Chan, P. Mummaneni |
| 14:40-14:45 | A075 | The Effect Of Surgical Wait Time On Patients With Degenerative Lumbar Spondylolisthesis: A Canadian Spine Outcomes and Research Network (CSORN) Study | J. Tee, **N. Dea**, R. Rampersaud, N. Manson, H. Hall, K. Thomas, G. McIntosh, C. Fisher PF |
| 14:45-14:50 | A076 | Surgical outcome of pedicle screw-lamina hook plus isthmic bone grafting through Wiltse approach for lumbar spondylolysis in children and adolescent an over 5 years follow-up | **X. Hu**, Z. Yang, Z. Wang, Z. Luo |
| 14:50-15:00 | | Discussion | All |

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| 14:30-15:00 | | NOVEL TECHNOLOGIES AND SACRAL JOINT FUSION (Room: Blue 2) | **Moderators:** Theodore Choma Alaa Eldin Ahmad |
|---|---|---|---|
| 14:30-14:35 | A077 | Twelve-month outcomes from a multicenter randomized controlled trial of minimally invasive sacroiliac joint fusion with triangular titanium implants vs conservative management | **P. Gaetani**, B. Sturesson, C. Zoia, R. Pflugmacher, D. Bongetta, J. Dengler, M. Minelli, D. Prestamburgo, A. Gasbarrini, D. Kools |
| 14:35-14:40 | A078 | Is Kambin's triangle safe for Lumbar Interbody Fusion? Minimally Invasive Extraforaminal Lumbar Interbody Fusion (ELIF) | **Hyeun-Sung Kim** |
| 14:40-14:45 | A079 | A patient-specific image-based computational model for biomechanical evaluation and design of 3D printed polycarbonate fusion cages | **E. Provaggi**, C. Capelli, J. Leong, R. Goodchild, W. Austin, D. Kalaskar |
| 14:45-14:50 | A080 | Minimally Invasive Sacroiliac Joint Fusion Using Triangular Titanium Implants: Pooled Analysis of 3 Prospective Clinical Trials | **J. Dengler**, B. Duhon, P. Whang, C. Frank, J. Glaser, B. Sturesson, S. Garfin, D. Cher, A. Rendahl, D.W. Polly |
| 14:50-15:00 | | Discussion | All |

| 14:30-15:00 | | ENDOSCOPIC AND MINIMALLY INVASIVE SPINE SURGERY (Room: Yellow 1) | **Moderators:** Asdrubal Falavigna Lorin Benneker |
|---|---|---|---|
| 14:30-14:35 | A081 | The Safety Profile of Percutaneous Minimally Invasive Sacroiliac Joint Fusion: A Systematic Review and Meta-Analysis | **A. Shamrock**, A. Patel, M. Al Maaieh |
| 14:35-14:40 | A082 | Does the addition of either a lateral or posterior interbody device to posterior instrumented lumbar fusion decrease cost over a 6 year period? | P. Schadler, P. Derman, J. Shue, L. Lee, H. Do, S. Koutsoumbelis, A.A. Sama, F.P. Girardi, F.P. Cammisa, **A. Hughes** |
| 14:40-14:45 | A083 | Contralateral keyhole endoscopic surgery (CKES) for lumbar spinal stenosis and lumbar disc herniation: technical note and preliminary results | **C. Park**, J. Hwang |
| 14:45-14:50 | A084 | Radiological status of paravertebral muscles after Bi-portal Arthroscopic Spinal Surgery (BASS) | **H. Lee**, Jae-Sung Ahn, K. Lee |
| 14:50-15:00 | | Discussion | All |

| 14:30-15:00 | | BASIC SCIENCE—SPINAL CORD INJURY (Room: Yellow 3) | **Moderators:** Zorica Buser Hans Jörg Meisel |
|---|---|---|---|
| 14:30-14:35 | A085 | Deleterious Effect of Methylprednisolone on Spinal Cord After Acute Traumatic Injury: Down-regulation of Acuaporine-4 Expression and Persistence of Blood-Spinal Cord Barrier Disruption. | **E. Cabrera-Aldana**, F. Ruelas-Pérez, C. Aranda-Fraustro, A. Martínez-Cruz, R. Rincón-Heredia, A. Reyes-Sánchez, G. Guizar-Sahagún, L. B. Tovar-y-Romo PF |
| 14:35-14:40 | A086 | Biomechanical Evaluation of Fusion and Non-Fusion Spinal Instrumentation used in Scoliotic Patients | M. Foltz, A. Freeman, A. Ellingson, J. Bechtold, V. Barocas, **D.W. Polly** |
| 14:40-14:45 | A087 | Spatial and temporal response of myelinating cells to traumatic spinal cord injury in animal studies—a systematic review | A. Shakouri-Motlagh, M. Mokhatab, **Z. Hassannejad**, V. Rahimi-Movaghar |
| 14:45-14:50 | A088 | Efficacy of hydrogels for repair of traumatic spinal cord injuries: a systematic review and meta analysis | **Z. Hassannejad**, V. Rahimi-Movaghar |
| 14:50-15:00 | | Discussion | All |

| 15:00-15:30 | | Break | |
|---|---|---|---|

PF AOSpine Past Fellow

15:30-17:00 AOSpine Members-only session—How to Write and Review a Paper (Global Spine Journal) (Room: Yellow 2)
Speakers: Jeffrey Wang, Jens Chapman,Karsten Wiechert

Member Privilege

## 15:30-16:15 Paper Sessions

| 15:30-16:15 | | LUMBAR SURGERY COMPLICATIONS (Room: Red) | Moderators: Alex Vaccaro, Claudio Lamartina |
|---|---|---|---|
| 15:30-15:35 | A089 | Economic Impact and Clinical Outcomes of Liberal Blood Transfusion in Spine Surgery | T. Purvis, **C.R. Goodwin**, R. De La Garza-Ramos, A. Karim Ahmed, V. Lafage, Brian J. Neuman, P.G. Passias, K.M. Kebaish, S.M. Frank, D.M. Sciubba |
| 15:35-15:40 | A090 | Obstructive Sleep Apnea is Associated with Increased Complication Rates in Elective Spine Surgery | **A. Chung**, R. Digiovanni, N. Olmscheid, J. Hustedt, R. Waldrop, N. Chutkan |
| 15:40-15:45 | A091 | Rates of aspiration pneumonia and various dysphagia stages after cervical fusion procedure | K. Jacobsen, **L. Lee**, Z. Buser, K. Barkoh, J. Lucas, C. Wang, F. Acosta, J. Liu, J. Wang PF |
| 15:45-15:50 | A092 | Predictors of Blood Transfusion in Posterior Lumbar Spinal Fusion: A Canadian Spine Outcome and Research Network (CSORN) study | **M. Morcos**, F. Jian, G. McIntosh, M. Weber |
| 15:50-15:55 | A093 | After-Hours' Emergent Spine Surgery—Perhaps we should think twice? | **R. Charest-Morin**, A. M. Flexman, M. Bond, T. Ailon, N. Dea, C. Fisher, D. Marcel, M. Boyd, S. Paquette, B. Kwon, J. Street PF |
| 15:55-16:00 | A094 | Post-Operative Venous Thromboembolic Events in patients undergoing Lumbar Spine Surgery | A. Nazareth, **R. Hah**, A. D'Oro, A. Jakoi, K. Schoell, P. Heindel, J. Wang, Z. Buser |
| 16:00-16:15 | | Discussion | All |

| 15:30-16:15 | | TRAUMA—LUMBAR (Room: Blue 2) | Moderators: Max Aebi, Bryan Ashman |
|---|---|---|---|
| 15:30-15:35 | A095 | Is the transpedicular bone grafting an effective technique for prevention of kyphosis in thoracolumbar fractures? | C.D. Ríos, M. Cahueque, G. Moreno, A. Aceves, L. Gutierrez, **M. Bregni** |
| 15:35-15:40 | A096 | Postoperative evaluation of vertebral body height correction in Magerl A thoracolumbar fractures | **N. Barut**, R. Bonaccorsi, Q. Monzani, H. Quentin |
| 15:40-15:45 | A097 | Impact of fragments displacement on surgical treatment of thoracolumbar fractures: a retrospective radiological analysis | **G. Lofrese**, F. De Iure, S. Battisti, M. Cappuccio PF |
| 15:45-15:50 | A098 | Could intermediate screw in thoracolumbar fracture fixation save motion levels? Comparative study between long segment and short segment with intermediate screw fixation. | **T. Elhewala**, A. El-Adawy, M. Hussein PF |
| 15:50-15:55 | A099 | Influence of insurance status on the outcome and length of work incapacity in patients with surgically treated fractures of the thoraco-lumbar junction | **M. Schroedel**, H. Hertlein |
| 15:55-16:00 | A100 | Short-Segment Fixation in Type C AO Thoracolumbar Fractures with Neurological Deficit: Survival Time of Paraplegic Patients Under Workers' Compensation | **J. Zamorano**, J. Lecaros, J. Cirillo, V. Ballesteros, J. Fleiderman, A. Urzúa PF |
| 16:00-16:15 | | Discussion | All |



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| 15:30-16:15 | | NOVEL CONCEPTS (Room: Yellow 1) | Moderators: Carlos Tucci Joseph Cheng |
|---|---|---|---|
| 15:30-15:35 | A101 | Spine sagittal balance characterization in professional soccer players | **B. Direito Santos**, O. Carvalho, E. Ribeiro, P. Varanda, R. M. Duarte, M. Vieira Da Silva |
| 15:35-15:40 | A102 | Biological disc replacement combined with a bio-resorbable stabilization system—A proof of concept study | **G. Lang**, J. Mojica Santiago, R. Navarro-Ramirez, I. Hussain, L. Bonassar, R. Hartl |
| 15:40-15:45 | A103 | A Correlation analysis of radiographic Spinopelvic Parameters in Health and Disease | **S. MLV**, D. Sharma, J. Menon |
| 15:45-15:50 | A104 | Intraoperative Stress in Spine Surgery: Attending versus Resident | **M. Reinhold**, J. Kremer PF |
| 15:50-15:55 | A105 | Factors that Impact Pedicle Screws Stability in Patients with Degenerative Diseases of Lumbar Spine | **A. Bokov**, S. Mlyavykh, A. Aleynik, M. Kutlaeva |
| 15:55-16:00 | A106 | Unilateral Spinous Process Non-Covering Hook Type Patient-Specific Drill Template for Thoracic Pedicle Screw Fixation: A Pilot Clinical Trial and Template Classification | **Y. Won**, S. Kim |
| 16:00-16:15 | | Discussion | All |

| 15:30-16:15 | | BASIC SCIENCE—DISC REGENERATION (Room: Yellow 3) | Moderators: Mauro Alini Shekar Kurpad |
|---|---|---|---|
| 15:30-15:35 | A107 | Diffusion characteristics of human annulus fibrosus—a study documenting the dependence of annulus fibrosus on endplate for diffusion | **N. Babu**, Arun-Kumar Viswanadha, S. Raju |
| 15:35-15:40 | A108 | Comparison of the stemness potential and response to inflammation of human intervertebral disc cells, adipose- and bone marrow-derived stem cells | **A. Colombini**, P. De Luca, M. Viganò, C. Perucca Orfei, R. Cecchinato, L. De Girolamo |
| 15:40-15:45 | A109 | Radiological, Histological, Morphological and Biochemical Comparison of two Ovine Lumbar Intervertebral Disc Injury Models | **C. Daly**, P. Ghosh, T. Badal, R. Shimmon, I. Ghosh, G. Jenkin, D. Oehme, J. Cooper-White, T. Naidoo, I. Sher, K. Jain, T. Goldschlager |
| 15:45-15:50 | A110 | Parvovirus B19 infection in intervertebral disc | **A. Reinke**, M. Sailer, M. Behr, B. Meyer, J. Lehmberg |
| 15:50-15:55 | A111 | Characterisation of the annulus fibrosus mechanical behaviour requires a specimen-specific approach | O. Kayode, Sebastien N.F. Sikora, Ruth K. Wilcox, **M. Mengoni** |
| 15:55-16:00 | A112 | The utilization of pressure mapping sensors to measure intradiscal pressure distribution and implant footprints—abilities and pitfalls | **O. Riesenbeck**, M. Schulze, D. Gehweiler, Michael J. Raschke, R. Hartensuer |
| 16:00-16:15 | | Discussion | All |

## 16:15-17:00 Paper Sessions

| 16:15-17:00 | | SPINE INFECTIONS 1 (Room: Red) | Moderators: Amer Aziz James Harrop |
|---|---|---|---|
| 16:15-16:20 | A113 | Improvement in Frankel Scale in caries spine patients with Frankel Scale "A" undergone anterior decompression and cage with autologous bone graft after a 5 years follow up | **A. Dogar**, H. Hussain, A. Ahmad, A. Aziz, S. Javed, N. Ahmed, R. Akram |
| 16:20-16:25 | A114 | The In Vitro and In Vivo effects of Vancomycin on Osteogenesis in Lumbar Spine Surgery | **B. Lawrence**, S. Maitra, R. Spiker, N. Spina, D.S. Brodke PF |
| 16:25-16:30 | A115 | Hematogenous Spondylitis caused by Methicillin-resistant Staphylococcus Aureus. Incidence, risk factors, management and outcomes | H. Abdelrahman, **H. Gendy**, M. Shousha, H. Boehm |
| 16:30-16:35 | A116 | Perioperative Invasive Vascular Catheterization Associated with Increased Risk of Postoperative Infection in Lumbar Spine Surgery: an analysis of 65,158 patient records | P. Heindel, **J. Lucas**, A. D'Oro, N. Patel, K. Schoell, Z. Buser, J. Wang PF |
| 16:35-16:40 | A117 | One stage surgical treatment of infected lumbar total disc arthroplasty with cutaneous abdominal fistulas—report of 3 cases | **C. H. Hoffmann**, F. Kandziora |
| 16:40-16:45 | A118 | Wound infection after a spinal surgery has got a negative influence on the patients' subjective long term treatment outcome | **A. Lazáry**, I. Klemencsics, P. Varga |
| 16:45-17:00 | | Discussion | All |

| 16:15-17:00 | | MINIMALLY INVASIVE SPINE SURGERY 1 (Room: Blue 2) | **Moderators:** Abdulrazzaq Alobaid Roger Härtl |
|---|---|---|---|
| 16:15-16:20 | A119 | Minimally invasive resection of ventral and ventrolateral intradural extramedullary spinal lesions. Clinical outcomes and the addition of image merge technique. | **R. Maduri**, A. Belouauer, L. Bobinski, J. Duff |
| 16:20-16:25 | A120 | Old dogs, new tricks: what motivates experienced spine surgeons to try minimally invasive surgery? | **B. Ashman** |
| 16:25-16:30 | A121 | A single-incision, oblique retroperitoneal approach for lumbar interbody fusion from L1 to S1 in adult spinal deformity | **Eun-Min Seo** |
| 16:30-16:35 | A122 | Treatment of the fractional curve of adult scoliosis with circumferential minimally invasive surgery (cMIS) versus traditional, open surgery: an analysis of surgical outcomes | **D. Chou**, P. Mummaneni, P. Nunley, J. Zavatsky, R. Eastlack, D. Okonkwo, M. Wang, P. Park, J. Uribe, N. Anand, V. Deviren, B. Akbarnia, S. Nguyen, G. Mundis Jr. |
| 16:35-16:40 | A123 | Learning Curve for MISS Aspirants: A Retrospective Review from five years of Minimal Invasive Spine Surgeries | H. Modi, **S.A. Goel**, Y. Desai |
| 16:40-16:45 | A124 | Efficiency of MISt (Minimally invasive spine stabilization) for the patient of metastatic spinal tumor | T. Hasegawa, **K. Nakanishi** |
| 16:45-17:00 | | Discussion | All |

| 16:15-17:00 | | NOVEL TECHNOLOGIES 1 (Room: Yellow 1) | **Moderators:** Lali Sekhon Ghassan Skaf |
|---|---|---|---|
| 16:15-16:20 | A125 | Detethering of the C2 nerve root and avoidance of transection and injury during C1 screw placement: A cadaveric feasibility study | **C. Fisahn**, J. Johal, M. Moisi, J. Iwanaga, R.J. Oskouian, J.R. Chapman, R.S.Tubbs |
| 16:20-16:25 | A126 | Development of a new assessment tool for cervical myelopathy using a virtual reality hand tracking sensor | **M.A. Alagha**, M. Alagha, E. Dunstan, O. Sperwer, K. Timmins, B. Boszczyk |
| 16:25-16:30 | A127 | A proinflammatory and degenerative intervertebral disc organ culture model to investigate novel anti-inflammatory treatment approaches for degenerative disc disease | **G. Lang**, Y. Liu, Z. Zhou, D. Kubosch, N. Suedkamp, M. Alini, S. Grad, Z. Li |
| 16:30-16:35 | A128 | Comparative analysis of inflammatory processes during cervical and lumbar degenerative disc disease | E. Touli, K. Wuertz-Kozak, H. Greutert, S. Ferguson, **O. Hausmann** |
| 16:35-16:40 | A129 | Dysphagia in Standalone versus Conventional Anterior Cervical Discectomy | **C. Fisahn**, B. Burgess, F. Alonso, Daniel C. Norvell, R. Shane Tubbs, Rod J. Oskouian, J.R. Chapman |
| 16:40-16:45 | A130 | Driving reaction time after spinal surgery: A systematic review | **A. Alhammoud**, K. Alkhalili, A. Baco |
| 16:45-17:00 | | Discussion | All |

| 16:15-17:00 | | OSTEOPOROTIC FRACTURES (Room: Yellow 3) | **Moderators:** Abdulaziz Al-Mutair Klaus Schnake |
|---|---|---|---|
| 16:15-16:20 | A131 | Bone Quality of Lumbar Spine Assessment Using Dual Emission X-ray Absorptiometry—a Potentially Misleading Results | **A. Bokov**, S. Mlyavykh, M. Rasteryaeva, T. Malysheva |
| 16:20-16:25 | A132 | Vertebral fracture over the metal structure in patients with osteoporosis. Can we prevent these injuries? | **I. Basankin**, V. Porhanov, A. Zavrazhnov, K. Tahmazyan, A. Afaunov, D. Ptashnikov, S. Malahov, V. Shapovalov |
| 16:25-16:30 | A133 | Comparison of Unipedicular versus Bipedicular balloon Kyphoplasty for Osteoporotic Vertebral Compression Fractures | **H. Cho**, J. Kim |
| 16:30-16:35 | A134 | Percutaneous Vertebral Body Stenting and Bone Cement Augmentation Reduces Morbidity in Osteoporotic Spine Fractures | H. Tan, **K.S Oh** |
| 16:35-16:40 | A135 | Conservative Management of Osteoporotic Vertebral Fractures | H. Cho, **J. Kim** |
| 16:40-16:45 | A136 | Cement Leakage after Vertebroplasty; Correlation with Patterns of Compression Fractures and Bone Mineral Density | **J. Kim**, Hong-Man Cho |
| 16:45-17:00 | | Discussion | All |

