The Canadian Spine Society is a collaborative organization of spine surgeons advancing excellence in research, education and patient care.

16th ANNUAL SCIENTIFIC CONFERENCE OF THE CANADIAN SPINE SOCIETY
Wednesday, February 24th - Saturday, February 27th

ABSTRACTS FOR PRESENTATION 2016

The Fairmont Château Whistler
4599 Château Boulevard
Whistler British Columbia V0N 1B4 Canada

Accreditation: This event is an Accredited Group Learning Activity (Section 1) as defined by the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada, approved by The Canadian Orthopaedic Association.

Course Objectives: The Annual Scientific Conference of the Canadian Spine Society provides a contemporary review of spine surgery and spine care in Canada. The conference is a joint meeting of the Canadian Spine Society and the Canadian Paediatric Spine Society that encompasses a full range of spinal problems and current solutions. This year the focus will extend from the best means of triaging back pain patients to avoid unnecessary surgical intervention to the complication of post-operative spinal infection. Paediatric presentations will include the ongoing study of home-based pain management following scoliosis surgery and the status of the national spine registry. The program offers a carefully constructed mix of didactic lectures, research updates and interactive symposia. It offers an opportunity to obtain valuable continuing medical education while engaging in a vibrant exchange of ideas and points of view. Attendees will come away with a comprehensive overview of the Canadian approach to spine.
CONFLICT OF INTEREST (COI) DISCLOSURE INFORMATION

is available for all speakers presenting abstracts at the 16th Annual Scientific Conference of the Canadian Spine Society

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16th ANNUAL SCIENTIFIC CONFERENCE OF THE CANADIAN SPINE SOCIETY
Wednesday, February 24th - Saturday, February 27th
The Fairmont Chateau Whistler
Whistler British Columbia
PODIUM PRESENTATIONS

THURSDAY

FEBRUARY 25th, 2016

Abstracts for Oral Presentation

<table>
<thead>
<tr>
<th>ABSTRACT #</th>
<th>PROGRAM CODE</th>
<th>PRESENTER LAST NAME</th>
<th>PRESENTER FIRST NAME</th>
<th>AWARDS TO BE CONSIDERED FOR</th>
<th>Part I ABSTRACTS PAGE</th>
<th>Part II CONFLICT OF INTEREST DISCLOSURE</th>
</tr>
</thead>
<tbody>
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<td>Ilyas</td>
<td>Best Overall Paper Fellow's Best Paper</td>
<td>Page 6</td>
<td>Page 85</td>
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<tr>
<td>0013</td>
<td>1.02</td>
<td>Xu</td>
<td>Yan</td>
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<td>Page 7</td>
<td>Page 86</td>
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<td>1.03</td>
<td>Rampersaud</td>
<td>Y. Raja</td>
<td>Best Overall Paper</td>
<td>Page 8</td>
<td>Page 87</td>
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<td>1.04</td>
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<td>Best Overall Paper Fellow's Best Paper</td>
<td>Page 9</td>
<td>Page 88</td>
</tr>
<tr>
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<td>1.05</td>
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<td>Godefroy</td>
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<td>Page 10</td>
<td>Page 89</td>
</tr>
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<td>0124</td>
<td>1.06</td>
<td>Crawford</td>
<td>Eric</td>
<td>Best Overall Paper Resident's Best Paper</td>
<td>Page 11</td>
<td>Page 90</td>
</tr>
<tr>
<td>0139</td>
<td>1.07</td>
<td>Zarrabian</td>
<td>Mohammad</td>
<td>Best Overall Paper Fellow's Best Paper</td>
<td>Page 12</td>
<td>Page 91</td>
</tr>
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<td>0.08</td>
<td>Hardy St-Pierre</td>
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<td>Page 13</td>
<td>Page 92</td>
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<td>1.09</td>
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<td>Page 14</td>
<td>Page 93</td>
</tr>
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<td>1.10</td>
<td>Ailon</td>
<td>Tamir</td>
<td>Best Overall Paper</td>
<td>Page 15</td>
<td>Page 94</td>
</tr>
<tr>
<td>0060</td>
<td>1.11</td>
<td>Hardy St-Pierre</td>
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<td>Page 16</td>
<td>Page 95</td>
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<td>Page 96</td>
</tr>
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<td>1.13</td>
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<td>Michael</td>
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<td>Page 18</td>
<td>Page 97</td>
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<td>1.14</td>
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<td>Alex</td>
<td>Best Overall Paper</td>
<td>Page 19</td>
<td>Page 98</td>
</tr>
</tbody>
</table>
## PODIUM PRESENTATIONS