# Thursday Program Schedule

| 17:00-18:00 Spine Societies (Room: Red) | | |
|---|---|---|
| 17:00-18:00 | **Symposium Hosted by North American Spine Society—The Next Steps—Thinking Globally** | **Moderator:** Joseph Cheng |
| 17:00-17:05 | Introduction | Jeffrey Wang |
| 17:05-17:15 | Disruptive Technology in Spine | Norman Chutkan |
| 17:15-17:25 | Worldwide standardization of spinal care: possible, feasible? | Joseph Cheng |
| 17:25-17:35 | Responsibility of spine organizations: how are we doing? | Jeffrey Wang |
| 17:35-17:45 | Spine Care in Asia: 20 years ago, Today, and 20 years from Now | Yong Hai |
| 17:45-18:00 | Discussion | All |

| 17:00-18:00 Spine Societies (Room: Blue 2) | | |
|---|---|---|
| 17:00-18:00 | **Symposium Hosted by Scoliosis Research Society World Wide Course—What Distinguishes a Single Discipline versus a Multidisciplinary Approach to Spinal Deformity Surgery** | **Moderators:** Marinus De Kleuver, Sigurd Berven, Marco Brayda-Bruno |
| 17:00-17:10 | Risk stratification | Benny Dahl |
| 17:10-17:17 | Case Presentation of a Complication with a Neurological Deficit | Sigurd Berven |
| 17:17-17:25 | How to handle neuromonitoring alers, incl the use of a Neuromonitoring checklist | Praveen V. Mummaneni |
| 17:25-17:32 | Case Presentation needing a plastic surgery approach and closure | Marco Brayda-Bruno |
| 17:32-17:40 | Plastic surgery recommendations for complex pediatric spinal approaches and closures | Franz Baruffaldi Preis |
| 17:40-18:00 | Summing up: checklist to identify indication for dual discipline approach | Marinus De Kleuver/ Sigurd Berven |

| 17:00-18:00 Spine Societies (Room: Yellow 1) | | |
|---|---|---|
| 17:00-18:00 | **Symposium Hosted by American Association of Neurological Surgeons—Nuances of Minimally Invasive Surgery (MIS): Lumbar Degeneration and Deformity** | **Moderator:** Christopher I. Shaffrey |
| 17:00-17:12 | Update on Decompressive Techniques | John Joseph Knightly |
| 17:12-17:25 | Anterior Column Reconstruction (Lateral and ALIF) and Spinal Alignment | Regis W. Haid |
| 17:25-17:38 | Open and MIS... How to select using the MISDEF algorithm | Christopher I. Shaffrey |
| 17:38-17:51 | MIS Posterior Approaches for Alignment and Fusion (TLIF, percutaneous fixation) | Praveen V. Mummaneni |
| 17:51-18:00 | Discussion / Q and A | All |

| 17:00-18:30 Spine Societies (Room: Yellow 3) | | |
|---|---|---|
| 17:00-18:30 | **Symposium Hosted by Cervical Spine Research Society and CSRS-EU—Complications in Cervical Spine Surgery: Causes, Management Techniques, and Prevention** | **Moderator:** Darrel Brodke |
| 17:00-17:03 | Introduction | Darrel Brodke |
| 17:03-17:17 | Dysphagia/Dysphonia | Heiko Koller |
| 17:17-17:31 | C5 Palsy after C-Spine Surgery | Yohan Robinson |
| 17:31-17:45 | CSF Leak in Cervical Surgery | Ronald Bartels |
| 17:45-17:59 | Vertebral Artery Injury | K. Daniel Riew |
| 17:59-18:13 | Spinal Cord Injury During Surgery | Michael Fehlings |
| 18:13-18:27 | Neck Pain after Stand Alone Cage | Ronald Bartels |
| 18:27-18:30 | Final Thoughts | Darrel Brodke |

| | |
|---|---|
| 18:00-19:30 | Welcome reception and official exhibition opening |

Global Spine Congress 2017

# Friday

## May 5, 2017

## 07:00-08:00 AOSpine Member Representative Election (Room: Blue 1)

Member Privilege

| 08:00-09:00 | Symposium—Sacrolliac Joint Fusion: Surgical Controversies (Room: Red) | **Moderator:** Jeffrey Wang |
|---|---|---|
| 08:00-08:15 | The pathogenesis and diagnosis of SI joint problems and conservative treatments | Bengt Sturesson |
| 08:15-08:25 | SI fusion is appropriate | David Polly |
| 08:25-08:35 | SI fusion is not appropriate | Theodore Choma |
| 08:35-08:40 | Debate: The surgical treatment of SI joint | All |
| 08:40-08:50 | The controversy regarding the surgical treatment of SI joint | Jeffrey Wang |
| 08:50-09:00 | Discussion | All |

| 08:00-09:00 | Symposium hosted by AOTK—Incremental Correction Techniques in Pediatric Spinal Deformity (Room: Blue 2) | **Moderators:** Maarten Spruit Venugopal Menon |
|---|---|---|
| 08:00-08:03 | Case presentation AIS double major curve | Philip Horsting |
| 08:03-08:10 | Technique of Correction | Philip Horsting |
| 08:10-08:20 | Discussion | All |
| 08:20-08:23 | Case presentation severe AIS curve | Michael Grevitt |
| 08:23-08:30 | Technique of Correction | Michael Grevitt |
| 08:30-08:40 | Discussion | All |
| 08:40-08:50 | EOS: concept of growth modulation and management with Trolley | Jean Ouellet |
| 08:50-09:00 | Discussion | All |

| 08:00-09:00 | Symposium hosted by AOSpine Research—Surgeon to Surgeon Scientist (Room: Yellow 1) | **Moderators:** Sh. Rajasekaran Asdrubal Falavigna |
|---|---|---|
| 08:00-08:05 | Introduction—Surgeon to Surgeon Scientist | Sh. Rajasekaran |
| 08:05-08:14 | Integrating research in your daily practice | Alex Vaccaro |
| 08:14-08:23 | Planning a research project | Michael Fehlings |
| 08:23-08:32 | Structuring a clinical research unit | Asdrubal Falavigna |
| 08:32-08:41 | Overcoming barriers to completing a study | James Harrop |
| 08:41-08:50 | AOSpine—your partner in research | Sh. Rajasekaran |
| 08:50-09:00 | Discussion | All |

| 08:00-09:00 | Symposium—Early onset scoliosis management in countries with limited resources (Room: Yellow 3) | **Moderators:** Youssry El Hawary Amer Aziz |
|---|---|---|
| 08:00-08:05 | Introduction | Youssry El Hawary, Amer Aziz |
| 08:05-08:15 | Early onset scoliosis in developing countries | Youssry El Hawary |
| 08:15-08:25 | Management of severe curves (>100 degrees) by growth friendly technique: Nanjing experience | Yong QIU |
| 08:25-08:35 | EOS Ghurki Hospital (Lahore, Pakistan): Experience, problems, complications | Amer Aziz |
| 08:35-08:45 | How to begin the EOS service in country with limited resources | Alaa Eldin Ahmad |
| 08:45-09:00 | Discussion | All |

## 09:00-10:00 AOSpine Members-only session—Global teachers—How to Teach in Different Cultures (Room: Yellow 2) Moderator: Bryan Ashman
Speakers: Mohammad El Sharkawi, Chung Chek Wong, Emre Acaroglu, Juan Emmerich

Member Privilege

| 09:00-10:00 Paper Sessions | | | |
|---|---|---|---|
| **09:00-10:00** | | ADOLESCENT SCOLIOSIS 2 (Room: Red) | **Moderators:** Alaa Eldin Ahmad, David Polly |
| 09:00-09:05 | A137 | Direct vertebral rotation vs single concave rod rotation. Low-dose intraoperative computed tomography evaluation of spine derotation in adolescent idiopathic scoliosis surgery | **R. Pankowski**, M. Roclawski, W. Kloc, T. Mazurek, M. Ceynowa, M. Mikulicz |
| 09:05-09:10 | A138 | Prognostic factors of uninstrumented thoracic curve correction above selective fusion for Lenke 5 Idiopathic Adolescent Scoliosis | **F. Solla**, C. Doria, Jean-Luc Clément |
| 09:10-09:15 | A139 | Optimal Selection of the Lowest Instrumented Vertebra for Lenke Type 5 and 6 Thoracolumbar/Lumbar Major AIS Curves at Minimum 5 Year Followup | **L. Lenke**, R. Lehman, B. Lonner, T. Errico, R. Betz, S. Shah, H. Shufflebarger, M. Kelly, P. Newton, K. Blanke, Harms Study Group |
| 09:15-09:20 | A140 | ISYQOL discriminates better than the SRS-22 subgroups of adolescents with spinal deformities | A. Caronni, S. Donzelli, L. Sciumè, O. Amata, F. Di Felice, **S. Minnella**, F. Zaina, S. Negrini |
| 09:20-09:25 | A141 | Use of Intraoperative Traction in Adolescent Idiopathic Scoliosis: Impact on Concave Apical Screws Density, Curve Correction and Functional Outcomes | **H. Suthar**, M. Yarlagadda, S. Hegde, C. Chikhale, M. Jindal |
| 09:25-09:30 | A142 | The development of an adolescent spine deformity surgery core outcome set for the Nordic spine registries. A project supported by the AOSpine knowledge forum deformity | **S. Faraj**, M. Van Hooff, R. Holewijn, N. Germscheid, T. Haanstra, M. De Kleuver |
| 09:30-09:35 | A143 | Is there still a place for convex hemiepiphysiodesis in congenital scoliosis in young children? A long term follow-up | G. Kreichati, M. Rizkallah, E. Choufani, **K. Kharrat** |
| 09:35-09:40 | A144 | ISYQOL: new quality of life questionnaire for adolescents with spinal deformities developed through Rasch analysis | A. Caronni, L. Sciumè, S. Donzelli, O. Amata, F. Di Felice, **S. Minnella**, F. Zaina, S. Negrini |
| 09:40-09:45 | A145 | Magnetically Controlled Growing Rods with Maximal Distraction: A New Mode of Failure | **C. Jones**, F. Brooks, A. Clarke, M. Hutton, S. Khan, D. Chan, O. Stokes |
| 09:45-10:00 | | Discussion | All |

| **09:00-10:00** | | CERVICAL MYELOPATHY (Room: Blue 2) | **Moderators:** Alessandro Ducati, Eric Klineberg |
|---|---|---|---|
| 09:00-09:05 | A146 | Combinatorial Surgical and Neuroprotective Therapy for Cervical Spondylotic Myelopathy Results in Improved Neurological Function: from Preclinical Proof of Concept to a Phase III Randomized Controlled Trial | **M. Fehlings**, S. Karadimas, B. Kopjar, P. Arnold |
| 09:05-09:10 | A147 | Congenital Cervical Spine Stenosis in a Global Cohort of Patients with Degenerative Cervical Myelopathy: A Report Based on a MRI Diagnostic Criterion | **A. Nouri**, L. Tetreault, A. Martin, A. Nater, S. Nori, M. Shamji, M. Fehlings |
| 09:10-09:15 | A148 | Multilevel cervical spondylo-arthopaty with or without myelopathy: Evaluation of long term-follow-up between anterior and posterior approach | **G. Barbagli** |
| 09:15-09:20 | A149 | Prediction of Outcome following Surgical Treatment of Cervical Myelopathy Based on Features of Ossification of the Posterior Longitudinal Ligament: A Systematic Review | H. Nakashima, **L. Tetreault**, S. Kato, M. Kryshtalskyj, N. Nagoshi, A. Nouri, A. Singh, M. Fehlings |
| 09:20-09:25 | A150 | Correlation and profile of quality of life and functional outcome measures for cervical spondylotic myelopathy after surgery | **Z. Yilong**, Y. Sun, F. Zhou |
| 09:25-09:30 | A151 | Functional and clinical outcome after circunferential decompression (360 degrees) surgical treatment of severe degenerative cervical spondylotic myelopathy in the elderly patients | **M. Tellez-Gtz** |
| 09:30-09:35 | A152 | Increased segmental range of motion is correlated with spondylolisthesis in the cervical spine after laminoplasty | E. Iwata, M. Tanaka, A. Okuda, Y. Morimoto, K. Masuda, Y. Tanaka, **H. Shigematsu** PF |
| 09:35-09:40 | A153 | Cervical fusion with expandable corpectomy device | **L. Ruiz Cardoso**, O. Tortolero Barron, A. Gonzalez Moga, M. Fuentes Rivera, J. Guzman Carranza, H. Santos Benitez |
| 09:40-09:45 | A154 | To evaluate the results of a single staged simultaneous decompression surgery for tandem spinal stenosis—a review of 149 patients | S. Bhojraj, **P. Patel**, P. Nagad |
| 09:45-10:00 | | Discussion | All |

| 09:00-10:00 | | LUMBAR SURGERY 1 (Room: Yellow 1) | **Moderators:** Christopher Shaffrey Imad Ahmad |
|---|---|---|---|
| 09:00-09:05 | A155 | Reposition of vertebra in low-grade lumbar spondylolisthesis: influence on the clinical outcome and shape of lumbar lordosis | M. Kuhta, M. Vodicar, B. Bricelj, M. Vogrin, **R. Vengust** |
| 09:05-09:10 | A156 | Can Liposomal Bupivacaine Be Safely Utilized in Patients Undergoing Spine Surgery? | L. Brown, J. Juaregui, S. Koenig, M. Shasti, Steven C. Ludwig, **D. Gelb**, K. Banagan, E. Koh |
| 09:10-09:15 | A157 | The long-term clinical efficacy of single segment lumbar 4-5 fusion and its effect on the lumbar-pelvis sagittal alignment parameter | Z. Wang, **X. Hu**, Z. Luo |
| 09:15-09:20 | A158 | Continuous outcome monitoring to improve quality of spine surgery in patients with degenerative lumbar spine disorders | **M. Van Hooff**, D. Groot, P. Horsting, M. Spruit, L. De Klerk, E. Van Den Eede, T. Stevens, D. Pluimers, J. Van Loon, M. De Kleuver |
| 09:20-09:25 | A159 | Quality of life in patients who underwent lumbar spine fusion surgery compared with adjusted normal Italian population: a pilot study | **S. Padovani**, T. Amoroso, G. Caruso, M. Bianconi, G. Valpiani, L. Massari |
| 09:25-09:30 | A160 | Comparison of peri-operative and short term outcomes between minimally invasive and conventional lumbar interbody fusion | **A. Nadig**, J. George, J. Virdee |
| 09:30-09:35 | A161 | The Use of Cortical Bone Trajectory Technique in Preventing Implant Loosening in Osteoporotic Spines | **K.S. Oh** |
| 09:35-09:40 | A162 | Correlation between outcome measurement tools in patients with lumbar spine fusion for degenerative disease | **R. Rocha**, R. Motta, C. Oliveira, R. Pratali |
| 09:40-09:45 | A163 | Trends and costs of external electric bone stimulators and grafting materials in anterior lumbar interbody fusion | A. D'Oro, **Z. Buser**, Jong-Beom Park, S. Tim Yoon, D. Brodke, J. Youssef, Hans-Joerg Meisel, K. Radcliff, P. Hsieh, J. Wang |
| 09:45-10:00 | | Discussion | All |

| 09:00-10:00 | | SPINE INFECTIONS 2 (Room: Yellow 3) | **Moderators:** Chung Chek Wong Bizhan Aarabi |
|---|---|---|---|
| 09:00-09:05 | A164 | Evaluation of intra-wound povidone-iodine irrigation and intra-wound vancomycin powder in the prevention of surgical site infection in spinal surgery | **J. Lemans,** C. Öner, M. Ekkelenkamp, C. Vogely, M. Kruyt |
| 09:05-09:10 | A165 | Predicting the need for surgical intervention in patients with Spondylodiscitis - The Brighton Score | **N. Appalanaidu,** C. Gee, K. Brogan, S. Karmani, S. Elsayed |
| 09:10-09:15 | A166 | Vertebral form of non-bacterial osteomyelitis in children | O. Kopchak, M. Kostik, A. Maletin, **A. Mushkin** |
| 09:15-09:20 | A167 | One or two-level spondylodiscitis between D11 and L5 treated with mini-open extreme lateral debridement and fusion in combination with posterior percutaneous fixation | **C. Arvinius,** R. Luque, I. Dominguez, J. Rey, M. Noriega, J. Alia |
| 09:20-09:25 | A168 | Detection and Quantification of Bacteria in Degenerating Intervertebral Discs | J. Hu, **K. Raasck,** L. Haglund, P. Jarzem |
| 09:25-09:30 | A169 | Spinal reconstruction in early-age pediatric patients with vertebral lesions: 3 years follow-up of 20 consecutive cases | **D. Naumov,** A. Mushkin |
| 09:30-09:35 | A170 | Pyogenic spondylodiscitis: epidemiology, diagnosis and treatment of 205 patients with two-year follow-up | **E. Pola,** G. Autore, L. Nasto, D. Colangelo, V. Formica, V. Pambianco, M. Fantoni, F. Tamburrelli, G. Maccauro |
| 09:35-09:40 | A171 | Spinal infections: Analysis of 600 patients over 11 years | **H. Abdelrahman,** M. Shousha, H. Boehm |
| 09:40-10:00 | | Discussion | All |

| 10:00-10:30 | | Break | |
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## 10:30-11:30 AOSpine Past Fellows session—AOSpine Past Fellows Research Session (Room: Yellow 2)
Speaker: Emre Acaroglu

| 10:30-11:30 Paper Sessions | | | |
|---|---|---|---|
| **10:30-11:30** | | DEFORMITY (Room: Red) | **Moderators:** Lawrence Lenke, Yong Hai |
| 10:30-10:35 | A172 | Technical report of an oblique osteotomy of the spine for surgical correction of severe scoliosis | **M.A. Farfan**, C. Montero Silva, D. Meneses Quintero, F. Alvarado Gomez, W. Godoy Carrero, D. Rosero Rodriguez, J. Ruiz Herrera, C. Castellanos Mendoza |
| 10:35-10:40 | A173 | Progression of untreated Scheuermann's kyphosis—radiographs after mean follow-up of 46 years | **L. Ristolainen**, J.A. Kettunen, M. Heliövaara, U.M. Kujala, A. Heinonen, D. Schlenzka |
| 10:40-10:45 | A174 | Is use of posterior spinal instrumentation beneficial in surgically treating myelopathy associated with posteiror longitudinal ligmanet of the thoracic spine? | **K. Miyamoto**, K. Fushimi, C. Iwai, Y. Kondo, H. Akiyama, K. Shimizu |
| 10:45-10:50 | A175 | Management of Severe Kyphosis in Spina Bifida Patients | **S. Ryabykh**, D. Savin, A. Mushkin, A. Gubin |
| 10:50-10:55 | A176 | No relation between lumbopelvic mismatch and poor outcome in thoracic hyperkyphosis corrections | **D. Wong Chung**, M. Van Hooff, M. De Kleuver, H. Graat, R. Hoogendoorn |
| 10:55-11:00 | A177 | Cervical sagittal alignment in AIS | **G. La Maida**, M. Ferraro, A. Della Valle, F. Locatelli, B. Misaggi |
| 11:00-11:05 | A178 | Tilt on traction: A new parameter to decide the lower instrumented vertebra in scoliosis correction | **H. Suthar**, M. Yarlagadda, S. Hegde, C. Chikhale, M. Jindal |
| 11:05-11:10 | A179 | Anterior Spinal Overgrowth is not exclusive for Idiopathic Scoliosis, and is located in the disc | **R. Brink**, T. Schlösser, D. Colo, L. Vavruch, M. Van Stralen, K. Vincken, M. Malmqvist, M. Kruyt, H. Tropp, R. Castelein |
| 11:10-11:15 | A180 | Distal Adding-on and Risk Factors in Severe and Rigid Scoliosis | L. Zang, S. Yuan, **Y. Hai** |
| 11:15-11:30 | | Discussion | All |

| 10:30-11:30 | | CERVICAL SURGERY (Room: Blue 2) | **Moderators:** John Webb Manabu Ito |
|---|---|---|---|
| 10:30-10:35 | A181 | Inpatient Outcomes in Dialysis Dependent Patients Undergoing Elective Cervical Spine Surgery for Degenerative Cervical Conditions | A. Chung, S. Mitchell, J. Hustedt, N. Olmscheid, R. Waldrop, **N. Chutkan** |
| 10:35-10:40 | A182 | Impact of C1 laminectomy without fusion on upper cervical instability | **T. Jeong**, S. Lee, W. Kim, S. Son |
| 10:40-10:45 | A183 | Adjacent Segment Disease after Anterior Cervical Interbody Fusion using Conventional Plate versus Zero-Profile Implant—A Preliminary Report | Jae-Sung Ahn, Ho-Jin Lee, **K. Lee** |
| 10:45-10:50 | A184 | Influence of neck postural changes on cervical spine motion and angle during swallowing | J. Kim, **J. Hong**, I. Kim, J. Kwon, J. Lee |
| 10:50-10:55 | A185 | Malnutrition Is More Than Just Low Serum Protein And Is Associated With Poor Outcomes And Increased Hospital Costs In Patients Undergoing Elective Cervical Spine Surgery | A. Chung, **B. Eyberg**, J. Hustedt, N. Olmscheid, N. Chutkan, R. Waldrop |
| 10:55-11:00 | A186 | Dose additional uncinate resection increase pseudarthrosis following anterior cervical discectomy and fusion? | **Jong-Min Baik**, Dong-Ho Lee |
| 11:00-11:05 | A187 | Associations between Modic changes and Cervical degenerative disease | **G. Song**, D. Son |
| 11:05-11:10 | A188 | Is there a need to bridge the cervico-thoracic junction in posterior multi-segmental instrumentation of the lower cervical spine? | **G. Osterhoff**, Yu-Mi Ryang, J. Von Oelhafen, B. Meyer, F. Ringel PF |
| 11:10-11:15 | A189 | Radiographic evaluation of the reliability of neck anatomic structures as anterior cervical surgical landmarks | **J. Liu**, X. Xiong, S. Huang, Z. Liu |
| 11:15-11:30 | | Discussion | All |

| 10:30-11:30 | | SPINE TRAUMA (Room: Yellow 1) | **Moderators:** José Maria Jimenez Abdulrazzaq Alobaid |
|---|---|---|---|
| 10:30-10:35 | A190 | Quality of life after spinal cord injury—Results from a Canadian national cross-sectional survey | C. Iorio-Morin, V. Noonan, B. White, L. Noreau, J. Leblond, Frédéric S. Dumont, **N. Dea** PF |
| 10:35-10:40 | A191 | Missile injuries of the spine | **H. Bhatoe** |
| 10:40-10:45 | A192 | Steroid use for acute spinal cord injury in Latin America: a potentially dangerous practice guided by fear of lawsuit | **A. Falavigna**, A. Teles, D. Riew, J. Cabrera |
| 10:45-10:50 | A193 | Adverse Effects of Vasopressor Support for the Maintenance of Mean Arterial Pressure in Acute Spinal Cord Injuries | **L. Hiatt**, S. Theiss, T. Swain, G. McGwin |
| 10:50-10:55 | A194 | A new concept of outcome measurement in spine trauma—The AOSpine Clinician Reported Outcome Spine Trauma (AOSpine CROST) | S. Sadiqi, Jorrit-Jan Verlaan, M. Lehr, M. Post, **S. Muijs**, J. Chapman, M. Dvorak, F. Kandziora, S. Rajasekaran, K. Schnake, A. Vaccaro, C. Oner |
| 10:55-11:00 | A195 | International validation of the AOSpine Patient Reported Outcome Spine Trauma (AOSpine PROST) | S. Sadiqi, **M. Lehr**, M. Post, J. Chapman, M. Dvorak, F. Kandziora, S. Rajasekaran, K. Schnake, A. Vaccaro, C. Oner |
| 11:00-11:05 | A196 | Outcome of Early Surgical Intervention in Spinal trauma patients, an overview of 109 spinal trauma patients | A. Dogar, **A. Ahmed**, H. Hussain, A. Aziz, S. Javed, N. Ahmed, R. Akram |
| 11:05-11:10 | A197 | Spinal fractures in ankylosing spondylitis patients: a systematic review of the literature | **A. Nunes**, P. Fernandes, A. Cevadinha Caetano, J. Miguel Sousa, R. Mendes Almeida, J. Guimarães Consciência |
| 11:10-11:15 | A198 | Acute traumatic spinal cord injury; determinants of outcome and challenges of care at the National Hospital Abuja | **A. Yusuf**, M. Mahmud, D. Jeneral Alfin, A. Aruna PF |
| 11:15-11:30 | | Discussion | All |

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| 10:30-11:30 | | NON-OPERATIVE MEDICAL TREATMENTS (Room: Yellow 3) | **Moderators:** Karsten Wiechert Max Aebi |
|---|---|---|---|
| 10:30-10:35 | A199 | Complexities of Physical and Psychosocial Variables Independently Contribute to Resource Utilization after Lumbar Surgery | **C. Mancuso**, R. Duculan, F. Cammisa, A. Sama, A. Hughes, D. Lebl, F. Girardi |
| 10:35-10:40 | A200 | Dispersal Pattern of Injectate after Cervical Epidural Steroid Injection Evaluated with Magnetic Resonance Imaging | **C. Goldstein**, T. Pashuck, K. Ingalls, C. James, L. Billings, M. Agha, M. Drymalski, T. Choma, J. Jeffries PF |
| 10:40-10:45 | A201 | Patient Satisfaction Does Not Correlate with Pain Medication Consumption in Postoperative | M. Bice, A. Abtahi, D. Barton, A. Presson, Q. Ding, B. Lawrence, **D. Brodke**, W. Ryan Spiker |
| 10:45-10:50 | A202 | Epiduroscopic laser neural decompression—clinical significance and complications for 8 years | **C. Kim**, J. Kim |
| 10:50-10:55 | A203 | Spondylolisthesis in elite athletes; Case series of effective rehabilitation with return to peak performance | **R. Newsome**, J. Shipley, M. Athanassacopoulos, A. Cole, R. Michael, L. Breakwell, J. Tomlinson, N. Chiverton |
| 10:55-11:00 | A204 | Opioid use in relation to treatment outcome in patients with low back pain—data from a prospective randomized controlled trial | **J. Dengler**, B. Sturesson, D. Kools, D. Prestamburgo, R. Pflugmacher, P. Vajkoczy |
| 11:00-11:05 | A205 | Back pain x leg pain—impact of quality of life in degenerative lumbar disease | R. Motta, **R. Pratali**, R. Rocha, C. Oliveira, M. Nogueira |
| 11:05-11:10 | A206 | Influence on non-specific back pain and postural trunk control by whole-body vibration therapy | **C. Melcher**, W. Veronika, V. Jansson, C. Birkenmaier, S. Rarak, B. Wegener |
| 11:10-11:15 | A207 | Treatment of Chronic Low Back Pain via Ablation of the Basivertebral Nerve: Results of a multicenter, randomized, double blinded, sham controlled trial (SMART Trial) | **B. Meyer**, R. Sasso, C. Yeung, H. Bae, A. Rhyne, J. Franke, P. Vajkoczy, M. De Palma, J. Fischgrund |
| 11:15-11:30 | | Discussion | All |

11:30-12:30 AOSpine Past Fellows session—Past Chairpersons of AOSpine: Encouraging Leaders (Room: Yellow 2) Moderator: Emre Acaroglu
Speakers: Jeffrey Wang, John Webb, Luiz Vialle, Max Aebi, Emre Acaroglu



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| 11:30-12:30 Paper Sessions | | | |
|---|---|---|---|
| **11:30-12:30** | | ADOLESCENT SCOLIOSIS 3 (Room: Red) | **Moderators:** Youssry El Hawary Lawrence Lenke |
| 11:30-11:35 | A208 | Modern Luque Trolley: Self-Growing Rod Construct to Manage EOS While Maintaining Spontaneous Spinal Growth | **Y. Alabdulkarim**, J. Ouellet, C. Ferland |
| 11:35-11:40 | A209 | Could Shilla procedure prevent crankshaft phenomenon? | **K. Kharrat**, M. Rizkallah, A. Sebaaly |
| 11:40-11:45 | A210 | Phenotyping Chronic Pain in Adolescents with Idiopathic Scoliosis: Preliminary Results of a Cohort Study | **C. Ferland**, My-Linh Ma, C. D'Aiuto, Diana-Luk Ye, J. Chong, N. Saran, S. Marchand, Jean A. Ouellet |
| 11:45-11:50 | A211 | Radiological analysis of pedicle subtraction osteotomies in children | **N. Babu**, Arun-Kumar Viswanadha |
| 11:50-11:55 | A212 | Patient-related outcomes in adolescent spine deformity surgery—A cohort study based on a single centre spine outcomes registry | **M. Van Hooff**, T. Stevens, P. Horsting, L. De Klerk, M. De Kleuver |
| 11:55-12:00 | A213 | Vertebral modulation through Posterior Tethering Technique for Correction of Early Onset Scoliosis | **A. Ahmad** |
| 12:00-12:05 | A214 | Radiographic and biomechanical study on Co-Cr rod in adolescent idiopathic scoliosis surgery | **L. Scaramuzzo**, F. Galbusera, F. Giudici, L. La Barbera, L. Minoia, C. Ottardi, M. Archetti, T. Villa, A. Zagra |
| 12:05-12:10 | A215 | Corrosion of the internal mechanism of Magnetically Controlled Growth Rods explains the mechanism of failure | **V. Panagiotopoulou**, S. Tucker, H. Hothi, J. Henckel, A. Gibson, J. Leong, T. Ember, J. Skinner, A. Hart |
| 12:10-12:15 | A216 | The Importance of Selective Thoracic Fusion in Thoracic Adolescent Idiopathic Scoliosis | **Dong-Gune Chang**, J. Yang, Jung-Hee Lee, Seung-Woo Suh, Jong-Beom Park, Jin-Hyok Kim, Se-Il Suk PF |
| 12:15-12:30 | | Discussion | All |

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| 11:30-12:30 | | CERVICAL MYELOPATHY IMAGING (Room: Blue 2) | **Moderators:** Bizhan Aarabi Chung Chek Wong |
|---|---|---|---|
| 11:30-11:35 | A217 | Multi-Parametric Microstructural Spinal Cord MRI Applied to Degenerative Cervical Myelopathy | **A.R. Martin**, B. De Leener, J. Cohen-Adad, David W. Cadotte, S. Kali-Ryan, S.F. Lange, L. Tetreault, A. Nouri, A. Crawley, David J. Mikulis, H. Ginsberg, M. Fehlings |
| 11:35-11:40 | A218 | Quantitative Multiparametric Spinal Cord MRI Detects Subclinical Tissue Injury in Asymptomatic Cervical Spinal Cord Compression | **A.R. Martin**, B. De Leener, J. Cohen-Adad, David W. Cadotte, J.R. Wilson, L. Tetrealt, A. Nouri, A. Crawley, D.J. Mikulis, H. Ginsberg, M. Fehlings |
| 11:40-11:45 | A219 | Dynamic Compression of Cervical Spinal Cord in Symptomatic Patients: A Study With The Help of Kinetic MRI | **T. Vu**, S. Vo PF |
| 11:45-11:50 | A220 | Impact of Pre-operative Flexion and Extension MRI on Decision-Making for Cervical Spondylotic Myelopathy | **B. Awad**, K. Zaghloul |
| 11:50-11:55 | A221 | Comparison of Pre-Operation Diffusion Tensor Imaging versus T2 Signal Intensity in a Large Series of Cervical Spondylotic Myelopathy Patients for Assessment of Disease Severity and Prognostication of Recovery | **S. Shabani**, H. Nguyen, A. Rao, M. Kaushal, S. Kurpad |
| 11:55-12:00 | A222 | MRI Analysis of the Combined AOSpine North America and International Studies: The Prevalence and Spectrum of Pathologies in a Global Cohort of Patients with Degenerative Cervical Myelopathy | **A. Nouri**, A. Martin, L. Tetreault, A. Nater, H. Nakashima, N. Nagoshi, H. Reihani-Kermani, M. Fehlings |
| 12:00-12:05 | A223 | Kinematic MRI in the identification of occult cervical spine pathology | **R. Grazina**, R. Rocha, J. Nunes, Ó. Alves, D. Monteiro, N. Almeida, M. Resende, H. Morais, S. Castro, D. Seixas |
| 12:05-12:10 | A224 | Morphological characteristics of diffuse idiopathic skeletal hyperostosis in the cervical spine on computed tomography images | J. Bakker, **J. Kuperus**, H. Kuijf, C. Oner, P. De Jong, Jorrit-Jan Verlaan |
| 12:10-12:15 | A225 | High Resolution Diffusion Tensor Imaging in Cervical Spondylotic Myelopathy: A Preliminary Follow-up Study | L. Guan, X. Chen, **Y. Hai** |
| 12:15-12:30 | | Discussion | All |

| 11:30-12:30 | | THORACOLUMBAR TRAUMA (Room: Yellow 1) | **Moderator:** José Maria Jimenez Patrick Hsieh |
|---|---|---|---|
| 11:30-11:35 | A226 | Efficacy and Safety of Riluzole in Acute Spinal Cord Injury (SCI). Rationale and Design of AOSpine Phase III Multi-center Double Blinded Randomized Controlled Trial. (RISCIS) | **M. Fehlings**, B. Kopjar, R. Grossman |
| 11:35-11:40 | A227 | Natural History, Mortality, Complications and Impact of Early Surgical Decompression in Thoracic Spinal Cord Injury: A Multicenter Prospective Study from the North American Clinical Trials Network and AOSpine Spinal Cord Injury Knowledge Forum | **J.R. Wilson**, J. Harrop, M. Fehlings, R. Grossman, E. Toups, B. Aarabi PF |
| 11:40-11:45 | A228 | How far can we go with percutaneous fixation of spinal fractures? A comparative study with open fixation in 110 patients with fractures of the thoracolumbar transition (T12-L1) | **A. Figueiredo**, A. Mendonça, P. Lourenço, C. Jardim, C. Alegre, F. Fonseca |
| 11:45-11:50 | A229 | Early versus late surgery for traumatic spinal cord injury in the thoracic or thoracolumbar area—secondary results of a randomized controlled trial at one-year follow-up | E. Barzideh, A. Haghnegahdar, S. Saadat, **P. Derakhshan**, R. Behjat, A. Shahlaee, A. Niakan, A. Vaccaro, V. Rahimi-Movaghar |
| 11:50-11:55 | A230 | Quality of life following thoracoscopic stabilization of traumatic thoracolumbar fractures with a distractable cage | **A. Smits**, A. Noor, F. Bakker, J. Deunk, J. Deunk, F. Bloemers |
| 11:55-12:00 | A231 | The change of adjacent segment after thoracolumbar posterior instrumentation and fusion surgery in thoracolumbar fractures | Dong-Eun Shin, **Tae-Keun Ahn** |
| 12:00-12:05 | A232 | Minimally Invasive Stabilisation of the Fractured Ankylosed spine: A comparative case series study | **F. Brooks**, D. Roy, B. Williams, M. Selby |
| 12:05-12:10 | A233 | Percutaneous fluoroscopic—guided versus percutaneous 3D navigation—guided versus open pedicle screw fixation for treatment of thoracolumbar fractures without neurologic deficits | **M. Roclawski**, R. Pankowski, W. Kloc, S. Adamski, W. Libionka, M. Ceynowa |
| 12:10-12:15 | A234 | Sacral fractures with spondylopelvic dissociation | **I. Barni** |
| 12:15-12:30 | | Discussion | All |

# Friday Program Schedule

| 11:30-12:30 | | SPINE BIOLOGICS (Room: Yellow 3) | **Moderators:** Giovanni Barbanti Brodano, Tim Yoon |
|---|---|---|---|
| 11:30-11:35 | A235 | Human Intervertebral Disc Cells hinder Primary Human Osteoblasts and Stromal Cells to undergo Osteogenesis | **R. May**, A. Tekari, S. Chan, D. Frauchiger, L.M. Benneker, S. Kohl, B. Gantenbein |
| 11:35-11:40 | A236 | Comparison of Outcomes Between Artificial Disc Replacements and Bone Marrow Concentrate Injections for Chronic Discogenic Low Back Pain—2 year follow up | **F. Techy**, S. Costa, T. Santomaso, K. Pettine PF |
| 11:40-11:45 | A237 | Destiny of allogeneic Tie2+ cells from isolation to injection into intervertebral discs in organ explant culture | **D. Frauchiger**, A. Tekari, L.M. Benneker, D. Sakai, B. Gantenbein |
| 11:45-11:50 | A238 | Intervertebral disc repair by combining genipin-enhanced fibrin hydrogel and engineered silk-fleece | **D. Frauchiger**, S. Heeb, A. Tekari, M. Wöltje, L.M. Benneker, B. Gantenbein |
| 11:50-11:55 | A239 | Effects of Systemic PEGylated NELL-1 on Bone Healing and Density in a Mouse Model | **E. Lord**, J. Tanjaya, J. Kwak, E. Chen, K. Khalilinejad, J. Wang, C. Soo, K. Ting |
| 11:55-12:00 | A240 | The Effect of The Extra Dural Compression on The Intraspinal Pressure, In Vitro Study | **M.A. Mansi**, J. Hines, M. Bassi, P. Barriga, R. Reindl, J. Ouellet, P. Jarzem |
| 12:00-12:05 | A241 | The effects of combined high-dose parathyroid hormone (PTH 1-34) and low dose bone morphogenetic protein 2 (BMP-2) treatment in a rabbit model of lumbar spinal fusion | C. Holmes, W. Ishida, B. Elder, Sheng-Fu Larry Lo, M. Taylor, J. Locke, **T. Witham** PF |
| 12:05-12:10 | A242 | Mesenchymal progenitor cells primed with pentosan polysulfate mediate disc repair following microdiscectomy in an ovine model | **C. Daly**, P. Ghosh, T. Badal, R. Shimmon, I. Ghosh, G. Jenkin, D. Oehme, K. Jain, I. Sher, A. Vais, C. Cohen, T. Goldschlager |
| 12:10-12:15 | A243 | Effect of RNA Interference (RNAi)-Mediated Suppression of Fas Gene on Viability of Rat Intervertebral Disc Cells | **Jong-Beom Park** |
| 12:15-12:30 | | Discussion | All |

| 12:30-14:00 | | Industry Lunch Symposia | |
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| 14:00-15:00 | Symposium Hosted by AOSpine and European Association of Neurosurgical Societies—Sagittal imbalance: when and why to stop correction? (Room: Red) | **Moderators:** Bernhard Meyer, Massimo Balsano |
|---|---|---|
| 14:00-14:15 | Sagittal imbalance in cervical spine disease: a segmental or global spine problem? Indications and surgical strategies for correction | Ehab Shiban, Massimo Balsano |
| 14:15-14:30 | Sagittal imbalance in degenerative scoliosis and lumbar spine degenerative disease: Indications for correction, surgical goals to improve functional outcome and how to prevent complications | Peter Vajkoczy, Claudio Lamartina |
| 14:30-14:45 | Sagittal imbalance in post-traumatic deformity. From "minor" to "major" cases: when, how and why to correct | Florian Ringel, Patrick Tropiano |
| 14:45-15:00 | Discussion | All |

| 14:00-15:00 | Symposium Hosted by AOSpine Knowledge Forum Degenerative/ Biologics—Updates on Grafts and Biomaterials in Lumbar Spine Surgery (Room: Blue 2) | **Moderators:** Patrick Hsieh, Tim Yoon |
|---|---|---|
| 14:00-14:05 | Opening Remarks | Jeffrey Wang |
| 14:05-14:15 | Evidence-Based Classification of grafts and biomaterials for spine fusion | Tim Yoon |
| 14:15-14:25 | Optimizing graft choices to achieve arthrodesis in adult spinal deformity surgery | Darrel Brodke |
| 14:25-14:35 | Stem cells for lumbar fusion: Current practice and evidence | Patrick Hsieh |
| 14:35-14:45 | Novel biologics for spine fusion and disc repair | Zorica Buser |
| | Debate: Allograft versus PEEK and novel biomaterial for Lumbar Interbody Fusion | All |
| 14:45-14:50 | Allograft optimizes lumbar interbody fusion | Jong Beom Park |
| 14:50-14:55 | PEEK and Nanosurface technology | Hans Jörg Meisel |
| 14:55-15:00 | Discussion | All |