### FRIDAY

**FEBRUARY 26th, 2016**

### Abstracts for Oral Presentation

<table>
<thead>
<tr>
<th>ABSTRACT #</th>
<th>PROGRAM CODE</th>
<th>PRESENTER LAST NAME</th>
<th>PRESENTER FIRST NAME</th>
<th>AWARDS TO BE CONSIDERED FOR</th>
<th>Part I ABSTRACTS PAGE</th>
<th>Part II CONFLICT OF INTEREST DISCLOSURE</th>
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<td>Page 23</td>
<td>Page 101</td>
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<td>2.18</td>
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<td>Nader</td>
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<td>Page 24</td>
<td>Page 102</td>
</tr>
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<td>0065</td>
<td>2.19</td>
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<td>Vanessa</td>
<td>Best Overall Paper</td>
<td>Page 25</td>
<td>Page 103</td>
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<td>2.20</td>
<td>Finkelstein</td>
<td>Joel</td>
<td>Best Overall Paper</td>
<td>Page 26</td>
<td>Page 104</td>
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<td>Page 105</td>
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<td>Page 28</td>
<td>Page 106</td>
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<td>2.23</td>
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<td>Page 29</td>
<td>Page 107</td>
</tr>
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<td>2.24</td>
<td>Rutgess</td>
<td>Joost</td>
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<td>Page 30</td>
<td>Page 108</td>
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<td>Page 109</td>
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<td>Page 32</td>
<td>Page 110</td>
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<td>2.27</td>
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<td>Andrew</td>
<td>Best Overall Paper Resident's Best Paper</td>
<td>Page 33</td>
<td>Page 111</td>
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<tr>
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<td>2.28</td>
<td>Malakoutian</td>
<td>Masoud</td>
<td>Best Overall Paper</td>
<td>Page 34</td>
<td>Page 112</td>
</tr>
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<td>2.29</td>
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<td>Brian</td>
<td>Best Overall Paper</td>
<td>Page 35</td>
<td>Page 113</td>
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<td>2.30</td>
<td>Hardy St-Pierre</td>
<td>Godefroy</td>
<td>Best Overall Paper Fellow's Best Paper</td>
<td>Page 36</td>
<td>Page 114</td>
</tr>
</tbody>
</table>
# PODIUM PRESENTATIONS

## SATURDAY

**FEBRUARY 27th, 2016**

Abstracts for Oral Presentation

<table>
<thead>
<tr>
<th>ABSTRACT #</th>
<th>PROGRAM CODE</th>
<th>PRESENTER LAST NAME</th>
<th>PRESENTER FIRST NAME</th>
<th>AWARDS TO BE CONSIDERED FOR</th>
<th>Part I ABSTRACTS PAGE</th>
<th>Part II CONFLICT OF INTEREST DISCLOSURE</th>
</tr>
</thead>
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<tr>
<td>0016</td>
<td>3.31</td>
<td>Nater</td>
<td>Anick</td>
<td>Best Overall Paper</td>
<td>Page 38</td>
<td>Page 115</td>
</tr>
<tr>
<td>0030</td>
<td>3.32</td>
<td>Dea</td>
<td>Nicolas</td>
<td>Best Overall Paper</td>
<td>Page 39</td>
<td>Page 116</td>
</tr>
<tr>
<td>0095</td>
<td>3.33</td>
<td>Pahuta</td>
<td>Markian</td>
<td>Best Overall Paper, Fellow's Best Paper</td>
<td>Page 40</td>
<td>Page 117</td>
</tr>
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<td>0125</td>
<td>3.34</td>
<td>Fenton</td>
<td>Eoin</td>
<td>Best Overall Paper</td>
<td>Page 41</td>
<td>Page 118</td>
</tr>
<tr>
<td>0024</td>
<td>3.35</td>
<td>Nouri</td>
<td>Aria</td>
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<td>Page 42</td>
<td>Page 119</td>
</tr>
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<td>0025</td>
<td>3.36</td>
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<td>Lindsay</td>
<td>Best Overall Paper, Fellow's Best Paper</td>
<td>Page 43</td>
<td>Page 120</td>
</tr>
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<td>3.37</td>
<td>Witiw</td>
<td>Christopher</td>
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<td>Page 44</td>
<td>Page 121</td>
</tr>
<tr>
<td>0165</td>
<td>3.38</td>
<td>Santaguida</td>
<td>Carlo</td>
<td>Best Overall Paper</td>
<td>Page 45</td>
<td>Page 122</td>
</tr>
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<td>3.39</td>
<td>Aziz</td>
<td>Mina</td>
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<td>Page 46</td>
<td>Page 123</td>
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<td>0062</td>
<td>3.40</td>
<td>Khashan</td>
<td>Morsi</td>
<td>Best Overall Paper, Fellow's Best Paper</td>
<td>Page 47</td>
<td>Page 124</td>
</tr>
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<td>3.41</td>
<td>Tomkins-Lane</td>
<td>Christy</td>
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<td>Page 48</td>
<td>Page 125</td>
</tr>
<tr>
<td>0082</td>
<td>3.42</td>
<td>Miyanj</td>
<td>Firoz</td>
<td>Best Overall Paper</td>
<td>Page 49</td>
<td>Page 126</td>
</tr>
<tr>
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<td>3.43</td>
<td>Johnson</td>
<td>Michael</td>
<td>Best Overall Paper</td>
<td>Page 50</td>
<td>Page 127</td>
</tr>
<tr>
<td>0098</td>
<td>3.44</td>
<td>Tee</td>
<td>Jin</td>
<td>Best Overall Paper, Fellow's Best Paper</td>
<td>Page 51</td>
<td>Page 128</td>
</tr>
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<td>0140</td>
<td>3.45</td>
<td>Wai</td>
<td>Eugene</td>
<td>Best Overall Paper</td>
<td>Page 52</td>
<td>Page 129</td>
</tr>
</tbody>
</table>
## POSTERS FOR PRESENTATION

<table>
<thead>
<tr>
<th>ABSTRACT #</th>
<th>PROGRAM CODE &amp; POSTER #</th>
<th>PRESENTER LAST NAME</th>
<th>PRESENTER FIRST NAME</th>
<th>PRESENTATION DAY</th>
<th>Part I ABSTRACTS PAGE</th>
<th>Part II CONFLICT OF INTEREST DISCLOSURE</th>
</tr>
</thead>
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<tr>
<td>0005</td>
<td>P01</td>
<td>Evaniew</td>
<td>Nathan</td>
<td>THURSDAY</td>
<td>Page 54</td>
<td>Page 130</td>
</tr>
<tr>
<td>0023</td>
<td>P02</td>
<td>Nouri</td>
<td>Aria</td>
<td>THURSDAY</td>
<td>Page 55</td>
<td>Page 131</td>
</tr>
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<td>0026</td>
<td>P03</td>
<td>Tetreault</td>
<td>Lindsay</td>
<td>THURSDAY</td>
<td>Page 56</td>
<td>Page 132</td>
</tr>
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<td>P04</td>
<td>Tetreault</td>
<td>Lindsay</td>
<td>THURSDAY</td>
<td>Page 57</td>
<td>Page 133</td>
</tr>
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<td>P05</td>
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<td>Lindsay</td>
<td>THURSDAY</td>
<td>Page 58</td>
<td>Page 134</td>
</tr>
<tr>
<td>0036</td>
<td>P06</td>
<td>Fehlings</td>
<td>Michael</td>
<td>THURSDAY</td>
<td>Page 59</td>
<td>Page 135</td>
</tr>
<tr>
<td>0068</td>
<td>P07</td>
<td>Wilson</td>
<td>Jefferson</td>
<td>THURSDAY</td>
<td>Page 60</td>
<td>Page 136</td>
</tr>
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<td>0049</td>
<td>P08</td>
<td>Ailon</td>
<td>Tamir</td>
<td>THURSDAY</td>
<td>Page 61</td>
<td>Page 137</td>
</tr>
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<td>0031</td>
<td>P09</td>
<td>Charest-Morin</td>
<td>Raphaëlle</td>
<td>FRIDAY</td>
<td>Page 62</td>
<td>Page 138</td>
</tr>
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<td>0067</td>
<td>P10</td>
<td>Charest-Morin</td>
<td>Raphaëlle</td>
<td>FRIDAY</td>
<td>Page 63</td>
<td>Page 139</td>
</tr>
<tr>
<td>0077</td>
<td>P11</td>
<td>Marion</td>
<td>Travis</td>
<td>FRIDAY</td>
<td>Page 64</td>
<td>Page 140</td>
</tr>
<tr>
<td>0134</td>
<td>P12</td>
<td>Marion</td>
<td>Travis</td>
<td>FRIDAY</td>
<td>Page 65</td>
<td>Page 141</td>
</tr>
<tr>
<td>0019</td>
<td>P13</td>
<td>Kato</td>
<td>So</td>
<td>FRIDAY</td>
<td>Page 66</td>
<td>Page 142</td>
</tr>
<tr>
<td>0079</td>
<td>P14</td>
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<td>Firoz</td>
<td>FRIDAY</td>
<td>Page 67</td>
<td>Page 143</td>
</tr>
<tr>
<td>0045</td>
<td>P15</td>
<td>Enright</td>
<td>Austin</td>
<td>FRIDAY</td>
<td>Page 68</td>
<td>Page 144</td>
</tr>
<tr>
<td>0115</td>
<td>P16</td>
<td>Manson</td>
<td>Neil</td>
<td>FRIDAY</td>
<td>Page 69</td>
<td>Page 145</td>
</tr>
<tr>
<td>0015</td>
<td>P17</td>
<td>Fehlings</td>
<td>Michael</td>
<td>SATURDAY</td>
<td>Page 70</td>
<td>Page 146</td>
</tr>
<tr>
<td>0126</td>
<td>P18</td>
<td>Dakson</td>
<td>Ayoub</td>
<td>SATURDAY</td>
<td>Page 71</td>
<td>Page 147</td>
</tr>
<tr>
<td>0127</td>
<td>P19</td>
<td>Dakson</td>
<td>Ayoub</td>
<td>SATURDAY</td>
<td>Page 72</td>
<td>Page 148</td>
</tr>
<tr>
<td>0128</td>
<td>P20</td>
<td>Leck</td>
<td>Erika</td>
<td>SATURDAY</td>
<td>Page 73</td>
<td>Page 149</td>
</tr>
<tr>
<td>0063</td>
<td>P21</td>
<td>Khashan</td>
<td>Morsi</td>
<td>SATURDAY</td>
<td>Page 74</td>
<td>Page 150</td>
</tr>
<tr>
<td>0117</td>
<td>P22</td>
<td>Abraham</td>
<td>Edward</td>
<td>SATURDAY</td>
<td>Page 75</td>
<td>Page 151</td>
</tr>
<tr>
<td>0118</td>
<td>P23</td>
<td>Manson</td>
<td>Neil</td>
<td>SATURDAY</td>
<td>Page 76</td>
<td>Page 152</td>
</tr>
<tr>
<td>0160</td>
<td>P24</td>
<td>Pahuta</td>
<td>Markian</td>
<td>SATURDAY</td>
<td>Page 77</td>
<td>Page 153</td>
</tr>
</tbody>
</table>
1.01

Do Lumbar Decompression and Fusion Patients Recall Their Preoperative Status? Recall Bias in Patient-Reported Outcomes

Ilyas Aleem1, Jonathan Duncan1, Amin Ahmed1, Jason Eck1, John Rhee2, Bradford Currier1, Ahmad Nassr1
1Mayo Clinic, Rochester, MN, USA, 2Emory, Atlanta, GA, USA

Objectives

To characterize the accuracy of patient recall of preoperative symptoms in a cohort of lumbar spine surgery patients.

Method

We analyzed consecutive patients undergoing lumbar decompression or decompression and fusion for lumbar radiculopathy by a single surgeon over a four-year period. Using standardized questionnaires, we recorded back and leg numeric pain scores (NPS) and Oswestry Disability Indices (ODI) preoperatively and asked patients to recall their preoperative status at a minimum of one-year following surgery. We then statistically compared actual and recalled preoperative scores. Multivariable linear regression was used to identify factors that had an impact on recollection. Pearson correlation coefficients quantified relations between recalled and actual scores.