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| 14:00-15:00 | Symposium Hosted by AO Alliance—Neurotrauma in the developing world: every little bit helps (Room: Yellow 1) | **Moderator:** Claude Martin |
|---|---|---|
| 14:00-14:10 | Training a generalist spine surgeon for LICs environment: is it possible? | Alex Buteera |
| 14:10-14:20 | Neurotrauma education in LICs: what do we teach and what is our audience? | Brian Sonkwe |
| 14:20-14:30 | Global neurotrauma research challenges and opportunities | Valentine Mandizvidza |
| 14:30-14:40 | Returning home after a spine fellowship: what can I do? | Boston Munthali |
| 14:40-15:00 | Questions and Answers | All |

| 14:00-15:00 | Symposium—Mismatches between imaging and clinical findings (Room: Yellow 3) | **Moderators:** Max Aebi, Alberto Zerbi |
|---|---|---|
| 14:00-14:05 | Introduction | Max Aebi |
| 14:05-14:20 | The clinician point of view in degenerative and trauma patients | Pedro Berjano |
| 14:20-14:35 | Clinical relevance of degenerative manifestation of the lumbar spine | John Carrino |
| 14:35-14:50 | Imaging in trauma patients | Gustav Andreisek |
| 14:50-15:00 | Open discussion | All |

## 15.00-15:30 Paper Sessions

| **15:00-15:30** | | MINIMALLY INVASIVE SPINE SURGERY LATERAL LUMBAR FUSION (Room: Red) | **Moderator:** Paul Thng, Roger Härtl |
|---|---|---|---|
| 15:00-15:05 | A244 | Comparative study at difference of perioperative complication, cage location and sagittal alignment; MIS-OLIF (minimally invasive oblique lateral lumbar interbody fusion) vs. MIS-DLIF (direct lateral lumbar interbody fusion) | **Jung-Woo Hur**, Kyeong-Sik Ryu, Jin-Sung Kim, Ji-Hoon Seong, Hyun-Jin Cho, Ho-Jung Chung, Roger Härtl |
| 15:05-15:10 | A245 | Does a Preoperative Pain Free Posture Predict Success of Indirect Decompression by Extreme Lateral Interbody Fusion (XLIF) in Degenerative Lumbar Spinal Conditions? | **K. Lim**, J. Brown, C. Daly, T. Goldschlager |
| 15:10-15:15 | A246 | Saggital alignment parameters in patients submitted to extreme—lateral interbody fusion (XLIFR) versus minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF) | **C. Menezes**, D. Abreu Oliveira, R. Araujo Porto, A. Arruda |
| 15:15-15:20 | A247 | Mini-Open Approach to Lateral Transpsoatic Interbody Fusion of the Lumbar Spine: A Technical Perspective Comprising > 5,000 Levels | **G. Fantini**, A. Hughes, F. Girardi, A. Sama, C. Goodwin, F. Cammisa |
| 15:20-15:30 | | Discussion | All |

| **15:00-15:30** | | SURGICAL COMPLICATIONS (Room: Blue 2) | **Moderators:** Emiliano Vialle, Benny Dahl |
|---|---|---|---|
| 15:00-15:05 | A248 | Emergent Reintubation in Spine Patients | Z. Child, **R. Bransford**, A. Dagal, J. Agel |
| 15:05-15:10 | A249 | Airway Adverse Events After Posterior Occipitocervical Fusion | V. Sheshadri, R. Moga, P. Manninen, **C. Goldstein**, Y. Raja Rampersaud, E. Massicotte, M. Fehlings, L. Venkatraghavan PF |
| 15:10-15:15 | A250 | The Effect of Pre-Operative Smoking on Short-Term Outcomes after Anterior Cervical Discectomy and Fusion | **T. Purvis**, Haroldo J. Rodriguez, A. Karim Ahmed, C. Boone, R. De La Garza-Ramos, C.R. Goodwin, D.M. Sciubba |
| 15:15-15:20 | A251 | Renal Dysfunction in Lumbar Fusion Patients: Short-Term Complications in a Nationwide Sample | **T. Purvis**, Remi A. Kessler, C. Boone, B.D. Elder, C.R. Goodwin, D.M. Sciubba |
| 15:20-15:30 | | Discussion | All |



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| 15:00-15:30 | | TUMOR 2 (Room: Yellow 1) | **Moderators:** Stefano Boriani Emre Acaroglu |
|---|---|---|---|
| 15:00-15:05 | A252 | Unilateral laminectomy approach for the removal of spinal meningiomas and schwannomas: Impact on clinical outcomes and foraminal extension | **Jong-Hyeok Park**, W. Eoh, Eun-Sang Kim, Sun-Ho Lee |
| 15:05-15:10 | A253 | The Management of Spinal Metastases from Renal Cell Carcinoma | O. Lapaeva, **D. Ptashnikov**, D. Mikhaylov, N. Zaborovskii, S. Masevnin, Z. Mooraby, Y. Lexz, O. Smekalenkov |
| 15:10-15:15 | A254 | Metastatic Spinal Cord Compression: Effects of tumour type on survival | **S. Aziz**, P. Basu, S. Dhiran, J. Braybrooke, O. Gabbar, P. Sell, A. Law, W. Yoon |
| 15:15-15:20 | A255 | Chromosomal deletion (22q13) may be associated with sacral chordoma recurrence | **Á. Bozsódi**, B. Scholtz, G. Papp, P. Varga, A. Lazary |
| 15:20-15:30 | | Discussion | All |

| 15:00-15:30 | | BIOMECHANICS (Room: Yellow 3) | **Moderators:** Stephen Lewis Tim Yoon |
|---|---|---|---|
| 15:00-15:05 | A256 | The effect of an interspinous spacer on the pars interarticularis after minimally invasive lumbar decompression—a finite element analysis | **H. Lo** |
| 15:05-15:10 | A257 | Optimal Cement Dosage and Configuration for Prophylactic Vertebroplasty Above Long Thoracolumbar Fusion Constructs to Reduce Proximal Junction Kyphosis (PJK): A Finite Element Model | D. Briski, **J. Zavatsky**, R. McGuire |
| 15:10-15:15 | A258 | A biomechanical analysis of a novel growing rod for early onset scoliosis | C. Zong-Xing, W. Jaw-Lin, **L. Po-Liang** |
| 15:15-15:20 | A259 | Biomechanical aspects of non-rigidity in lumbopelvic reconstruction following total sacrectomy | **P. Eltes**, L. Kiss, D. Lacroix, A. Lazary, P. Varga |
| 15:20-15:30 | | Discussion | All |

| 15:30-16:00 | | Break | |
|---|---|---|---|

16:00-16:45 AOSpine Members-only session—Prevention and Patient-Led Care in the New Health Economy (Room: Yellow 2)
Speakers: Dominik Hotz

Member Privilege

| 16:00-16:45 Paper Sessions | | | |
|---|---|---|---|
| **16:00-16:45** | | ADULT DEFORMITY 2 (Room: Red) | **Moderators:** Darrel Brodke, Yong Qiu |
| 16:00-16:05 | A260 | A retrospective value analysis of the management of primary adult spinal deformity | D. Beckerman, **S. Berven**, L. Racine, T. Sharf, M. Callahan, S. Burch, V. Deviren, S. Hu, B. Tay |
| 16:05-16:10 | A261 | Development and Assessment of a Novel Adult Spinal Deformity (ASD) Frailty Index (ASD-FI) to Assist with Risk Stratification for ASD Surgery | E. Miller, B. Neuman, A. Jain, D.M. Sciubba, K. Kebaish, J. Scheer, J. Smith, C. Shaffrey, **C. Ames** |
| 16:10-16:15 | A262 | Despite Higher Risk Stratification Scores, Frail Patients Achieve Greater Two-year Health Related Quality of Life Improvement from Baseline Compared to Non-frail Patients Following Adult Spinal Deformity Surgery | E. Miller, **T. Ailon**, J. Scheer, A. Daniels, D. Kojo Hamilton, J. Smith, C. Shaffrey, B. Neuman, K. Kebaish, C. Ames PF |
| 16:15-16:20 | A263 | Which clinical parameters of the Schwab-SRS classification system for ASD is significant in predicting treatment outcomes for surgically treated patients? | S. Yuksel, T. Mmopelwa, S. Ayhan, **V. Nabiyev**, F. Pellise, A. Vila-Casademunt, A. Alanay, F. Perez Grueso, F. Kleinstuck, I. Obeid, E. Acaroglu, European Spine Study Group (ESSG) |
| 16:20-16:25 | A264 | Factors associated with prolonged ventilation and reintubation in adult spinal deformity (ASD) surgery | **R. De La Garza Ramos**, J. Nakhla, R. Nasser, A. Jada, N. Haranhalli, D.M. Sciubba, R. Yassari |
| 16:25-16:30 | A265 | Adult spinal deformity patients with previous fusions have an equal chance of reaching substantial clinical benefit thresholds in health-related quality of life measures but do not reach the same absolute level of improvement | **T. Ailon**, J. Smith, C. Shaffrey, A. Soroceanu, V. Lafage, F. Schwab, D. Burton, R. Hart, H. Kim, J. Gum, R. Hostin, M. Kelly, S. Glassman, J. Scheer, S. Bess, C. Ames PF |
| 16:30-16:45 | | Discussion | All |

| **16:00-16:45** | | CERVICAL SURGERY COMPLICATIONS (Room: Blue 2) | **Moderators:** James Harrop, Juan Emmerich |
|---|---|---|---|
| 16:00-16:05 | A266 | Risk factors and clinical outcomes of dysphagia after anterior cervical surgery in patients with degenerative cervical myelopathy: Results from the Prospective AOSpine Studies | N. Nagoshi, **L. Tetreault**, H. Nakashima, P. Arnold, G. Barbagallo, B. Kopjar, M. Fehlings |
| 16:05-16:10 | A267 | A new scoring system for evaluation early dysphagia after anterior cervical spine surgery: a prospective study | Z. Liu, J. Liu, W. Tong, **S. Huang** |
| 16:10-16:15 | A268 | Preoperative radiographic parameters to predict a higher pseudarthrosis rate following anterior cervical discectomy and fusion | **S. Choi**, J. Cho, Jung-Ki Ha, Dong-Ho Lee |
| 16:15-16:20 | A269 | Risk factors for Dysphagia after anterior cervical surgery: preliminary results from a prospective multicenter study of the AOSLA Group | **A. Falavigna**, D. Doze, J. Guyot, R. Yurac, J. Jimenez, B. Zárate, N. Scheverin, P. Jalón, O. Righesso, E. Sfreddo, M. Koff |
| 16:20-16:25 | A270 | The Effect of uncinate process resection on the subsidence in anterior cervical discectomy and fusion | **D. Son**, S. Lee |
| 16:25-16:30 | A271 | Predictors of clinical outcome in cervical arthrodesis: Evaluation of physical, mental and social factors | **E. Shiban**, J. Thiel, U. Hoffmann, Y. Shiban, J. Lehmberg, B. Meyer |
| 16:30-16:45 | | Discussion | All |



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| 16:00-16:45 | | LUMBAR SURGERY 2 (Room: Yellow 1) | **Moderators:**<br>Manabu Ito<br>Lawrence Rhines |
|---|---|---|---|
| 16:00-16:05 | A272 | Is there clinical evidence of galvanic corrosion in constructs with CoCr rods and Titanium screws? | **V. Panagiotopoulou**, H. Hothi, H. Anwar, S. Molloy, K. Rezajooi, J. Sutcliffe, J. Skinner, A. Hart |
| 16:05-16:10 | A273 | A radiological evaluation of insertion S2 alar-iliac screw in the Japanese population | **K. Masuda**, H. Shigematsu, E. Iwata, M. Tanaka, A. Okuda, Y. Morimoto, Y. Tanaka, K. Kawate |
| 16:10-16:15 | A274 | Autologous disc chondrocyte transplantation in lumbar spine disc degeneration disease—a prospective, controlled, randomized study | **C. Hohaus**, F. Didrigkeit, H. Meisel |
| 16:15-16:20 | A275 | Factors influencing lumbar paraspinal fatty infiltration on MRI | **S. Hoppe**, D. Maurer, S. Ahmad, W. Valenzuela, L. Benneker |
| 16:20-16:25 | A276 | Failed back surgery syndrome: is this patient created problem or surgeon created problem? | **A. Younus** |
| 16:25-16:30 | A277 | Multiple Anterior Cages vs Osteotomies in Sagittal Imbalance Management | **R. Bassani**, F. Gregori, S. Brock, D. Gavino, G. Casero, C. Ferlinghetti |
| 16:30-16:45 | | Discussion | All |

| 16:00-16:45 | | TRAUMA CERVICAL 2 (Room: Yellow 3) | **Moderators:**<br>Joseph Cheng<br>Jong Beom Park |
|---|---|---|---|
| 16:00-16:05 | A278 | The Impact of Translation and Stenosis on Spinal Cord Injuries in Traumatic Jumped Facet Injuries | R. Bransford, **D. Glassman**, E. Magnuson, J. Agel PF |
| 16:05-16:10 | A279 | Prospective Clinical and Radiographic Assessment of the Cervical Spine in Professional Rodeo Riders After Exposure to Greater than 10G Linear Acceleration | **T. McClellan**, A. Theologis, J. Shaw, J. Mulvihill, M. Zaid, C. Hess, J. Narvid, A. Gean, J. Larouche |
| 16:10-16:15 | A280 | Glasgow Coma Scale score, Age and intramedullary lesion length on MRI are independent predictors of mortality in traumatic upper cervical spinal cord injuries | **B. Aarabi**, D. Hersh, D. Stein, E. Le, M. Simard, C. Sansur, D. Ibrahimi, G. Schwartzbauer, C. Diaz, J. Massetti, N. Akhtar-Danesh |
| 16:15-16:20 | A281 | Cervical facet dislocations in the adolescent population: a report of 21 cases at a Level 1 trauma center from 2004-2014 | **R. Bransford**, A. Anissipour, J. Agel, C. Bellabarba |
| 16:20-16:25 | A282 | Odontoid Synchondrosis Fracture in children: Report of 6 cases with special reference to posterior partial odontoidectomy in an irreducible atlantoaxial dislocation | **A. Rahimizadeh** |
| 16:25-16:30 | A283 | A retrospective review of patients receiving cervical spine stabilization while being actively anticoagulated with heparin in the immediate perioperative period | Francis X. Camillo, **S. Mitchell** |
| 16:30-16:45 | | Discussion | All |

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# Friday Program Schedule

| 16:45-17:45 Spine Societies (Room: Red) | | |
|---|---|---|
| 16:45-17:45 | **Symposium Hosted by EUROSPINE—New Technologies** | **Moderator:** Marco Teli |
| 16:45-17:00 | Introduction | Marco Teli |
| 17:00-17:15 | New technologies for study design and research for surgeons | Margareta Nordin |
| 17:15-17:30 | Computer-assisted surgery in spinal trauma | Thomas Blattert |
| 17:30-17:45 | Corrective strategies in complex dystrophic spinal deformities | Marco Brayda-Bruno |

| 16:45-17:45 Spine Societies (Room: Blue 2) | | |
|---|---|---|
| 16:45-17:45 | **Symposium Hosted by Deutsche Wirbelsäulengesellschaft—Treatment standards in spine surgery—the German perspective** | **Moderators:** Klaus Dieter Schaser, Thomas Niemeyer, Viola Bullmann |
| 16:45-17:00 | State of the art in thoracolumbar fractures | Alexander Disch |
| 17:00-17:15 | Lumbar spinal canal stenosis and degenerative spondylolisthesis | Thomas Niemeyer |
| 17:15-17:30 | Idiopathic scoliosis | Viola Bullmann |
| 17:30-17:45 | Vertebral tumours | Klaus Dieter Schaser |

| 16:45-17:45 Spine Societies (Room: Yellow 1) | | |
|---|---|---|
| 16:45-17:45 | **Symposium Hosted by Società Italiana di Chirurgia Vertebrale—Gruppo Italiano Scoliosi—Infections in Spine Surgery** | **Moderators:** Bernardo Misaggi, Tiziana Greggi, Giuseppe Costanzo |
| 16:45-16:52 | Epidemiology, diagnosis and drug treatment of pyogenic spondylodiscitis | Massimo Fantoni |
| 16:52-16:59 | Proposal of a new classification for pyogenic spondylodiscitis | Enrico Pola/Francesco C. Tamburrelli |
| 16:59-17:06 | Pyogenic spondylodiscitis, spondylitis and degenerative disc disease: differential diagnosis | Alberto Zerbi |
| 17:06-17:13 | Surgical treatment of cervical spondylodiscitis | Vincenzo Denaro/Alberto Di Martino |
| 17:13-17:20 | Surgical treatment of dorso-lumbar spondylodiscitis | Giovanni Barbanti Brodano/Alessandro Gasbarrini/Stefano Boriani |
| 17:20-17:27 | Pediatric spondylodiscitis | Marco Crostelli / Osvaldo Mazza |
| 17:27-17:45 | Discussion | All |

| 16:45-17:45 Spine Societies (Room: Yellow 3) | | |
|---|---|---|
| 16:45-17:45 | **Symposium Hosted by Société Francaise de Chirurgie Rachidienne—Management of Odontoid Fractures** | **Moderators:** Patrick Tropiano, Stéphane Fuentes |
| 16:45-16:48 | Introduction | Patrick Tropiano |
| 16:48-16:58 | Management of Odontoid fracture in young patients | Benjamin Blondel |
| 16:58-17:03 | Discussion | All |
| 17:03-17:13 | Management of Odontoid fracture in elderly patients | Patrick Tropiano |
| 17:13-17:17 | Discussion | All |
| 17:17-17:27 | MIS in the mamagement of odontoid fractures | Stéphane Fuentes |
| 17:27-17:32 | Discussion | All |
| 17:32-17:42 | Management of special odontoid fractures | Stéphane Fuentes |
| 17:42-17:45 | Discussion | All |

| | | |
|---|---|---|
| 18:00-19:00 | Cadaver lab—Industry sponsored symposium | |