Results

Sixty-two patients with a mean age of 66.1 years (55% female) were included. All patients showed significant improvement in back pain (mean difference (MD) = -3.2, 95% CI -4.0 to -2.4, p < 0.01), leg pain (MD -3.3, 95% CI -4.3 to -2.2, p < 0.01), and disability (MD -25.0%, 95% CI -28.7 to -19.6, p < 0.01) postoperatively. Patient recollection of preoperative status was significantly worse for back pain (MD +2.3, 95% CI 1.5 to 3.2, p < 0.05), leg pain (MD +1.8, 95% CI 0.9 to 2.7, p < 0.05) and disability (MD +9.6%, 95% CI 5.6 to 14.0, p < 0.05). This was maintained across age, gender, and symptom duration. The magnitude of recall bias was moderate to severe and exceeded the minimal clinically important difference (MCID) in more than 67% of patients for back and leg pain. No significant correlation between actual and recalled scores with regards to back (r=0.18) or leg pain (r=0.24) and only moderate correlation with disability (r=0.44) was seen.

Conclusions

Significant recall bias of preoperative symptoms exists in patients undergoing spine surgery, potentially limiting accurate assessment and interpretation of post-operative assessment.
1.02

Trends and Costs of Lumbar Fusion and Disc Replacement Surgeries in Ontario: a Population-Based Study

Yan Xu, David Yen, Ana Johnson
Queen’s University, Kingston, Ontario, Canada

Objectives

Lumbar fusion (LF) surgeries have become widely used for the treatment of degenerative conditions of the spine, despite limited evidence for its efficacy and cost-effectiveness. In the United States, LF rates have risen rapidly, approaching those of hip and knee replacements. We sought to determine the longitudinal utilization rates and direct medical costs associated with LF procedures in Ontario, Canada’s largest province, and to compare these with rates of total hip and knee replacements.

Method

Using administrative data, we conducted a time-series analysis of rates and costs associated with LF for degenerative spine conditions between 1993 and 2011 in Ontario. We stratified surgical rates and costs by age deciles. Rates of hip and knee replacements were also evaluated over the same period and compared to those of LF.

Results

Over the 18-year period, rates of LF increased from 6.16 to 14.13 per 100,000 Ontarians (p<0.05), though well below hip and knee replacement rates. Age groups experiencing the highest LF utilization were 60-69 and 70-79 years. In 2011, direct medical costs and professional fees associated with LF exceeded $24 million. Spinal stenosis and spondylolisthesis were the primary diagnoses in 42.9% and 26.6% of cases respectively.

Conclusions

Rates of LF surgery for degenerative spine conditions more than doubled from 1998 to 2011, with spinal stenosis and spondylolisthesis comprising the most common primary diagnoses. Given its unfavourable cost-effectiveness for the treatment of these two conditions and its large and growing budgetary impact, the uptake of LF requires increased scrutiny.
Ontario Inter-professional Spine Assessment and Education Clinics (ISAEC): Patient, Provider and System Impact of an Integrated Model of Care for the Management of Low Back Pain (LBP)

Y. Raja Rampersaud$^{1,3}$, Andrew Bidos$^3$, Sue Schultz$^4$, Caroline Fanti$^3$, Barry Young$^3$, Brian Drew$^{5,3}$, David Puskas$^{2,3}$, David Henry$^4$

$^1$University Health Network, Toronto, ON, Canada, $^2$Thunder Bay Regional, Thunder Bay, ON, Canada, $^3$Inter-Professional Spine Assessment and Education Clinic, ON, Canada, $^4$Institute for Clinical Evaluative Sciences, Toronto, ON, Canada, $^5$Hamilton General Hospital, Hamilton, ON, Canada

Objectives

The objectives of this study are to determine the impact of ISAEC on 1) Patient reported satisfaction and outcome; 2) Primary care provider (PCP) satisfaction and knowledge transfer; and 3) Utilization of spinal imaging from the perspective of the health care system.

Method

1) Mixed methods study for patient and provider evaluation (patient reported outcomes measures and surveys). 2) Institute for Clinical Evaluative Sciences (ICES) administrative data analysis comparing spine imaging test ordering by ISAEC and non-ISAEC physicians.

Results

From November 2012 to May 2015, 3347 patients have been assessed. Mean wait time for primary assessment was 10 days. Majority of patients (68%) were diagnosed with back-dominant pain. Majority of presentations (68%) were considered complex (e.g. positive for psychosocial factors (52.2%)). Patient satisfaction (n=1922) was 99%, and 95% felt they understood their condition better. For 417 patients enrolled in a longitudinal study, significant reduction in ODI was observed at 6 months (Baseline=36% / 6 months=26%).

At 4 and 12 months into the program, enrolled PCPs (n=134 /220) on average showed a two-fold increase in their confidence managing LBP (assessment and management, referral for imaging and specialist consultation). 97% of PCPs reported overall satisfaction with the ISAEC model of care and felt that ISAEC services would be useful to all PCPs. Within the ISAEC network of providers, specialist referral appropriateness was 96% and <4% of ISAEC patients have gone on to specialist interventions. Compared to non-ISAEC physicians, the overall annual costs for all LBP-related diagnostic imaging ordered by ISAEC-physicians fell 28% in year 1 and an additional 5% in year 2. This translates to an annual estimated per physician cost avoidance of $3150 and $4175 in year 1 and 2 respectively.

Conclusions

A shared-care model of care for LBP provides significant multidimensional impact on patients, providers and the health care system.
1.04

Validation of the Self-Administered Online Assessment of Preferences (SOAP) utility elicitation tool

Markian Pahuta¹, Aaron Frombach¹, Gunita Mitera², Doug Coyle¹, Joel Werier¹, Eugene Wai¹
¹University of Ottawa, Ottawa, Canada, ²University of Toronto, Toronto, Canada

Objectives

Quality-adjusted life-years (QALY) quantify the net morbidity and mortality experienced by patients in a single number. QALYs are computed using “utilities” which are a measure of preference for a clinical outcome.

If a disease process has not been studied using general health surveys, utilities can be obtained using the standard gamble method (SG). There have been no reports in the literature of the validity and reliability of SG utilities. We sought to determine the validity and reliability of SG utilities for metastatic epidural spinal cord compression (MESCC).

Method

We developed an electronic self-administered SG utility elicitation tool (SOAP). MESCC health state descriptions were developed from key domains identified by the EORTC MESCC working group which included: ambulation, continence, pain, independence, and “other symptoms.” Health states were constructed to have one, three or five dysfunctional domains.

Individuals accompanying patients to the emergency department waiting room of a tertiary care hospital were recruited. Participants made SOAP MESCC health state valuations in the waiting room, 48 hours later at home. Validity was measured by logical consistency. Reliability was measured using 95% Limits of Agreement and the Interclass Correlation Coefficient (ICC).

Results

Of 81 participants, 55 (68%) completed the re-test. Of these 55 participants, 39 (71%) provided a valid response twice. For the single, triple and fully dysfunctional health states; 95% limits of agreement were: 0±0.32, 0±0.25, and 0±0.38; and the ICCs were: 0.765, 0.799, and 0.558.

Conclusions

The validity of responses using the SOAP tool is greater than that for the survey used to derive Canadian EQ-5D weights. Responses for non-fully dysfunctional health states show substantial reliability. Therefore the SOAP tool has excellent psychometric properties and can be used for future study of MESCC and potentially for other disorders.
1.05

Performance indicators in spine surgery: a systematic review

Godefroy Hardy St-Pierre, John Hurlbert
University of Calgary, Calgary, Alberta, Canada

Objectives

The Patient Protection and Affordable Care Act has given significant traction to the idea that healthcare must provide value to the patient through the introduction of hospital value-based purchasing. This systematic review was also meant to elucidate how performance indicators are currently used in clinical spine surgery if at all.

Method

MEDLINE, CINAHL Plus, EMBASE and Google Scholar were searched for studies reporting the use of performance indicators specific to spine surgery. The search was further broadened by investigating the grey literature including reports by the American College of Surgeons (ACS), the National Quality Forum (NQF), the National Institute for Health and Care Excellence (NICE), the National Health Service (NHS), the Joint Commission, the Centers for Medicare and Medicaid (CMS), the Surgical Clinical Outcomes and Assessment Program (SCOAP) of the Foundation for Healthcare quality.

Results

865 citations were found across databases. A total of 26 full text articles and reports were retrieved and reviewed. No performance indicators were identified for 3 reasons. First, outcome data without an established standard is more appropriately termed a metric rather than a performance indicator: a widely accepted standard has yet to be established for spine surgery outcomes. Secondly, most of the retrieved articles had unclear exclusion criteria and little or no risk-adjustment associated with their reported outcomes. Finally most articles simply reported the current performance without mentioning a target or expectation.

On a positive note, our review revealed a relative consensus among the spine surgery community concerning the outcome metrics to be used in the crafting of performance indicators. The VAS, the ODI, the NDI, the EQ-5D and the SF-36 and its derivatives were almost ubiquitous throughout the literature.

Conclusions

The science of performance measurement applied to spine surgery is still in its infancy. Current performance metrics used in clinical settings require refinement to become performance indicators.
Inter-professional Spine Assessment & Education Clinics (ISAEC): a networked model of care with changes to referral population profile and reduced surgical wait-times.

Eric Crawford¹, Robert Ravinsky¹, Andrew Bidos², Y. Raja Rampersaud¹,³
¹Division of Orthopaedic Surgery and Neurosurgery, Department of Surgery, University of Toronto, Toronto, ON, Canada, ²Toronto Western Hospital, University Health Network, Toronto, ON, Canada, ³Spinal Program, Krembil Neuroscience Centre, Toronto Western Hospital, University Health Network, Toronto, ON, Canada

Objectives

The primary objective of this study is to determine the effect of ISAEC on referral population profile and wait-times for surgical consultation and surgery.

Method

Patients assessed through ISAEC were compared to a cohort undergoing traditional triage and clinical assessments (TTCA). A retrospective review of prospectively collected data from a single surgeon from the ISAEC network was performed. Data is reported as medians with inter-quartile ranges (M;IQR).

Results

From November 2012 to August 2015, 1,585 patients were assessed though ISAEC in Toronto, of which 271 patients (17.1%) were referred for and underwent surgical consultation. Prior to ISAEC, the senior author screened patients referred from primary care, with 66.6% of referrals that were deemed possibly surgical accepted for consultation (TTCA). Time from referral to surgical consultation was significantly reduced (p<0.001) for patients assessed through ISAEC (64; 48-97 days, n=271) compared to the TTCA group (144; 110-264days, n=318). Patients assessed through ISAEC (52; 39-64years, 56.1% male, 92.5% leg-dominant pain) were younger, more likely to be male and more likely to have a leg-dominant pattern of pain compared to TTCA (60.7; 49-70years, 46.5% male, 65.9% leg-dominant pain). For those patients proceeding to surgery, time from referral to surgery was also significantly reduced (p<0.001) for patients assessed through ISAEC (176; 131-307days, n=59), compared to the TTCA group (376; 297-555days, n=105). As a result of different diagnostic profiles, the majority (58.2%) of ISAEC patients underwent microdiscectomy, whereas the majority (89.5%) of TTCA patients underwent lumbar spine decompression with our without instrumentation.