Global Spine Congress 2017

# Saturday

## May 6, 2017

# Saturday Program Schedule

| 08:00-09:00 Spine Societies (Room: Red) | | |
|---|---|---|
| 08:00-09:00 | Symposium—Postoperative Problems in Spine Surgery patients | **Moderator:** Jens Chapman |
| 08:00-08.05 | Introduction | Jens Chapman |
| 08:05-08:15 | Intraop complications and when to use what diagnostics | John Street |
| 08:15-08:25 | Missed nonspinal pathology | Daniel Sciubba |
| 08:25-08:35 | Adjacent segment disease; why, what to look for and when do we intervene? | Darrel Brodke |
| 08:35-08:45 | Maximizing long-term outcomes of major spine surgery. What matters? | Justin Smith |
| 08:45-09:00 | Panel Discussion and Summary | All |

| 08:00-09:00 Spine Societies (Room: Blue 2) | | |
|---|---|---|
| 08:00-09:00 | Symposium Hosted by AOSpine Asia Pacific—Craniovertebral junction pathologies | **Moderator:** Manabu Ito |
| 08:00-08:10 | Case presentation of basilar invagination and Atlanto axial dislocation | Rudrappa Satish |
| 08:10-08:20 | Technique of Reduction and Decompression in C1-2 fixation | Jin Sup Yeom |
| 08:20-08:25 | Video—How do I do the reduction | Jin Sup Yeom |
| 08:25-08:35 | Vertebral artery injury—How to tackle? | Kshitij Chaudary |
| 08:35-08:40 | C1-2 transarticular fixation—Tips for surgery | Rudrappa Satish |
| 08:40-08:45 | C1-2 lateral mass fixation—Tips for surgery | Kshitij Chaudary |
| 08:45-09:00 | Questions and Answers | All |

| 08:00-09:00 Spine Societies (Room: Yellow 1) | | |
|---|---|---|
| 08:00-09:00 | Symposium Hosted by AOSpine Middle East—Spinal Infections | **Moderators:** Abdelaziz Al-Mutair Mohammad El-Sharkawi |
| 08:00-08:05 | Welcome and Introduction | Abdulaziz Al-Mutair |
| 08:05-08:15 | Spinal Infection Epidemiology, Pathophysiology, Laboratory and Radiological Diagnosis | Ghassan Skaf |
| 08:15-08:25 | Pyogenic Spondylodiscitis | Imad Ahmed |
| 08:25-08:35 | Spinal Tuberculosis | Youssry El Hawary |
| 08:35-08:45 | Atypical and Multidrug Resistant Spine Tuberculosis | Amer Aziz |
| 08:45-08:55 | Postsurgical Site Infection; Diagnosis, Management, Outcome, and Prognosis | Mohamed Abdel-Wanis |
| 08:55-09:00 | Discussion and conclusion | Abdulaziz Al-Mutair |

| 08:00-09:00 Spine Societies (Room: Yellow 3) | | |
|---|---|---|
| 08:00-09:00 | Symposium Hosted by AOVET—A pain in the neck—surgical advances in canine cervical diseases | |
| 08:00-09:00 | A pain in the neck—surgical advances in canine cervical diseases | Bianca Hettlich |

09:00-10:00 AOSpine Members-only session—AOSpine Subaxial Classification System—Training and testing (Room: Yellow 2) Moderator: Cumhur Oner
Speakers: Cumhur Oner, Greg Schroeder

Member Privilege

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| 09:00-10:00 Paper Sessions | | | |
|---|---|---|---|
| **09:00-10:00** | | DEFORMITY—CERVICAL (Room: Red) | **Moderators:** Sigurd Berven, Juan Emmerich |
| 09:00-09:05 | A284 | Comparison of Frailty Based on Cervical and Global SVA Classification | E. Miller, B. Neuman, **D.M. Sciubba**, J. Scheer, J. Smith, K. Kebaish, C. Shaffrey, C. Ames PF |
| 09:05-09:10 | A285 | The Health Impact of Symptomatic Adult Cervical Deformity: Comparison to United States Population Norms and Chronic Disease States Based on the EQ-5D | **J. Smith**, B. Line, S. Bess, C. Shaffrey, H. Kim, G. Mundis, J. Scheer, E. Klineberg, R. Hostin, M. Gupta, A. Daniels, M. Kelly, J. Gum, F. Schwab, V. Lafage, R. Lafage, T. Ailon, P. Passias, T. Protopsaltis, T. Albert, K. Daniel Riew, R. Hart, D. Burton, V. Deviren, C. Ames |
| 09:10-09:15 | A286 | Surgical treatment for kyphotic deformities of the cervical spine. A review of the surgical approaches and clinical outcomes | J. Stulik, P. Nesnidal, **G. Swamy**, Z. Klezl PF |
| 09:15-09:20 | A287 | Assessment of a Novel Adult Cervical Deformity (CD) Frailty Index (FI) as a Component of Preoperative Risk Stratification | E. Miller, B. Neuman, **D.M. Sciubba**, K. Kebaish, J. Scheer, J. Smith, C. Shaffrey, C. Ames PF |
| 09:20-09:25 | A288 | Iatrogenic cervical subaxial kyphotic deformity following C1/C2 fixation. Post-traumatic epiphenomenon or iatrogenic reciprocal change. A series of 20 cases. | **J.M. Duff**, J. J. Michael |
| 09:25-09:30 | A289 | The application of one stage combined approach with circumferential osteotomy in the treatment of congenital cervical scoliosis | **Y. Sun**, F. Zhang, S. Pan, L. Zhang, Y. Diao, X. Chen, F. Zhou, Y. Zhao |
| 09:30-09:35 | A290 | Significance of Multimodal intraoperative monitoring (MIOM) for the patients with Craniovertebral junction pathology | **J. Hong**, J. Lee, J. Kwon, I. Kim |
| 09:35-09:40 | A291 | The impact of cervical sagittal alignment on post-operative outcome after anterior cervical fusion in patients without evident deformity. A new method to evaluate the right amount of cervical lordosis | **M. Pecoraro**, M. Ajello, N. Marengo, G. Pilloni, F. Penner, F. Zenga, D. Garbossa, A. Ducati |
| 09:40-09:45 | A292 | Correlation Between Cervical Alignment and Neck Disability | R. Pratali, **M. Motta**, C. Oliveira |
| 09:45-10:00 | | Discussion | All |

| **09:00-10:00** | | MINIMALLY INVASIVE SPINE SURGERY 2 (Room: Blue 2) | **Moderators:** Alessandro Ducati, Andreas Korge |
|---|---|---|---|
| 09:00-09:05 | A293 | Endoscopic Lumbar foraminal decompression: myth? or trustworthy? | **Chul-Woo Lee**, Kang-Jun Yoon |
| 09:05-09:10 | A294 | Re-thoracoscopy after thoracoscopically assisted spinal operations in prone position. Is it possible, is it dangerous, why was it necessary? | M. Shousha, H. El Saghir, **H. Boehm** |
| 09:10-09:15 | A295 | Is the Virgin Surgery or Revision Surgery ?: Transforaminal Percutaneous Endoscopic Lumbar Discectomy in the Recurred Lumbar Herniated Nucleus Pulposus after Open Lumbar Discectomy | **Hyeun-Sung Kim** |
| 09:15-09:20 | A296 | Evaluating the feasibility of minimally invasive lateral mass screw instrumentation of the cervical spine: A cadaveric study | **A. Kumar**, R. Merrill, S. Qureshi |
| 09:20-09:25 | A297 | The Teardrop Technique—Safe and Easy Iliac Screw Placement | C. Birkenmaier, B. Wegener, **C. Melcher** |
| 09:25-09:30 | A298 | Uniportal Percutaneous Endoscopic Laminotomy with Flavectomy for the Lumbar Canal or Lateral Recess Stenosis | **Chul-Woo Lee**, Kang-Jun Yoon |
| 09:30-09:35 | A299 | Prophylactic vertebral augmentation after intra-disc leakage due to kyphoplasty for the treatment of osteoporotic compression fracture: a retrospective cohort study | **J. Jiang**, W. Tian, B. Xiao |
| 09:35-09:40 | A300 | Volumetric radiographic method to assess indirect decompression after ELIF using a new generation intraoperative CT scanner | **R. Navarro-Ramirez**, C. Berlin, I. Janssen, G. Lang, M. Avila, G. Askin, M. Zubkov, R. Härtl |
| 09:40-09:45 | A301 | Cervical Radiculopathy Treated with Posterior Cervical Cages: Intra-operative and Clinical Outcomes in 76 patients | **T. Niedzielak**, R. Blok, J. Malloy, IV |
| 09:45-10:00 | | Discussion | All |

| 09:00-10:00 | | LUMBAR STENOSIS (Room: Yellow 1) | **Moderators:** Imad Ahmad Luiz Vialle |
|---|---|---|---|
| 09:00-09:05 | A302 | Blood Transfusions in Elective Lumbar Spine Surgery: Risk Factors, Inpatient Outcomes, and Resource Utilization | **A. Chung**, R. Digiovanni, J. Hustedt, N. Chutkan, R. Waldrop |
| 09:05-09:10 | A303 | Advanced Age is Associated with Poorer Outcomes and Increased Hospital Resource Utilization in Patients Undergoing Elective Surgery for Degenerative Lumbar Conditions | A. Chung, P. Johnson, J. Hustedt, R. Waldrop, N. Olmscheid, **N. Chutkan** |
| 09:10-09:15 | A304 | Transforaminal lumbar interbody fusion: influence on sagittal balance | **E. Ribeiro**, B. Direito Santos, A. Costa, R. Duarte, P. Varanda, M. Vieira Da Silva |
| 09:15-09:20 | A305 | Robot-guided Pedicle Screw Fixation for Lumbar Spondylolisthesis—Long-term Clinical Outcomes and Revisions | **ML. Schroder**, V. Staartjes |
| 09:20-09:25 | A306 | The Utility of Pre-Operative Labs in Predicting Post-Operative Complications Following Posterior Lumbar Fusion | N. Lakomkin, V. Goz, Joseph S. Cheng, **D. Brodke**, W.R. Spiker |
| 09:25-09:30 | A307 | Short-term and middle-term effectiveness of caudal injections in patients with spinal stenosis. A prospective study | N. Valanos, I. Valanos, T. Tryfon, P. Pantelidis, A. Dimirios, **A. Siozos**, A. Kyriakidis |
| 09:30-09:35 | A308 | Interspinous process decompression with the aspen device for lumbar spinal stenosis: results after 2 yrs. Follow-up | **M. Balsano**, A. Zachos, S. Negri, C. Doria |
| 09:35-09:40 | A309 | Morphological, clinical and self-assessment classifications of lumbar spinal stenosis, useful for science only or a daily routine? | **D. Bludovsky**, D. Stepanek, M. Kulle |
| 09:40-09:45 | A310 | The predictive formula of lumbar lordosis and lower lumbar lordosis regulated by pelvic incidence among old men | **Youngbae B. Kim** |
| 09:45-10:00 | | Discussion | All |

| 09:00-10:00 | | SURGICAL COMPLICATIONS—DEFORMITY (Room: Yellow 3) | **Moderator:** Bryan Ashman Emiliano Vialle |
|---|---|---|---|
| 09:00-09:05 | A311 | Use of the Adult Spinal Deformity (ASD) Frailty Index (ASD-FI) to Predict Major Complications in the Scoli-Risk 1 Multicenter, International Patient Database | E. Miller, L. Lenke, J. Scheer, K. Espinoza, B. Neuman, K. Kebaish, **C. Ames** |
| 09:05-09:10 | A312 | Neurologic Complications Following Complex Adult Spinal Deformity Surgery: 2 Year Follow-up of the Scoli-Risk 1 Prospective, Multicenter, International Study | **L. Lenke**, C. Shaffrey, L. Carreon, K. Cheung, K. Kebaish, F. Schwab, F. Pellise, C. Ames, Q. Yong, B. Dahl, M. Fehlings, AOSpine Knowledge Forum Deformity |
| 09:10-09:15 | A313 | Development and External Validation of the Adult Spine Deformity (ASD) Frailty Index (ASD-FI) | E. Miller, D.M. Sciubba, **B. Neuman**, A. Vila-Casademunt, K. Kebaish, F. Pellise, C. Ames PF |
| 09:15-09:20 | A314 | Reduced Post-Operative Infections and Revision Surgery with Plastic Surgery Closure in the Treatment of Neuromuscular Scoliosis | **B.W. Cook**, D. Briski, A. King, J. Zavatsky |
| 09:20-09:25 | A315 | Complication Rates Associated with 3-Column Osteotomy in 82 Adult Spinal Deformity Patients: Retrospective Review of a Prospectively Collected Multicenter Consecutive Series with Minimum 2-Year Follow-Up | **J. Smith**, C. Shaffrey, E. Klineberg, V. Lafage, F. Schwab, R. Lafage, H. Kim, R. Hostin, G. Mundis, M. Gupta, B. Liabaud, J. Scheer, B. Diebo, T. Protopsaltis, M. Kelly, V. Deviren, R. Hart, D. Burton, S. Bess, C. Ames |
| 09:25-09:30 | A316 | Bimodal Incidence and causes of proximal junctional kyphosis (PJK) in adult spinal deformity (ASD) | M. Gupta, B. Diebo, T. Protopsaltis, R. Hart, **J. Smith**, C. Ames, R. Lafage, J. Scheer, H. Kim, D. Burton, P. Passias, F. Schwab, V. Lafage, E. Klineberg, International Spine Study Group |
| 09:30-09:35 | A317 | Risk stratification for patients undergoing surgical correction of scoliosis based on the rates of perioperative complications in a tertiary hospital between 2010-2014 and the review of the current literature | **M.A. Farfan**, F. Alvarado Gómez, Carlos S. Montero, D. Meneses Quintero, W. Godoy Carrero, J. Ruiz Herrera, D. Rosero Rodriguez |
| 09:35-09:40 | A318 | Safety Attitudes Among Spinal Care Professionals: results of an international survey | **P. Gadjradj**, W. Rietdijk, B. Harhangi |
| 09:40-09:45 | A319 | Searching for optimal position of bone graft in order to prevent dislodgement in multiple anterior cervical corpectomy and fusion | **Y. Kondo**, K. Miyamoto, K. Shimizu |
| 09:45-10:00 | | Discussion | All |

| 10:00-10:30 | | Break | |
|---|---|---|---|

10:30-11:30 AOSpine Members-only session—AOSpine Sacral Classification System—Training and Testing (Room: Yellow 2) Moderator: Greg Schroeder
Speakers: Cumhur Oner, Greg Schroeder, Carlo Bellabarba

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| 10:30-11:30 Paper Sessions | | | |
|---|---|---|---|
| **10:30-11:30** | | ARTHROPLASTY—CERVICAL (Room: Red) | **Moderators:** Fernando Techy, Zdenek Klezl |
| 10:30-10:35 | A320 | 30-day Readmission and Reoperation after Single-level Anterior Cervical Discectomy and Fusion versus Cervical Disc Replacement | N. Bhashyam, R. De La Garza Ramos, J. Nakhla, M. Kinon, **R. Yassari** PF |
| 10:35-10:40 | A321 | Cervical Disc Arthroplasty versus Anterior Cervical Discectomy and Fusion(Short and Long Term Follow Up): A Systematic Review of Randomized controlled Trials | **A. Tarawneh**, S. Alawi, O. Janbek |
| 10:40-10:45 | A322 | Multi-level fusion versus hybrid Surgery in three-Level cervical disc disease: Retrospective matched analysis of clinical and radiologic results in minimum 2-year follow-up | **Jung-Woo Hur**, Kyeong-Sik Ryu, Jin-Sung Kim, Ji-Hoon Seong, Hyun-Jin Cho, Ho-Jung Chung |
| 10:45-10:50 | A323 | In vivo study on the effect of cervical arthroplasty on cervical spine biokinematics | **Ó. Alves**, R. Reinas, D. Kitumba, F. Pagaimo |
| 10:50-10:55 | A324 | Hybrid Surgery for Multilevel Cervical Degeneration Disc Disease | **G. Grasso** |
| 10:55-11:00 | A325 | Efficacy and safety of lumbar arthroplasty in degenerative disc disease | H. Santos Benitez, M. Fuentes Rivera, A. Gonzalez Moga, **M. Castillo Urbina**, G. Huerta Hernandez |
| 11:00-11:05 | A326 | 2 years functional outcome is predictive of a long-term results: a 10 years follow-up of BRYAN© cervical disc system on a 70 patients' series | V. Lavanga, S. Marco, **R. Assietti** |
| 11:05-11:10 | A327 | Current Practice of Cervical Disk Arthroplasty: a Survey among 387 AOSpine International Members | **T. Chin-See Chong**, P. Gadjradj, R. Boelen, B. Harhangi |
| 11:10-11:15 | A328 | Total Disc Replacement. Part I: Assessment of Clinical Outcomes and Disc Prosthesis Survival in the Lumbar Spine | **L. Laugesen**, R. Paulsen, Leah Y. Carreon, C. Ernst, M. Andersen |
| 11:15-11:30 | | Discussion | All |

| **10:30-11:30** | | ADULT DEFORMITY 3 (Room: Blue 2) | **Moderators:** Sigurd Berven, Ahmet Alanay |
|---|---|---|---|
| 10:30-10:35 | A329 | Predicting Sagittal Balance Correction after Bilateral Pelvic Osteotomy: A Mathematical Model | **J. Sembrano,** V. Zarei, J. Bechtold, S. Yson |
| 10:35-10:40 | A330 | A less invasive technique for 360 degree deformity correction in ankylosing spondylitis. Does it really make a difference? | **M. Ibrahim,** M. El-Meshtawy, M. Shousha, H. Boehm |
| 10:40-10:45 | A331 | Surgical Strategy Can Mitigate Effects of Patient Factors on Pseudarthrosis Rate at 2 Years Following Adult Deformity Surgery (ASD) | E. Miller, D. Kojo Hamilton, A. Daniels, **B. Neuman,** K. Kebaish, J. Scheer, J. Smith, C. Shaffrey, C. Ames PF |
| 10:45-10:50 | A332 | Spinal deformity correction outcomes after long fusion with or without pelvis fixation in adults | N. Zaborovskii, **D. Ptashnikov,** D. Mikhaylov, O. Smekalenkov, S. Masevnin |
| 10:50-10:55 | A333 | Risk factors for 30-day readmissions and reoperations after three-column osteotomy for complex spinal deformity | R. De La Garza Ramos, **J. Nakhla,** N. Bhashyam, R. Nasser, A. Jada, D.M. Sciubba, R. Yassari |
| 10:55-11:00 | A334 | Clinical and radiographic assessment of a hybrid minimally invasive approach in moderate-severe adult lumbar deformity | **L. Proietti,** G. Barone, L. Ricciardi, E. Valenzi, G. Noia, A. Perna, I. Giannelli, F. Tamburrelli |
| 11:00-11:05 | A335 | How Does The Sagittal Profile Change With Lumbar Surgical Decompression Without Fusion? | **Yogesh K. Pithwa** |
| 11:05-11:10 | A336 | Safety and efficacy of multilevel XLIFs approaching the convex side of adult scoliosis above 30 degrees | **A. Ramieri,** M. Miscusi, F. Polli, G. Costanzo |
| 11:10-11:30 | | Discussion | All |