Conclusions

A comprehensive shared-cared model of care for LBP with networked providers and alignment across the continuum of care resulted in sustained reduced wait-times for surgical consultation and surgery. Additionally, setting a priori referral criteria can result in the desired surgical practice profile. Future research should focus on the cost-effectiveness of ISAEC from a societal perspective.
1.07  
Improving Spine Surgical Access, Appropriateness, and Efficiency in Metropolitan, Urban and Rural Settings.

Mohammad Zarrabian\textsuperscript{1}, Andrew Bidos\textsuperscript{2}, Caroline Fanti\textsuperscript{3}, Barry Young\textsuperscript{5}, Brian Drew\textsuperscript{4}, David Puskas\textsuperscript{3}, Raja Rampersaud

\textsuperscript{1}Divisions of Orthopedic Surgery and Neurosurgery, Department of Surgery, University of Toronto, Toronto, Ontario, Canada; \textsuperscript{2}University Health Network, Toronto, Ontario, Canada; \textsuperscript{3}Thunder Bay Regional Health Sciences Centre, Thunder Bay, Ontario, Canada; \textsuperscript{4}Division of Orthopedic Surgery, McMaster University, Hamilton, Ontario, Canada; \textsuperscript{5}Inter-professional Spine Assessment and Education Clinics, Hamilton, Ontario, Canada

Objectives

The Inter-professional Spine Assessment and Education Clinics (ISAEC) were developed to improve primary care assessment and management of patients with persistent or recurrent low back related symptoms. In addition, adaptive ISAEC processes aim to improve the appropriateness of spine investigations and specialist referrals across different regions with distinct system and geographic barriers. The purpose of this study is to determine the effect of ISAEC on access for surgical assessment, referral appropriateness and efficiency in a rural (northern), urban, and metropolitan setting.

Method

Prospective data was retrospectively reviewed from networked ISAEC surgical clinics in Thunder Bay, Hamilton, and Toronto. Wait times for surgical assessment, referral related MRI, appropriateness of referral and proportion proceeding to surgical management were recorded at each site.

Results

Overall 386 patients were referred for surgical assessment. Average wait-time for surgical assessment was 5.4 weeks, 4.3 weeks, and 2.2 weeks at the metropolitan, urban, and rural centres respectively compared to greater than 5-6 months pre-ISAEC. Referral MRI utilization for the group decreased by 31% when compared to previously published Canadian Spine Society (CSS) data from Busse et al. Of the patients referred for formal surgical assessment 80% were deemed to have leg dominant pain and 96% were deemed appropriate surgical referrals (i.e. had a presentation that was amenable to surgical intervention). The proportion of patients that elected to undergo surgery varied between 25% and 66%. Comparatively, CSS data demonstrated that 82% of spine surgeons reported a proportion less than 20%.

Conclusions

A networked, shared-cared model of care for patients with low back-related symptoms significantly improved access for surgical assessment and management recommendations despite varying geographic practice settings and barriers. The greatest reductions were noted in the rural setting. In addition, significant improvements in referral appropriateness and efficiency (imaging utilization and surgical conversion rate) were achieved compared to historical reports across sites.
1.08

Reliability of the Spine CPR score among Emergency physicians

Godefroy Hardy St-Pierre, Michael Yang, John Hurlbert, Ken Thomas  
University of Calgary, Calgary, AB, Canada

Objectives

The Spine CPR score (Clinical Pathological Radiological) is the third iteration of the Calgary Spine Severity score. Attempted validation of that initial system lead to further modification published in October 2015. This score separates spine referrals into four time classes: routine, priority, urgent and emergent. It stratifies patients according to clinical, radiological and pathological findings. We aimed to find if the Spine CPR score had good inter-observer reliability among ER physicians as well as validity compared to a spine surgeon standard.

Method

We crafted 15 clinical vignettes accessible online joined with the Spine CPR score. 20 ER physicians at one center were asked to score each vignette from 1 to 5 in each category respectively clinical, pathological and radiological. A spine surgeon was asked to do the same. Total score were computed and associated with their respective time class. Inter-observer reliability was assessed with Fleiss’ kappa. Validity was assessed by the average Cohen’s kappa between the average score of the ER physicians compared to the spine surgeon standard.

Results

Fleiss’ kappa between the ER physicians was 0.805 corresponding to an excellent level of agreement on the Landis and Koch grading system. Overall average level of agreement was 91%. Similarly, the average Cohen’s kappa between the average score of the ER physicians compared to the spine surgeon standard was 0.849 also corresponding to an excellent level of agreement. Of note, agreement was 100% on all 4 vignettes presenting situations classified as Emergent respectively cauda equina, epidural abscess, rapidly progressive myelopathy and unstable fracture associate with a spinal cord injury. The vignette with the lowest agreement at 36% was a tethered cord with a stable myelopathy.

Conclusions

The Spine CPR score shows excellent inter-observer reliability and validity among ER physicians.
1.09

Deriving a clinical prediction model for degenerative spine disorders

Michael Yang, Godefroy Hardy St-Pierre, Stephan Duplessis
University of Calgary, Calgary, AB, Canada

Objectives

Surgeons base their decision-making on many variables including the undefinable clinical acumen. Trying to define which pre-operative variables correlate with offer of surgical treatment, we aimed to identify low risk and high risk groups of patients by creating a clinical prediction model.

Method

We performed retrospective analysis of prospectively collected data at the Foothills medical center on 1371 patients from 2009-2014. 231 variables were collected under the headings patient characteristics (age, height, weight, bmi, etc.) comorbidities, past surgeries and injuries, pain descriptors, conservative management, functional indicators, occupational variables, VAS back and leg, PDQ-9 and SF-12. A decision analysis model was used, with logistic regression analysis for the odds of having surgery based on pre-operative factors.

Results

We performed multivariate logistical regression analysis which revealed five variables leading to a convergent model: sitting tolerance > 2 hrs (OR 9.42), prior spine OR (OR 5.16), spine injections (OR 3.24), unlimited walking distance (OR 0.03) and walking distance > 1 mile (OR 0.06). Overall model accuracy was 81% with area under the curve at > 0.84 approaching excellent (0.90). All other variables were non-significant.

Conclusions

Direct functional metrics dominate the decision making process overshadowing traditional scales such as the VAS, PDQ-9 and SF-12. Sitting tolerance is possibly a good proxy measure differentiating back from leg pain. Prior spine OR possibly increases the probability of structural abnormality deemed causative of the presenting symptom. Spine injections are used and trusted as a diagnostic tool. Further statistical testing is required to refine this model.
1.10

Development of Validated Computer Based Preoperative Predictive Model for Reaching ODI MCID with 86% Accuracy based on 198 ASD Patients with 2-year Follow-up

Justin Scheer¹, Tamir Ailon², Justin Smith³, Christopher Shaffrey³, Eric Klineberg⁵, Frank Schwab⁶, Christopher Ames⁴, International Spine Study Group⁷

¹University of California San Diego, San Diego, CA, USA, ²University of British Columbia, Vancouver, BC, Canada, ³University of Virginia, Charlottesville, VA, USA, ⁴University of California San Francisco, San Francisco, CA, USA, ⁵University of California Davis, Sacramento, CA, USA, ⁶Hospital for Special Surgery, New York, NY, USA, ⁷, USA

Objectives

Surgical correction of adult spinal deformity (ASD) results in significant improvement in patients' disability as measured by ODI with the goal of reaching at least 1 MCID. However, it remains unknown what the specific drivers behind reaching MCID are. This study attempts to develop a preoperative predictive model to identify patients likely to reach ODI MCID.

Method

Inclusion criteria: age ≥18, ASD. 43 variables were included in the initial training of the model and included demographic data, comorbidities, modifiable surgical variables, baseline HRQOL, and coronal and sagittal radiographic parameters. Patients were grouped by meeting at least 1 ODI MCID or not at 2-year follow-up. An ensemble of decision trees was constructed using the C5.0 algorithm with 5 different bootstrapped models. Internal validation was accomplished via a 70:30 data split for training and testing each model, respectively. Final predictions from the models were chosen by voting with random selection for tied votes. Overall accuracy, and the area under a receiver operator characteristic curve (AUC) were calculated.

Results

198 patients were included, (MCID:109, NotMCID:89). The overall model accuracy was 86.0% correct with an AUC of 0.94 indicating a very good model fit. 11 variables were determined to be the top predictors (importance >0.90) of MCID outcome and included (in decreasing importance): gender, SRS activity, back pain, SVA, PI-LL, primary vs revision, T1SPI, ASA grade, T1PA, SRS pain, SRS total.

Conclusions

A successful model (86% accuracy, 0.94 AUC) was built predicting reaching ODI MCID. Most of the important predictors were not modifiable surgically indicating that the baseline clinical and radiographic status of the patient is a critical factor for reaching ODI MCID. This model can set the groundwork for preoperative point of care decision making and better education for expected outcomes for patients undergoing ASD surgery.
1.11

Validation of the Spine CPR score

Godefroy Hardy St-Pierre¹, Michael Yang¹, John Hurlbert¹, Ken Thomas¹, Andrew Nataraj²

¹University of Calgary, Calgary, Canada, ²University of Alberta, Edmonton, Canada

Objectives

The Spine CPR score (Clinical Pathological Radiological) is the third iteration of the Calgary Spine Severity score. This triage score is 12 years in the making. This score separates spine referrals into four time classes: routine, priority, urgent and emergent. It stratifies patients according to clinical, radiological and pathological findings. We aim to validate the Spine CPR score.

Method

We applied the Spine CPR to an unselected sample of patients from the Foothills Medical Center between April 2014 and September 2014: it was the same time period the 2nd iteration of the CSSS was derived from an Edmonton dataset. Variables collected were: elective/emergent OR, time to OR, clinical, pathological and radiological CPR. We compared the time to OR predicted by the Spine CPR in one of its four categories (Routine > 6 months = CPR 3-5, Priority < 6 months = CPR 6-8, Urgent < 1 month = CPR 9-11 and Emergent < 1 week = CPR 12-15) with the actual time to OR and corresponding time class. The current dataset was compared to the prior Edmonton dataset via ANOVA.

Results

859 patients were analyzed. 812 had sufficient information available to be scored. 49 were a mismatch with the actual time to OR for an accuracy of 93%. The Spine CPR score overestimated the urgency in 37 cases and underestimated it in 12 cases all within 1 time class. Average Clinical, Pathological and Radiological scores were respectively 3.31, 1.85 and 2.69 with an average Spine CPR score of 7.92. This was no different from the Edmonton dataset via ANOVA (p = 0.34/0.42/0.091/0.14)

Conclusions

The Spine CPR score is an accurate and easy to use validated triage score. Further statistical testing is required to ensure that the derivation and validation dataset are comparable.
Can Ultrasound Detect Curve Progression of Scoliosis Without Ionizing Radiation?

Edmond Lou¹², Rui Zheng¹, Doug Hill¹², Marc Moreau¹, Douglas Hedde¹, Sarah Southon¹²
¹University of Alberta, Edmonton, Alberta, Canada, ²Alberta Health Services, Edmonton, Alberta, Canada

Objectives

Ultrasound (US) imaging technique has been validated to reliably and accurately measure coronal curvature of children with adolescent idiopathic scoliosis (AIS). The average US measurement difference for 107 AIS curves was 2.7°±1.9° compared to radiographic Cobb angles. However, the sensitivity of ultrasound measurements is still questioned in monitoring non-progressive cases of children with AIS.