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| 10:30-11:30 | | TUMOR 3 (Room: Yellow 1) | Moderators: Stefano Boriani Lorin Benneker |
|---|---|---|---|
| 10:30-10:35 | A337 | En bloc resection versus intralesional surgery in the treatment of giant cell tumor of the spine | **R. Charest-Morin**, C. Fisher, P. Varga, Z. Gokaslan, L. Rhines, J. Reynold, M. Dekutoski, N. Quraishi, M. Bilsky, M. Fehlings, D. Chou, N. Germscheid, A. Luzatti, S. Boriani PF |
| 10:35-10:40 | A338 | Predictive Factors for Survival in Surgical Series of Symptomatic Metastatic Epidural Spinal Cord Compression: A Prospective North American Multi-Centre Study in 142 patients | **A. Nater**, M. Fehlings, L. Tetreault, B. Kopjar, A. Paul, M. Dekutoski, F. Joel, C. Fisher, J. France, G. Ziya, L. Rhines, P. Rose, A. Saghal, J. Schuster, A. Vaccaro |
| 10:40-10:45 | A339 | Validity and Reliability of the Spine Oncology Study Group Outcomes Questionnaire (SOSGOQ) | **A. Versteeg**, A. Sahgal, L. Rhines, D.M. Sciubba, J. Schuster, M. Weber, M. Fehlings, M. Clarke, P. Arnold, Z. Gokaslan, C. Fisher, AOSpine Knowledge Forum Tumor |
| 10:45-10:50 | A340 | Minimally invasive iliac screw fixation as a palliative option in management of painful metastatic lumbosacral deformity | **G. Liu**, M. Hasan, Hee-Kit Wong |
| 10:50-10:55 | A341 | Patient-Reported Outcomes After Surgical Stabilization of Spinal Tumors: Symptom-Based Validation of the Spinal Instability Neoplastic Score (SINS) and Surgery | **I. Hussain**, O. Bazilai, A. Reiner, N. Distefano, I. Laufer |
| 10:55-11:00 | A342 | Is intraoperative neurophysiological monitoring valuable predicting postoperative neurological recovery? | **Y. Rho** |
| 11:00-11:05 | A343 | En block spondilectomies for malignant neoplasms in children: review of 18 cases | **A. Luzzati**, M. Alloisio, G. Perrucchini, L. Cannavò, G. Scotto, E. Gallazzi, C. Zoccali, R. Biagini, U. Cariboni |
| 11:05-11:10 | A344 | Index for Extent of Surgery for Metastatic Spine Disease—"Intrusiveness Index" | **N. Kumar**, B. Tan, A. Zaw |
| 11:10-11:15 | A345 | Utility of Intraoperative Neuromonitoring in the Resection of Spinal Tumors | N. Lakomkin, A. Mistry, S. Zuckerman, T. Ladner, R. Vasquez, **J. Cheng** |
| 11:15-11:30 | | Discussion | All |

| 10:30-11:30 | | NOVEL TECHNOLOGIES 2 (Room: Yellow 3) | Moderators: Michael Fehlings Luiz Vialle |
|---|---|---|---|
| 10:30-10:35 | A346 | One-stage posterior selective and localized circumferential decompression with dekyphosis and instrumented fusion for thoracic myelopathy due to multilevel ossification of posterior longitudinal ligament | **C. Sun**, Z. Chen PF |
| 10:35-10:40 | A347 | 5-year experience with magnetically controlled growing rods for the management of early-onset scoliosis: results, complications and considerations for final treatment | G. La Rosa, L. Ruzzini, S. Sessa, **L. Oggiano** |
| 10:40-10:45 | A348 | Pedicle screw accuracy using 3D printed custom made guides | M. Agnoletto, **R. Cecchinato**, A. Redaelli, M. Damilano, P. Berjano, C. Lamartina |
| 10:45-10:50 | A349 | Safety and Efficacy of A Novel Anterior Decompression Technique (Vertebral Body Sliding Osteotomy) for Ossification of Posterior Longitudinal Ligament of the Cervical Spine: Comparison of Postoperative Outcomes between Vertebral Body Sliding Osteot | C. Hong, **Dong-Ho Lee**, J. Cho |
| 10:50-10:55 | A350 | Kyphoplasty Cement Encapsulation Biodegradable Balloon Catheter—Animal Study | **A. Alobaid** |
| 10:55-11:00 | A351 | Spontaneous correction of vertebral rotation using Apifix in Adolescent Scoliosis | **N. Sekouris**, I. Fligger, K. Soultanis, N. Karavidas, L. Flouda |
| 11:00-11:05 | A352 | Wearable Augmented Reality to aid percutaneous procedures in spine surgery | **P. Parchi**, F. Cutolo, L. Andreani, M. Carbone, V. Ferrari, M. Ferrari, M. Lisanti |
| 11:05-11:10 | A353 | The assessment of 3-D spinal balance and range of motion using the Microsoft Kinect system | P. Curran, **D. Beckerman**, S. Burch |
| 11:10-11:15 | A354 | Anterior distraction of the atlantoaxial joints for basilar invagination. A new technique | **S. Patkar** |
| 11:15-11:30 | | Discussion | All |

| 11:30-12:30 | Symposium Supported by Society of Lateral Access Surgery—What's the Place of Lateral Approach In a Spine Surgeon's Toolbox? (Room: Blue 2) | **Moderators:** Pedro Berjano Massimo Balsano |
|---|---|---|
| 11:30-11:35 | Introduction: Lateral approach after 12 years: past fashion or established technique? | Massimo Balsano |
| 11:35-11:45 | Lateral in primary cases: Same indications or specific uses? | Pedro Berjano |
| 11:45-11:55 | Lateral in revision cases: a powerful tool | Luiz Pimenta |
| 11:55-12:05 | Lateral in degenerative scoliosis: indications and advantages | Khai Lam |
| 12:05-12:15 | Lateral in sagittal imbalance | Cristiano Menezes |
| 12:15-12:30 | Q and A | All |

| 11:30-12:30 | Symposium Hosted by AOSpine Knowledge Forum Spinal Cord Injury—Latest AOSpine clinical practice guidelines: Degenerative Cervical Myelopathy and Traumatic Spinal Cord Injury (Room: Yellow 1) | **Moderator:** Michael Fehlings |
|---|---|---|
| 11:30-11:33 | Welcome and introduction | Michael Fehlings |
| 11:33-11:39 | Synergy between Degenerative Cervical Myelopathy and Spinal Cord Injury—what are the key questions? | Michael Fehlings |
| 11:39-11:45 | Overview of the Guidelines Process | Lindsay Tetreault |
| 11:45-11:51 | Role of surgery for mild, moderate and severe DCM--6 min—What is the evidence? What are the guidelines? | Brian Kwon |
| 11:51-11:57 | How should we manage the non-myelopathic patient with compression of the cervical cord? | Mark Kotter |
| 11:57-12:03 | Role and timing of surgery for traumatic spinal cord injury—what is the evidence? | Christina Goldstein |
| 12:03-12:09 | A re-evaluation of the role of methylprednisolone for traumatic spinal cord injury—what is the evidence? | Jefferson Wilson |
| 12:09-12:15 | Role of MRI in the management of SCI—an essential tool or a waste of time and money? What is the evidence? | Bizhan Aarabi |
| 12:15-12:30 | Discussion | Michael Fehlings |

| 11:30-12:30 | Symposium Hosted by AOSpine North America—Improving Surgical Quality in Spinal Deformity (Room: Yellow 3) | **Moderator:** Joseph Cheng |
|---|---|---|
| 11:30-11:32 | Introduction of AOSNA and Topic | Joseph Cheng / Darrel Brodke |
| 11:32-11:44 | Improving Biomechanical Quality in Spinal Deformity Surgery | Rani Nasser |
| 11:44-11:56 | Surgical Planning in Spinal Deformity: Quality and Costs | Jens Chapman |
| 11:56-12:08 | Techniques of Efficient Deformity Correction and Fixation | Sigurd Berven |
| 12:08-12:20 | Management of Common Complications in Spinal Deformity: Proximal Junctional Failure | Darrel Brodke |
| 12:20-12:30 | Discussion | All |

| 12:30-12:45 | Awards and closing ceremony—Global Spine Congress 2018 announcement (Room: Red) | Jeffrey Wang Claudio Lamartina Daniel K. Riew |
|---|---|---|

| 12:45-13:30 | AOSpine Closing Symposium—Minimally invasive intervertebral support strategies in the lumbar spine (Room: Red) | **Moderators:** Roger Härtl Andreas Korge |
|---|---|---|
| 12.45-12.50 | Case presentation | Roger Härtl / Andreas Korge |
| 12.50-13.00 | Why I prefer MIS TLIF | Frank Kandziora |
| 13.00-13.10 | Why I prefer OLIF | Christoph Mehren |
| 13.10-13.20 | Why I prefer XLIF | Luiz Pimenta |
| 13.20-13.30 | Discussion | Roger Härtl / Andreas Korge |

# E-posters

**P001** Double crush syndrome of the vertebral artery loop and foraminal stenosis causing monoparesis
**Y. Rho**

**P002** Clinical Comparison of ProDisc-C and Prestige-LP Cervical Disc Prostheses
H. Choi, **S. Kurpad,** H. Soliman

**P003** Bone Loss of Vertebral Bodies at the Operation Segment after Cervical Arthroplasty; A potential Complication?
**Dong-Hwa Heo,** C. Park

**P004** Still physiologic after multi-level cervical ADR?: a preliminary result
**Jun Ho Lee,** Jung Hwan Lee

**P005** Hybrid construct for multinivel disc disease in lumbar spine
H. Santos Benitez, **M. Fuentes,** A. Gonzalez Moga, G. Huerta Hernandez, M. Castillo Urbina

**P006** Investigation of efficacy of treatment in spinal cord injury: Erythropoietin versus methylprednisolone.
**O. Ozkunt,** K. Sariyilmaz, H. Gemalmaz, S. Gürgen, F. Dikici

**P007** A New Superficial Anatomical Landmark for the Odontoid Process: An Anatomical Study
**C. Fisahn,** Michael J. Montalbano, M. Moisi, M. Loukas, Jens R. Chapman, Rod J. Oskouian, R. Shane Tubbs

**P008** Predicting the Effect of Bilateral Pelvic Osteotomy on Surrounding Muscles: A Mathematical Model
**J. Sembrano,** V. Zarei, J. Bechtold, S. Yson

**P009** Histological Evaluation of Lumbar Spine Changes in Rats with Collagen-induced Arthritis
**T. Mihara,** S. Tanishima, A. Tanida, H. Nagashima

**P010** Nasal chondrocytes are potential autologous cell-transplant candidates for treating degenerative disc disease
**Max Hans-Peter Gay,** A. Mehrkens, A. Barbero, I. Martin, S. Schaeren

**P011** Tissue expression of angiotensin I—converting enzyme (ACE) gene in the rotator muscles of patients with adolescent idiopathic scoliosis—A cross-sectional study
M. Wajchenberg, **D. Martins,** R. Luciano, R. Araujo, B. Schmidt, A. Oliveira, E. Puertas, S. Almeida, F. Faloppa

**P012** Benchmarking of fatty degeneration of multifidius muscle between MRI and histopathology in adolescent idiopathic scoliosis
M. Wajchenberg, **D. Martins,** R. Luciano, E. Paredes-Gamero, E. Fernandes, A. Oliveira, B. Schmidt

**P013** Systematic Review of Recovery on Spinal Cord Injury with Antioxidant Therapy in Rats
**A. Falavigna,** L. Ajiboye, M. Koff, N. Diel, L. Radelli, F. Bassanesi, N. Ferrarini, S. Cardoso

**P014** Categorization of spinal cord injury animal models
**M. Sharif-Alhoseini,** V. Rahimi-Movaghar

**P015** Fate of neurons after traumatic spinal cord injury in rats: A systematic review
Z. Hassannejad, S. Zadegan, K. Sajadi, **V. Rahimi-Movaghar**

**P016** Effect of disc dimensions on diffusion of solutes in healthy human intervertebral discs
**N. Babu**, Arun-Kumar Viswanadha, A. Priyadarsini

**P017** Identification and validation of self screening tests for cervical myelopathy
**N. Babu**, Arun-Kumar Viswanadha, A. Priyadarsini

**P018** Comparison of stability between in situ and after reduction instrumentation in the degenerative spondylolisthesis. An in vitro porcine model
**H. Yurianto**

**P019** A Finite Element Analysis of force distribution differences in sagittal balance morphotypes
**G. Cacciola**, G. Anastasi, A. Pisani, L. Soliera, V. Filardi, S. Bertino, A. Barbanera

**P020** Biomechanical evaluation of the potential of kyphoplasty to stabilize a traumatic instable spinal segment
**R. Hartensuer**, O. Riesenbeck, N. Czarnowski, A. Stump, M. Müller, D. Wähnert, M. Raschke

**P021** Quality and Quantity of Motion using Polycrystalline Diamond Cervical Total Disc Arthroplasty in One- and Two-Level Setting
**L. Voronov**, S. Khayatzadeh, R. Havey, G. Carandang, A. Patwardhan

**P022** Biomechanical comparison for two types of sacropelvic fixation techniques based on finite element analysis
**J. Shin**, C. Lee, T. Goh, S. Son, J. Lee

**P023** Biomechanical Analysis of Anterior Cervical Discectomy and Fusion Supplemented with Machined Intrafacet Allograft Spacers
**R. Hah**, P. Anderson

**P024** Quantifying the quality of graft remodelling in cervical fusion
**D. McNally**, A. Parish, S. Johnson, G. Kesteloot

**P025** Trunk muscles cocontraction during sit-to-stand in individuals with and without chronic non-specific low back pain

**K. Rose-Dulcina**, S. Armand, A. Tabard-Fougere, S. Genevay, N. Vuillerme

**P026** Increasing Simulated Disc Heights with Lordotic Interbody Devices Results in Indirect Decompression by Increasing Foraminal Volume: A Finite Element Analysis

C. Ledonio, **D.W. Polly**, J. Harris, Y. Shih

**P027** Growing Rod Treatment for Early Onset Scoliosis Increases Thoracic Volume

C. Ledonio, Po-Chih Lee, A. Erdman, **D.W. Polly**

**P028** Rod breakage and nonunion following pedicle subtraction osteotomy: a biomechanical study on rod number, configuration and use of adjacent interbody cages

**L. La Barbera**, C. Ottardi, F. Galbusera, A. Luca, T. Villa

**P029** The Correlation between Abdominal Morphology and Adult Spinal Deformity (ASD) measured using Xipho-Pubic Angle (XPA): a multi-center cohort study

**F. Langella**, V. Lafage, Christopher P. Ames, S. Bess, D. Burton, H. Kim, R. Hostin, E. Klineberg, G. Mundis, F. Schwab, J. Smith, B. Liabaud, I. Issg, P. Berjano

**P030** Morphometric differences of vertebral bodies between scoliotic and non-scoliotic subjects

**J. Buric**, M. Dekleva

**P031** Surgeon neck syndrome: an entity proposed to cause neck pain in spine surgeons

N. Babu, **Arun-Kumar Viswanadha**, S. Raju

**P032** Kinematic MRI Analysis of the Lumbar Intervertebral Discs and Neural Foramens in Trunk Rotation

B. Ajeal, **O. Lawrence**, X. Yang, Y. Hicks, L. Nokes, K. Lyons, M. McCarthy

**P033** Relationship between cervical sagittal balance and curve patterns in adolescent idiopathic scoliosis

**M. Lima**, M. Risso, G. Zuiani, M. Lehoczki, M. Tebet, A. Rossato, E. Landim, P. Cavali, I. Guidolin Veiga, W. Pasqualini

**P034** Three-column Osteotomy for Correction of Cervical and Cervicothoracic Deformities: Alignment Changes and Early Complications in A Multicenter Prospective Series of 24 Patients

**J. Smith**, C. Shaffrey, R. Lafage, V. Lafage, F. Schwab, H. Kim, J. Scheer, T. Protopsaltis, P. Passias, G. Mundis, R. Hart, B. Neuman, E. Klineberg, R. Hostin, S. Bess, V. Deviren, C. Ames

**P035** Outcomes of Operative Treatment for Adult Cervical Deformity: A Prospective Multicenter Assessment with 1-Year Follow-up

PF

**T. Ailon**, J. Smith, C. Shaffrey, H. Kim, G. Mundis, M. Gupta, E. Klineberg, F. Schwab, V. Lafage, R. Lafage, P. Passias, T. Protopsaltis, B. Neuman, A. Daniels, J. Scheer, A. Soroceanu, R. Hart, D. Burton, V. Deviren, T. Albert, K. Riew, S. Bess, C. Ames

**P036** Normative values of the cervical spine alignment: a prospective study on asymptomatic subjects

**R. Pratali**, M. Nasredinne, B. Diebo, C. Oliveira, V. Lafage

**P037** Cervical spondylolysis over osteopetrotic spine

**M. Benhamida**, K. Habboubi, M. Bekkay, B. Oussama, A. Kherfani, M. Mestiri

**P038** Adjacent segment level disease in Klippel-Feil syndrome patients with congenital cervical fusion in the setting of anterolisthesis: Should management be altered in the presence of anterolisthesis?

F. Alonso, **C. Fisahn**, R. Shane Tubbs

**P039** Neglected adult Torticollis and maxillofacial deformity

**A. Tonkaboni**, B. Mirzashahi

**P040** The dropped head syndrome. Case report and literature review.

**H. Dagostin De Arjona**, R. Lima Lopes, R. Dùalessandro De Macedo, B. Pinto Coelho Fontes, G. Henrique C Ferreira, J. Andrade Neto, C. Magalhaes Menezes

**P041** How advantageous is it to insert screws into concave apex of a scoliotic curve?

**Yogesh K. Pithwa**

**P042** Growth Guiding Instrumentation for Early Onset Scoliosis: 15-years follow-up

**A. Mezentsev**, D. Petrenko, D. Demchenko, V. Krishnappa

**P043** Surgical correction in adolescent idiopathic scoliosis considering the pedicle screw density

**L. Scaramuzzo**, M. Archetti, L. Minoia, A. Zagra, F. Giudici

**P044** The Effect of Surgery and Postoperative Compensation on Shoulder Balance in Severe and Rigid Scoliosis

S. Yuan, **Y. Hai**, L. Zang

**P045** Risk Factors of Postoperative Major Complication in Spine Deformity Surgery

**Y. Hai**, H. Zhao

**P046** Outcomes and complications of S2-Iliac fixation in neuromuscular scoliosis, experience in a tertiary hospital

F. Alvarado Gomez, **C. Montero Silva**, D. Meneses Quintero, W. Godoy Carrero, J. Ruiz Herrera, D. Rosero Rodriguez

**P047** Outcome of selective fusion in Lenke type 1C and 5C Adolescent idiopathic scoliosis curves

**H. Suthar**, M. Yarlagadda, S. Hegde, C. Chikhale, M. Jindal

**P048** Short and mid-term results of surgical treatment of neuromuscular scoliosis

R. Varela, **M. Delgado**, R. Terrada, H. Guajardo, J. Cuellar

**P049** Isolating changes in gait following surgery for high grade spondylolisthesis using 3D gait analysis

**S. Munigangaiah**, G. Holmes, C. Bruce, J. Trivedi, N. Davidson

**P050** Surgical correction with pedicular screw fixation of a kyphosis associated with Prune Belly Syndrome: A case report.

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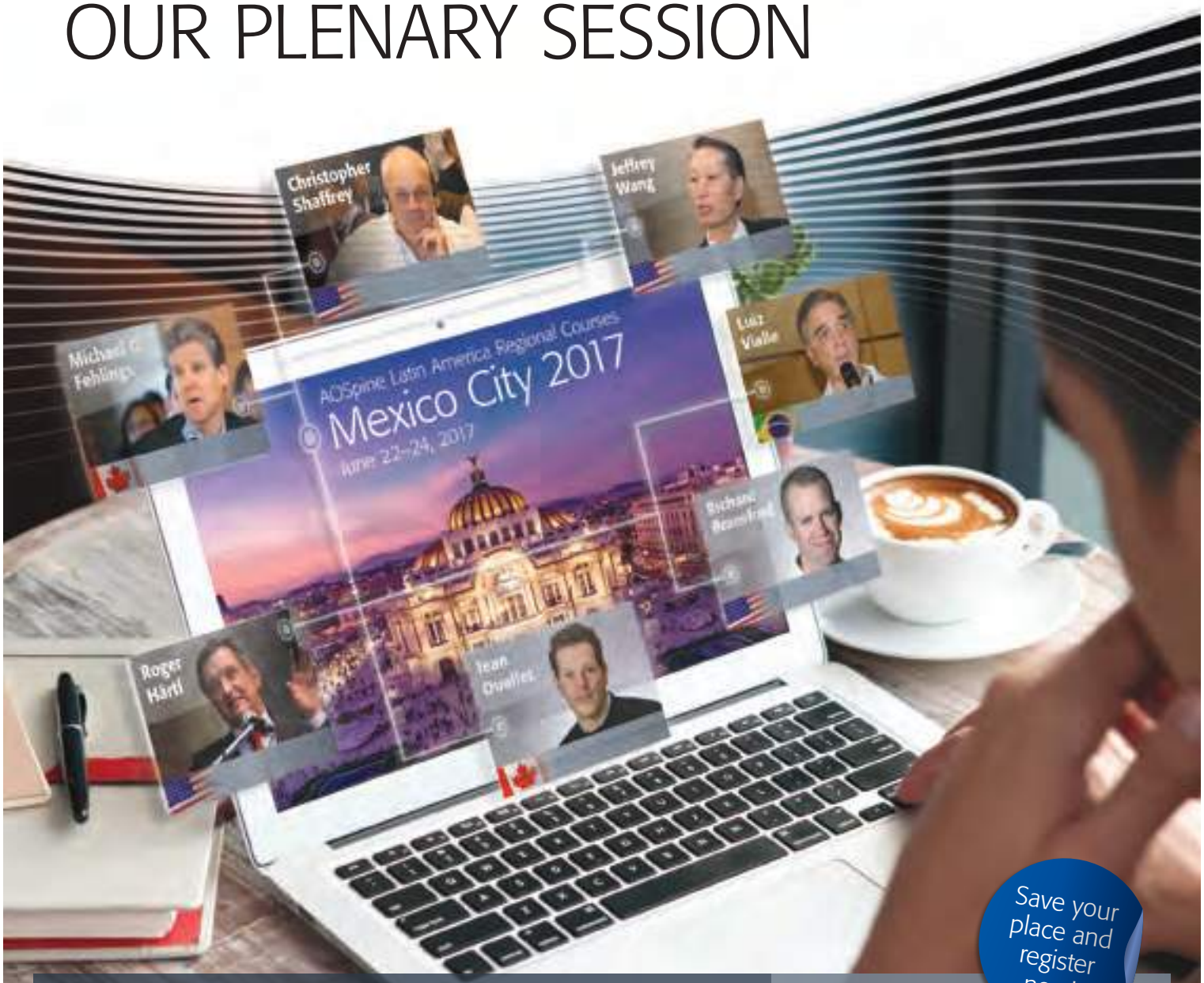


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| Garfin, Steven | **01**: DePuy (Johnson & Johnson) **03b**: Benvenue Medical DePuy (Johnson & Johnson) EBI/Biomet Globus Medical Intrinsic Therapeutics Magnifi Group, Inc. NuVasive SI Bone Spinal Kinetics **04**: SI Bone, Inc., San Jose, USA **06**: UCSD, Steven Garfin' M.D.'s employeer, received institutional support from: AO North American DePuy (Johnson & Johnson) EBI/Biomet Gllobus Medical Medtronic NuVasive Ortho Trauma Association Synthes **07**: Spine—Deputy Editor and Reviewer Advances in Osteoporotic Fracture Managment Brazilian Spine Socierty, Coluna SpineUniverse.com Chiense Journal of Traumatology Ceontemporary Spine Surgery **08**: International Society for the Advancement of Spine Surgery—Board of Directors, Past President |
| Gehweiler, Dominic | **09**: Research fellowship grant from the AO Research Institute Davos, Davos, Switzerland |

# Disclosure Information Index

| | |
|---|---|
| Gelb, Daniel | **01**: Depuy-Synthes Spine, Globus Medical **02**: Depuy-Synthes,Depuy-Synthes Spine **03b**: Depuy-Synthes Spine **04**: Advanced Spinal Intellectual Property (ASIP),Advanced Spinal Intellectual Property(ASIP) **09**: AOSpine North America Faculty at courses,AOSpine North America Spine Faculty at courses |
| Ghosh, Ian | **03a**: Proteobioactives |
| Ghosh, Peter | **03a**: Proteobioactives **03b**: Mesoblast,Paid consultant for Mesoblast **04**: Proteobioactives **08**: Advisory Board member for Mesoblast,Mesoblast Scientific Advisory Board |
| Girardi, Federico P. | **01**: Lanx Inc; NuVasive Inc; Ortho Development Corp, DePuy Spine, Johnson **02**: PharmaWrite, PharmaWrite, OOC,spine kenetics, LLC **03b**: Lanx Inc; Gerson Lehrman Group Inc; Spineart USA; Ortho Development Corp, DePuy Spine **04**: Small Bone Innovations; Pioneer Surgical Technology, Inc; Life Spine; Centinel Spine; Spinal Kinetics; Paradigm Spine **05**: MiMedx **08**: Spinal Kinetics; Centinel Spine; Healthpoint Capital, Scient'x USA, Spineart USA, LP, Paradigm Spine, LLC |
| Glassman, Steven | **01**: Medtronic **03b**: Medtronic **05**: Norton Healthcare **06**: Norton Healthcare—employment |
| Gokaslan, Ziya | **02**: AOSpine **04**: Spinal Kinetics **05**: AOSpine International |
| Goldschlager, Tony | **03b**: Consultant to Mesoblast Limited; Member of Scarification Advisory Board,Mesoblast **05**: Principal Investigator on a trial sponsored by Mesoblast Limited **08**: Advisory Board member of Mesoblast,Mesoblast Scientific Advisory Board |
| Goldstein, Christina | **08**: AOSpine North America; North American Spine Society |
| Goodwin, C. Rory | **05**: UNCF-Merck Science Initiative, NREF, Burroughs Wellcome Fund, The Johns Hopkins Neurosurgery Pain Research Institute **09**: UNCF Merck Postdoctoral Fellow and has received an award from the Burroughs Wellcome Fund and the Johns Hopkins Neurosurgery Pain Research Institute |
| Gum, Jeffrey | **05**: Integra, Intellirod Spine Inc, ISSG, Nuvasive **08**: American Journal of Orthopedics **09**: Pacira Pharmaceuticals- Honorarium; Fisher Owen Fund- Travel funds; Journal reviewer for TSJ and AJO |
| Gupta, Munish | **01**: DePuy Synthes **03b**: DePuy Synthes, Medtronic, Orthofix, Proctor & Gamble **06**: DePuy Synthes, Johnson & Johnson, Pfizer **09**: DePuy Synthes- honorarium for lectures Orthofix- honorarium for lectures |

## H

| | |
|---|---|
| Hah, Raymond | **03b**: Flospine,Flospine, INC **08**: Education Committee, Lumbar Spine Research Society |
| Haid, Regis W. | **01**: Elsevier Inc, **03b**: NuVasive, **04**: Globus Medical - NuVasive - Spine Wave - Vertical Health, **06**: Royalties - Patent Holder - Globus Medical - Medtronic Sofamor Danek - NuVasive, **07**: Contemporary Neurosurgery - SpineUniverse, **08**: AANS - LSRS - NREF - SMISS |
| Harris, Jeffrey | **03a**: Nuvasive, Inc. |
| Harrop, James | **02**: Depuy Spine |
| Hart, Alister | **09**: British Orthopaedic Consortium |
| Hart, Robert | **03b**: Depuy Synthes, Globus Medical,Globus, Seaspine **05**: Medtronic **06**: Depuy Synthes, Globus Medical, Seaspine **08**: CSRS, ISSG, ISSLS **09**: OHSU—patent |
| Hartensuer, Rene | **01**: none **02**: Spine Art, Joline **03a**: none **03b**: Depuy-Synthes **03c**: none **04**: none,**05**: Joline **06**: none **07**: none **08**: none **09**: none |
| Härtl, Roger | **03b**: AOSpine, Brainlab, DePuy-Synthes and Lanx **05**: Baxter |
| Hess, Christopher | **02**: Siemens **05**: General Electric, Quest Diagnostics, Cerebrotech **07**: Editorial Board, American Journal of Neuroradiology (AJNR) **08**: Committee Appointments, American Society of Neuroradiology (ASNR), Radiological Society of North America (RSNA), International Society for Magnetic Resonance in Medicine (ISMRM) |
| Hostin, Richard | **03b**: DePuy Synthes **05**: Nuvasive, Seeger, DJO |
| Hsieh, Patrick | **03b**: Medtronic, Depuy Sythes |
| Hu, Serena | **03b**: Nuvasive **04**: Nuvasive |
| Hughes, Alexander P. | **05**: MiMedx **06**: NuVasive |
| Hutton, Michael | **03a**: Educational contract- DePuy Synthes- $3000 |

## I

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|---|---|
| Ito, Manabu | **05**: Century Medical Inc., **08**: AOSpine Asia Pacific Education Board, AOSpine Knowledge Forum Deformity, AO Foundation Research Review Board |

## J

| | |
|---|---|
| Jain, Kanika | **06**: Cell Care |
| Janssen, Insa | **09**: Nuvasive Observership |
| Jenkin, Graham | **03b**: Cell Care Australia,Cytomatrix Cell Care **05**: Cytomatrix, |
| Jim, Youssef | **01**: Amedica, Nuvasive, Osprey Biomedical, SeaSpine **03b**: Amedica, Nuvasive, Providence Medical Technologies, SeaSpine, HealthTrust **04**: Vertifex, Amedica, Providence Medical Technologies **05**: Globus Medical **08**: Society of Lateral Access Surgeons |
| Johnson, Scott | **03a**: Cerapedics |
| Julius, Dengler | **05**: SI-Bone Inc., San Jose, USA |

## K

| | |
|---|---|
| Kaplan, Leon | **03b**: Mazor Robotics **03c**: Mazor robotics **04**: Mazor robotics |
| Karabulut, Cem | **05**: Medtronic |
| Kebaish, Khaled | **01**: DePuy Synthes **03b**: DePuy Synthes; K2M; Orthofix **05**: K2M and DePuy **06**: SpineCraft |
| Kelly, Michael | **05**: AOSpine, CSRS, OREF, PCORI, Cerapedics, DePuy Synthes/ISSG/HSG, Barnes Jewish Foundation |
| Kempen, Diederik | **05**: AO startup grant **09**: Depuy sponsored Fellowship |
| Kesteloot, Gregory | **03b**: Cerapedics |
| Kharrat, Khalil | **03c**: Fradis 3k France |
| Kim, Han Jo | **03b**: K2M, Zimmer Biomet **05**: ISSGF, CSRS **08**: HSS Journal, ASJ, GSJ |
| Kim, Hyeun-Sung | **02**: Joimax,Joimax Company **03b**: Solco Company / Lutronic Company,**03c**: Solco Company / Lutoronic Company **07**: A Editorial Member of the Journal of Minimally Invasive Spine Surgery and Technique **08**: A Faculty Member of the International Cooperation of KOMISS (Korean Minimally Invasive Spine Surgery Society). A Faculty Member of the Korean Spinal Deformity Research Society. A Faculty Member of the Korean Spinal Osteoporosis Research Society. A Faculty Member of the Korean Society of Peripheral Nervous System. A Faculty Member of the Korean Society of IMS (Interventional Muscle and Soft Tissue Stimulation Therapy). A Faculty Member of the Spinal Therapeutic Technology Related Link. A Faculty Member of the Korean Society of Thermology. A Faculty Member of the Korean Neurosurgery Hospital Society. A Faculty Member of the World Spine. A Global Leader of the V COMINCO. A Chairman of the Nanoori Hospital Group Scientific Team. A Scientific Committee Members of the 2016 WCMISST KOMISS Joint Meeting. A Scientific Committee Members of the 2016 Asia Spine. Adjunct professor of the Medical College of the Chosun University. An Advisory Doctor of the Korean Spinal Neurosurgery Society |
| Kim, Jeongryoul | **01**: Hong-man Cho **02**: Jeongryoul Kim |
| Kim, Youngbae | **01**:VHS medical center |
| King, Andrew | **09**: Will get Dr. King to Submit |
| Kleinstuck, Frank | **05**: Depuy Synthes, Depuy Synthes Spine, |
| Klineberg, Eric | **02**: AOSpine, K2M **03b**: DePuy Synthes, Stryker **09**: AOSpine—fellowship support |
| Knowledge Forum Tumor, AOSpine | **09**: Study group receives support from AOSpine International |
| Koh, Eugene | **03b**: Biomet |
| Kools, Djaya | **03b**: SI-BONE Inc., San Jose, USA **05**: SI-BONE Inc., San Jose, USA |
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| Kreichati, Gabi | **03c**: Fradis 3K France |
| Krinock, Mark | **03c**: K2M, Medtronic **04**: Stryker **05**: K2M, Medtronic |
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| Kwon, Brian | **03b**: Acorda Therapeutics |
| Kyrölä, Kati | **06**: Support to travelling expenses to attend Scoliosis Research Meeting, Prague, Czech, 2016 De Puy Synthes. |

# Disclosure Information Index

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## L

Lafage, Virginie — **02**: NuVasive, K2M, MSD, DePuy Spine, Medtronic, Medicrea **03b**: NuVasive **04**: Nemaris INC **05**: DePuy Spine, NuVasive, K2M, Stryker (paid trough ISSGF) and SRS **06**: Nemaris **08**: Nemaris, Nemaris Inc, SRS (Research Grant & 3D task force) **09**: Nemaris- Shareholder

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Lang, Gernot — **05**: AO Research fellowship **06**: AO Research Fellowship, Educational grant, DePuy Synthes Companies, Travel grant: GSK Foundation

Larouche, Jeremie — **04**: Shape Memory Orthopedics

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Lehman, Ronald — **02**: Medtronic; DePuy Synthes; Stryker Spine **03b**: Medtronic

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Lonner, Barron — **02**: DePuy Synthes; K2M **03a**: Mount Sinai Beth Israel,**03b**: DePuy Synthes **04**: Spine Search; Paradigm Spine,**05**: Setting Scoliosis Straight Foundation; AOSpine; John and Marcella Fox Fund Grant,**06**: DePuy Synthes **08**: DePuy Synthes

Loughenbury, Peter — **02**: Stryker

Ludwig, Steven — **01**: DePuy, A Johnson & Johnson Company; Thieme, QMP, Globus Medical, Depuy-Synthes **02**: DePuy, A Johnson & Johnson Company, Synthes, Depuy-Synthes **03b**: DePuy, A Johnson & Johnson Company; Globus Medical; K2Medical; Synthes, Depuy-Synthes **04**: Advanced Spinal Intellectual Property(ASIP); Innovative Surgical Designs(ISD) **05**: AOSpine North America Spine Fellowship Support, Globus Medical; K2Medical, **07**: Journal of Spinal Disorders and Techniques, The Spine Journal, Contemporary Spine Surgery **08**: Cervical Spine Research Society **09**: Thieme, QMP: Publishing royalties, financial or material support

## M

Malloy IV, John — **03b**: Amendia Biomet LinkSpine Precision Regeneration Technologies, Inc. Providence Medical Technology

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McGuire, Robert — **03b**: Rehab Inc, Zavation medical products **08**: AO North America

McNally, Donal — **03b**: Cerapedics **05**: Cerapedics,

Meisel, Hans-Joerg — **01**: Medtronic, Fehling Aesculap (past) **03b**: (money paid to institution)—Regenerate Life Sciences GmbH for Zyga, DiFusion Codon (past),Zyga, Difusion Codon **04**: (money paid to institution)—Regenerate Life Sciences GmbH in DiFusion, DiFusion

Menezes, Cristiano — **02**: Nuvasive, Depuy, Medtronic **05**: Nuvasive

Meyer, Bernhard — **01**: Spineart **02**: Medtronic **03b**: Medtronic, Ulrich Medical, Spineart **05**: Ulrich Medical, Relievant, Medtronic **07**: Neurosurgery, Acta Neurochirurgica, World Neurosurgery, Eur Spine J, Min Inv Neurosurg **08**: EANS, DWG, IGASS,ESS, DGNC

Mlyavykh, Sergey — **02**: DePuy Synthes Spine, Inc; Zimmer Biomet Spine, Inc; Double Medical Technology, Inc **03c**: Double Medical Technology, Inc **05**: Innovative Surgical Designs, Inc

Mmopelwa, Tiro — **05**: Medtronic

Mobasser, Jean-Pierre — **03b**: Medtronic

Morales Ciancio, Alejandro — **03b**: Medtronic

Moriguchi, Yu — **06**: AO Research Fellowship

Morreale, Joseph — **03b**: LDR Spine, Providence, AlloSource

Moszko, Slawomir — **01**: Spineart SA Geneva, Switzerland **03b**: Spineart SA Geneva, Switzerland Ulrich Medical GmbH Ulm, Germany

Mummaneni, Praveen — **01**: DePuy Spine, Quality Medical Publishers, Thieme Publishers **03b**: DePuy Spine **04**: Spinicity/ISD **06**: AOSpine (Honoraria and Grant)

Mundis, Gregory — **01**: Nuvasive, K2M **03b**: Nuvasive, K2M **05**: Nuvasive, DePuy Synthes/ISSG,nuvasive, DePuy Sythes/ISSG **09**: DePuy Synthes—honorarium

## N

Negrini, Stefano — **03b**: Medtronic Janssen Pharmaceutica **04**: ISICO

Neuman, Brian — **05**: DePuy Synthes

Newton, Peter — **01**: Thieme Publishing **03b**: DePuy Synthes; K2M **05**: DePuy Synthes; EOS Imaging **06**: DePuy Synthes **08**: K2M

Nguyen, Thuy — **07**: Thuy Nguyen

Niedzielak, Timothy — **03b**: Providence Medical Technology

Nordin, Margareta — **01**: Wolters Kluwer, Springer, **03b**: Medtronics, **08**: Eurospine, World Spine Care, Global Musculoskeletal Alliance

Norotte, Gilles — **01**: Spineway, Lyon , France

## O

Obeid, Ibrahim — **01**: Alphatec, Alphatec Spineart **03b**: DePuy Synthes Spine, Alphatec, Medtronic **05**: Depuy Synthes Spine

Oh, Kim Soon — **02**: Medtronic Corporation USA, Zimmer Corporation, USA **07**: Editorial Board, Journal of Musculoskeletal Research ISSN: **02**18-9577 Exco, Orthopaedic Education Board, Malaysia PPM-003-14-141**02**015

Okuyama, Koichiro — **01**: no **02**: no **03a**: no **03b**: no **03c**: no **04**: no **05**: no **06**: no **07**: no **08**: no **09**: This study was supported by the Japanese Labour, Health and Welfare Organization

Oner, Cumhur — **05**: DePuy-Synthes and the AOSpine

Osterhoff, Georg — **01**: N/A **02**: N/A **03a**: N/A **03b**: N/A **03c**: N/A **04**: N/A **05**: DePuySynthes (implants for research), Medtronic (implants for research) **06**: N/A **07**: N/A **08**: N/A **09**: AOSpine Fellowship

Ouellet, Jean A. — **03b**: Depuy Synthese

## P

Parchi, Paolo Domenico — **09**: Founding Member of e-Spress 3D s.r.l. Spin Off company of the Università of Pisa and of the Sant'Anna School for Advanced Studies

Parhami, Farhad — **03a**: MAX BioPharma (he is the Founder & President of MAX BioPharma. Starting July 1, 2**01**6, he will receive a salary from the company.) **04**: MAX BioPharma

Park, Hye-Young — **01**: VHS medical center

Pascal Moussellard, Hugues — **01**: Euros **03b**: Euros

Passias, Peter — **03b**: Medicrea

Paul, Arnold — **03b**: Medtronic Sofamor Danek, Stryker Spine, FzioMed, LifeSpine, Spinewave, MIEMS, AOSpine North America, Cerapedics, Integra Life **04**: Z-Plasty **09**: Honoraria: University of Missouri

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Pellise, Ferran — **03b**: Depuy Synthes Spine, Biomet Zimer,''Roussouly'' **05**: AOSpine; DePuy Synthes; Medtronic, Depuy Synthes Spine

Perez Grueso, Francisco Javier Sanchez — **03b**: DePuy Synthes Spine, DePuy Synthes **03c**: Depuy Synthes Spine **05**: Depuy Synthes Spine, Depuy,Synthes

Pettine, Kenneth — **05**: Spinal Kinetics AxioMed Globus Mesoblast LDR Spine Paradigm Spine

Pflugmacher, Robert — **05**: Si-Bone Inc., San Jose, USA

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Poelstra, Kees — **03b**: Mazor

Pratali, Raphael — **02**: Importek Brasil

Presilla, Stefano — **05**: Brainlab AG

Prestamburgo, Domenico — **05**: SI-BONE Inc., San Jose, USA

Protopsaltis, Themistocles — **03b**: Medicrea, Globus, Innovasis **05**: Zimmer Biomet, Zimmer Spine

## Q

Qureshi, Sheeraz — **01**: Zimmer, Stryker, Biomet, RTI **02**: Medtronic, Stryker **03b**: Medtronic, Stryker, Biomet, RTI **07**: Spine Journal, Spine, CORR, Global Spine Journal, Journal of the American Academy of Orthopaedic Surgeons **08**: AAOS Evaluations Committee, CSRS Program Committee, CSRS Survey Committee **09**: Advisory Boards : MTF MEdical Board of Directors, Pacina Spine Surgeon Advisory Board

## R

Radcliff, Kris — **01**: Globus Medical, Orthopedic Sciences (none), Altus Spine (none) **03b**: Advance Medical, Medtronic Advanced Energy, DePuy Spine **03c**: LDR Spine, Globus Medical **08**: Board of Directors: Association for Collaborative Spinal Research (None); Scientific Advisory Board: 4 Web Medical (None) **09**: DePuy Synthes (Paid directly to institution/ employer), Medtronic (Paid directly to institution/ employer), Paradigm Spine (Paid directly to institution/ employer)

Rahamimov, Nimrod — **02**: Medtronic -Israel

Reinert, Michael — **03b**: BRAINLAB AG

Reinhold, Maximilian — **02**: Link **06**: DePuySynthes,

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Rhines, Laurence — **02**: AOSpine **03b**: Globus, Stryker,Stryker, Globus **05**: AOSpine International

Rhyne, Alfred — **05**: Relievant

Riew, K. Daniel — **01**: Biomet, Medtronic, Zimmer Biomet **04**: Osprey, Expanding Orthopedics, Spinal Kinetics, Amedica, Vertiflex, Benvenue, Paradigm Spine, PSD, Spineology

Ringel, Florian — **03b**: Brain LAB AG

Robinson, Yohan — **02**: DePuy-Synthes, **05**: Swedish Medical Association

Rodriguez Munera, Andres — **02**: Pfizer

## S

Saghal, Arjun — **03b**: Varian Medical Systems **05**: Elekta, AOSpine International **09**: Honoraria: Elekta, Medtronic, Varian Medical Systems

Sama, Andrew A — **01**: Ortho Development Corporation; DePuy **02**: DePuy Spine **03b**: Ortho Development; Clariance Inc; Medtronic; DePuy **04**: Paradigm Spine; Sentio, LLC **05**: Spinal Kinetics; MiMedx; Aesculap,Spine Kinetics; MiMedx; Adsculap **08**: Clariance, Inc **09**: AOSpine

Samdani, Amer — **03b**: DePuy Synthes; Globus Medical; Stryker Spine; Zimmer Spine

Sasso, Rick — **05**: Relievant

Scarone, Pietro — **02**: BRAINLAB AG, BRAINLAB AG, GLOBUS INC. **03b**: BRAINLAB AG

Schaser, Klaus-Dieter — **02**: Medtronic

Schröder, Marc L. — **02**: Mazor Robotics **03b**: Mazor Robotics

Schroeder, Gregory — **05**: Medtronic

Schroerlucke, Samuel — **03b**: Mazor

Schuster, James — **05**: AOSpine International

Schwab, Frank — **01**: K2M, MSD **03b**: K2M, Medicrea, Medtronic, NuVasive, Zimmer Biomet, Zimmer Spine; MSD **05**: AOSpine, DePuy Synthes, SRS, Depuy Synthes (through ISSGF) **06**: NuVasive; Medtronic; Zimmer Spine; K2M; Medicrea, Nemaris INC, Zimmer Biomet **08**: Nemaris, Nemaris Inc. **09**: Nemaris—Shareholder

Sciubba, Daniel M. — **03b**: DePuy, Medtronic, Nuvasive, Globus, Orthofix **05**: AOSpine International

Selby, Mike — **03b**: LifeHealthCare DePuy Synthes **05**: Lifehealthcare Depuysynthes

Sembrano, Jonathan — **03c**: Zyga

Shaffrey, Christopher — **01**: Biomet, Medtronic, Nuvasive, Zimmer Biomet **03b**: Biomet; K2M; Medtronic; Nuvasive; Stryker Spine, Zimmer Biomet, In Vivo **04**: Nuvasive **05**: NIH, Department of Defense, ISSG, DePuy Synthes, AO **08**: ABNS, AAN, ABNS, AANS

Shah, Suken — **02**: Stryker Spine **03b**: DePuy Synthes; Ellipse Technologies; K2M **05**: DePuy Synthes **06**: DePuy Synthes **08**: DePuy Synthes

Shiban, Ehab — **02**: Invibio

Shufflebarger, Harry — **02**: DePuy Synthes; K2M **03b**: DePuy Synthes; K2M **05**: DePuy Synthes **06**: DePuy Synthes; K2M **08**: K2M

Skinner, John — **09**: British Orthopaedic Consortium

Smith, Justin — **01**: Zimmer, Zimmer Biomet, Biomet **02**: K2M, Zimmer **03b**: Cerapedics, NuVasive, Zimmer Biomet **05**: AOSpine, DePuy Synthes, NREF, DePuy Synthes/ISSG **06**: NuVasive, K2M, Zimmer Biomet **07**: Neurosurgery Editorial Board for Spine **08**: CSRS Board Member, ISSG Executive Committee **09**: Fellowship support from NREF and AOSpine

Solla, Federico — **05**: Medicrea **06**: Medicrea

Soo, Chia — **01**: Bone Biologics, Inc, Scarless Laboratories, Inc) **03c**: Bone Biologics, Inc, Scarless Laboratories, Inc) **04**: Bone Biologics, Inc, Scarless Laboratories, Inc) **05**: Scarless Laboratories, Inc)

Sperwer, Olaf — **06**: The study was funded by Nottingham University Hospitals (Spine Research). Bbraun and VRmed supported the development of the software. The companies had no role in the design, interpretation or reporting of the study. The authors declared no conflict of interest.

Spiker, Ryan — **03b**: Amedica, NEXXT, Nexus **09**: AOSpine/DePuy Synthes—Fellowship support

Stappenbeck, Frank — **03a**: MAXBioPharma **04**: MAXBioPharma

Stokes, Oliver M. — **06**: Consulting position Elipse Technologies- $5000 Consulting position Nuvasive- $2000 **09**: Travel Bursary Nuvasive $1000

Street, John — **03b**: Depuy Synthes **03c**: Medtronic **05**: Medtronic (paid to institution) **08**: NASS audit committee

Study Group, Harms — **05**: DePuy Synthes; K2M; EOS Imaging,DePuy Synthes; K2M; EOS Imaging

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Sturesson, Bengt — **03b**: Si-Bone Inc., San Jose, USA **05**: Si-Bone Inc., San Jose, USA

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## T

Tay, Bobby — **03b**: Biomet, Stryker and Lumetra, Biomet **09**: Fellowship Grants: AOSpine, Globus, NuVasive

# Disclosure Information Index

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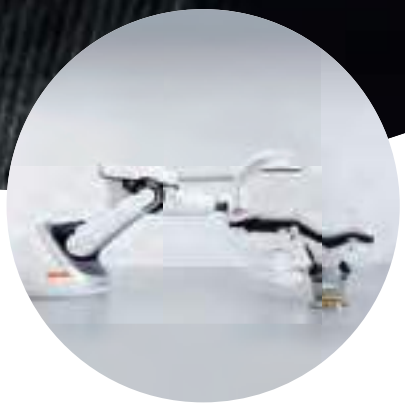
Join the Siemens Healthineers Lunch Symposium, May 4th, 12:15 pm, Plenary Room



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# Live Cadaver Lab demonstration

## Friday, May 5

### From 18:00 to 19:00 (Plenary Room)

Don't miss out on a revolutionary GSC industry session being held for the first time this congress! This highly interactive live Cadaver Lab session will follow the scientific sessions on Friday with an innovative format that will provide Global Spine Congress participants with the opportunity to learn practical "tips, tricks and pearls" from leading spine surgeons around the globe.

**Format**

Two Live Cadaver Lab operations will be shown simultaneously in the Red (Plenary) room at the Global Spine Congress in Milan. During the operation each leading surgeon will be discussing with moderators and the audience the specific details behind their innovative procedures.

**Duration of the session: 1 hour**

### Cadaver Lab LIVE demonstration (Room 1)

"Anterior Column Realignment and Posterior Fusion with Computer Assisted Rod Bending"

**Operating surgeon**

**Claudio Lamartina** (Italy)

I.R.C.C.S.
Istituto Ortopedico Galeazzi
Via Riccardo Galeazzi 4,
20161 Milano, Italy

### Cadaver Lab LIVE demonstration (Room 2)

"Demonstrating procedural efficiencies in creating posterior lordosis from L3 to Sacrum to impact outcomes"

**Operating surgeon**

**Joerg Franke** (Germany)

Head and Chairman
Department of Spinal Surgery Klinikum Dortmund
Germany

**Moderators**

**Pedro Berjano** (Italy), **Benny Dahl** (USA), **Frank Kandziora** (Germany)

We would like to thank the following valuable Cadaver Lab sponsors:

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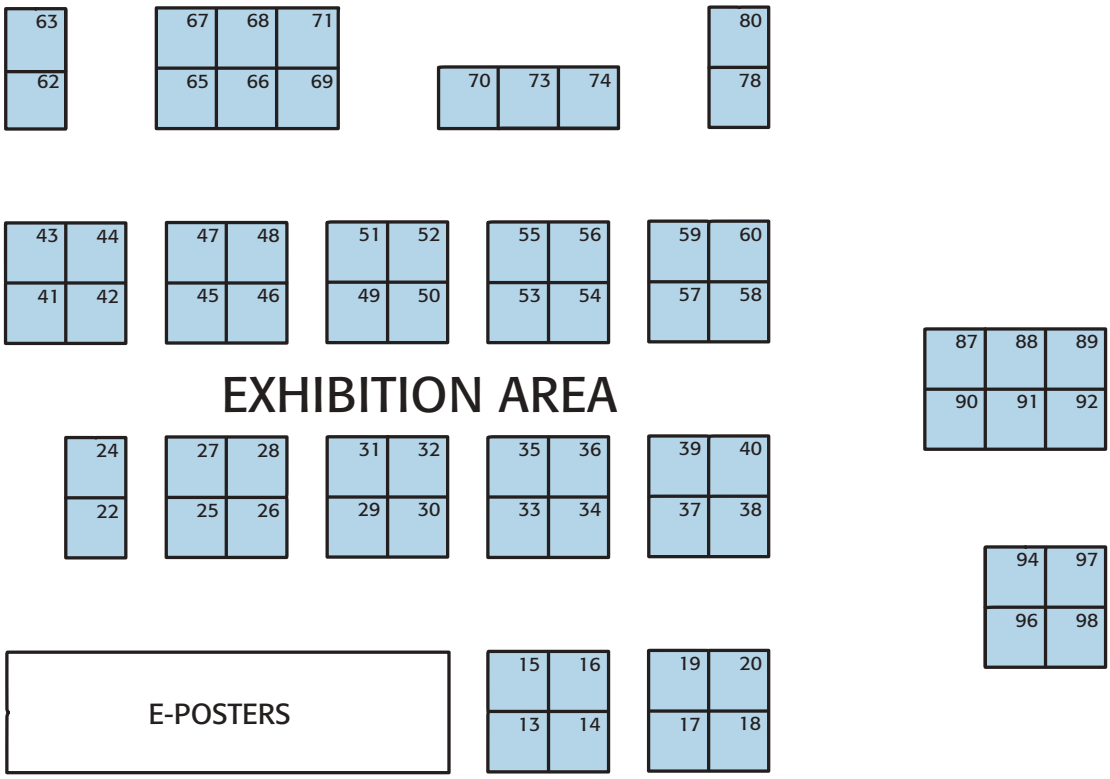
# Exhibitor location




## Exhibitors

| | |
|---|---|
| Allen Medical | 70+73+74 |
| AMS Group | 45 |
| Carl Zeiss Meditec | 58+60 |
| Cerapedics | 42 |
| Depuy Synthes | 65+66+67+68+69+71 |
| ECCE | 33 |
| Emerging Implant Technologies | 18 |
| EOS Imaging | 49 |
| European Spine Journal | 34 |
| Griffin Editore | 16 |
| G4Spine | 36 |
| icotec | 43 |
| Implanet | 41 |
| JP Medical Publishers | 17 |
| Joimax | 47+48 |
| Karl Storz Gmbh & Co | 32 |
| Medacta | 53+54+55+56 |
| Medtronic | 37+38+39+40 |
| Nuvasive | 94+96+97+98 |
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| Sanyou Medical Ltd Co. | 80 |
| Si-Bone | 63 |
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| SMTP Technology Co. Ltd | 78 |
| Spinal News International | 19 |
| Synbone | 62 |
| Tourism Singapore | 14 |
| Wisepress | 15 |
| Zimmer Biomet | 22+24 |

## Societies

| | |
|---|---|
| Deutsche Wirbelsäulengesellschaft | 29 |
| North American Spine Society | 27 |
| Russian Association Of Spinal Surgeons | 26 |
| Società Italiana Di Chirurgia Vertebrale & Gruppo Italiano Scoliosi | 31 |
| Société Francaise De La Chirurgie Du Rachis | 25 |
| Society For Lateral Access Surgery | 28 |
| Scoliosis Research Society | 30 |

# Societies and Publishers

## We would like to thank the following publishers:

## We would like to thank the following societies:

## We would like to thank the following partners:

# Industry Symposia (Lunch)

## Thursday, May 4

**Lunch Symposium***
12:15-13:15 Siemens (Room: Red Plenary)
Advanced Robotic Imaging in Spine Surgery

**Lunch Symposium**
12:15-13:15 SMTP Technology (Room: Blue 2)
The outstanding performance of Ultrasonic Osteotome in surgery

**Lunch Symposium***
12:15-13:15 NuVasive (Room: Yellow 1)
Sagittal Balance – Expert Panel Discussion

## Friday, May 5

**Lunch Symposium***
12:45-13:45 Medtronic (Room: Blue 2)
To PSO or not to PSO: When is this appropriate and what other technique creates necessary alignment

**Lunch Symposium***
12:45-13:45 Baxter (Room: Yellow 3)
Controlling Blood Loss in Complex Spinal Surgery

* Session offers a complimentary lunch option

AOSPINE

# AOSpine Member Representative Election

**Date:** May 5, 2017

**Time:** 7.00am to 8.00am

**Main point:** Elect the Member Representative of AOSpine

## Join us—Your vote counts!

For voting members only. We look forward to seeing you there!

# EANS 2017

## Controversies and Solutions in Neurosurgery

**Venice, Italy | October 1 – 5**

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- Claudius Thomé

**Highlights from the spinal neurosurgery programme include:**

- Spinal navigation will become the standard of care. Pros and cons.
- Registries are the future of spinal research. Pros and cons.
- Thoracolumbar burst fractures: surgery is the first choice. Pros and cons.

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# Notes

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# About the AO Foundation and AOSpine

## The AO Foundation

The AO Foundation, founded in 1958, is a medically guided not-for-profit organization led by an international group of surgeons who are specialized in the treatment of trauma and disorders of the musculoskeletal system. It has established specialty areas for trauma, spine, craniomaxillofacial, and veterinary surgery. These specialty areas continually redefine the state-of-the-art in their field, maintaining activities in research, development, clinical investigation, and education.

## AOSpine

AOSpine is a professional medical association of spine surgeons and a clinical division of the AO Foundation. AOSpine is the leading global academic community of spine surgeons dedicated to generating, distributing, and sharing knowledge through research, education and community development.

Established in June 2003, the organization is led by the AOSpine International Board. The board guides and supports the AOSpine regions Asia Pacific, Europe and Africa, Latin America, Middle East, and North America. Each region drives more than 150 local educational activities within the AOSpine international network. Today, AOSpine fosters a global community of 30,000 members and associates from all over the world.

## AOSpine Research

AOSpine drives and transforms spine care through a variety of pioneering research programs. Teams of research experts gather in intra- and inter-regional research programs and create valuable synergies between science and practical surgery. AOSpine continuously innovates spine surgery, offering its members the chance to be involved in the scientific advancement of spine care worldwide.

## AOSpine Education

AOSpine fosters lifelong learning for spine surgeons worldwide by offering educational activities that are developed and delivered by expert faculty, providing specific pathology courses based on a comprehensive competency-based curriculum. Highly interactive educational programs involve the learners, and by encouraging them to develop mentoring skills, AOSpine ensures the dissemination of know-how to the next generation of spine surgeons.

## AOSpine Community

AOSpine encourages its members to generate, distribute, and exchange knowledge, while also allowing them to build professional relationships both locally and globally.

The AOSpine website provides a platform for users to stay connected with the community and to keep up-to-date with the latest education and research news, as well as providing tools to improve professional practice.

A range of initiatives and activities, across five regions, ensure the continual strengthening and growth of our leading global community. AOSpine's strong academic credibility translates into attractive membership benefits, which are designed to keep members connected to the latest advances, and high-class education in spine surgery.

Global Spine Congress 2018

# The Global Spine Congress heads to Asia Pacific

## Global Spine Congress

**Singapore | May 2–5, 2018**

**www.gsc2018.org**

AOSpine International
Stettbachstrasse 6
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AOSPINE

UNIVERSIDADE FEDERAL DE SÃO PAULO – Unifesp

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# CERTIFICADO

Certificamos que

**MARCELO WAJCHENBERG**

Apresentou o trabalho científico

**TISSUE EXPRESSION OF ANGIOTENSIN I - CONVERTING ENZYME (ACE) GENE IN THE ROTATOR MUSCLES OF PATIENTS**

na modalidade de Apresentação de Pôster no I Encontro Unifesp de PÓS-DOUTORES

realizado nos dias 29 e 30 de novembro, e 1º de dezembro de 2017.

São Paulo, 1º de dezembro de 2017

Prof. Dr. Esper Abrão Cavalheiro

Pró-Reitor de Pós-Graduação e Pesquisa

UNIVERSIDADE FEDERAL DE SÃO PAULO – Unifesp

Pró-Reitoria de Pós-Graduação e Pesquisa

# CERTIFICADO

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Participou do

## I Encontro Unifesp de PÓS-DOUTORES

realizado nos dias 29 e 30 de novembro, e 1º de dezembro de 2017,

com carga horária de 15 horas na qualidade de congressista.

São Paulo, 1º de dezembro de 2017

**Prof. Dr. Esper Abrão Cavalheiro**

Pró-Reitor de Pós-Graduação e Pesquisa