Method

Sixty-five participants (54F;11M; Age: 14.7±1.9 years) were consented and recruited. All participants a) were diagnosed with AIS; b) had no surgical treatment prior to participation; c) had no in-brace radiographs in both previous and current exams, and d) the major Cobb angle was less than 45° in the previous radiograph. The standing postero-anterior radiograph and US spine were obtained during the regularly scheduled scoliosis clinic. To simulate a clinical practice to detect possible curve progression, the current ultrasound measurement was compared with the previous known radiograph measurement. To determine the Cobb angle from the ultrasound images, the current US image was overlaid on the previous radiograph during measurement.

Results

Overall, 109 curves including 62 mild (10-25°) and 47 moderate curves (26-45°) were obtained from the clinical records. However, two mild curves were not detected in the current US images. From the clinical records, 11 participants had curves progressed >5° between successive clinic visits, while ultrasound only detected 6. The sensitivity and specificity from ultrasound measurements were 54.5% and 96.3%, respectively. Also, the positive and negative predictive values were 75.0% and 91.2%, respectively. However, if a 6° difference between clinical records and the ultrasound measurement were used as the progression threshold, the sensitivity and specificity improved to 81.8% and 100%, respectively.

Conclusions

Using a 6° difference between the US and previous clinical record, it was 100% specific that there was no curve progression. Therefore, ultrasound imaging can be used to monitor AIS patients without exposing them to ionizing radiation.
Relationship between age and non-operative utilization in elective cervical spine surgery.

Sarfraz Malleck, Michael Johnson, Michael Goytan, Steven Passmore, Greg McIntosh
University of Manitoba, Winnipeg, Manitoba, Canada

Objectives
Request for spine surgeon consultation often exceeds the rate at which patients can be assessed, leading to waiting periods often measured in years. Recent analysis of the Canadian Spine Outcomes and Research Network (CSORN), reported near 50% of surgically consented thoracolumbar patients received no non-operative therapy, but those that did reported improved outcomes post spine surgery. This raises the question of what type of treatment barriers do pre-surgical patients face. An understanding of this issue could lead to improved participation in pre-surgical functional restoration programs and potentially improved surgical outcome.

Our objective was to determine whether a relationship exists between patient age and non-operative care utilization in candidates for cervical spine surgery. Our hypothesis was that the older patients are less likely to utilize non-operative care prior to cervical spine surgery.

Method
This was a retrospective study of prospectively collected data from one site within CSORN (n=147). Participants had degenerative spinal pathology or deformity of the cervical region, with no evidence of trauma, infection, or neoplasm and consented between January 2013 and June 2015. Data was analyzed using a one-way ANOVA model to compare the age of elective spinal surgery patients (M=56.7 years, SD=12.8) and their non-operative utilization frequency (>30 times, some, none) in the six months prior to orthopedic spine surgery.

Results
Patients who exhausted non-operative care were significantly younger (M=49.7 years, SD=10.4) than patients who chose not to attend non-operative care (M=58.4 years, SD=12.7) in the 6 months prior to spine surgery F(2,146)=3.99; p=0.02.

Conclusions
In this sample, older patients tended not to exhaust non-operative care prior to cervical spine surgery. It is possible that older patients may no longer have the benefits, income, or social supports and/or may have a different philosophy towards exercise. The extent of pre-surgical care is essential information for surgeons to know.
1.14 Larger global sagittal correction associated with increased PJK and major complications, but lead to better correction and HRQL scores

A Soroceanu¹, J Smith², V Lafage³, E Klineberg¹⁰, T Ailon⁴, C Ames⁵, C Shaffrey², M Gupta⁶, K Kebaish⁷, D Scubbia⁷, R Hart⁸, R Hostin⁶, F Schwab³

¹University of Calgary, Calgary, Canada, ²University of Virginia, Charlottesville, USA, ³Hospital for Special Surgery, New York, USA, ⁴University of British Columbia, Vancouver, Canada, ⁵University of California, San Francisco, San Francisco, USA, ⁶Washington University, St Louis, USA, ⁷Johns Hopkins University, Baltimore, USA, ⁸OHSU, Portland, USA, ⁹Baylor Scoliosis Center, Plano, USA, ¹⁰UC Davis, Sacramento, USA

Objectives

In recent years, emphasis has been placed on restoring sagittal alignment when performing adult spinal deformity (ASD) surgery. This study examines the impact of the magnitude of sagittal correction on complications and HRQL in ASD patients.

Method

Retrospective review of a multicenter database of surgical ASD patients undergoing PSO. Magnitude of correction was assessed using the T1-pelvic angle (TPA). Outcomes included complications, unplanned return to the OR, postop alignment, and 1-year HRQL. Multivariate linear, logistic and poisson regression was performed.

Results

199 patients met inclusion criteria. Larger TPA correction was associated with increased major complications (IRR 1.29 per 10⁰, p=0.004), increased post-operative complications (IRR 1.28 per 10⁰, p=0.031), increased PJK r(OR 1.69 per 10⁰, p=0.012), and more frequent unplanned return to the OR (OR 1.86 per 10⁰, p=0.049). Larger TPA correction led to better post-operative sagittal alignment (SVA coef 19.05 p=0.001, PI-LL coef 7.81 p=0.001, PT coef 5.02 p=0.0001), and better improvement on the SRS-22 (coef 0.44 p=0.0001).

Conclusions

In ASD patients with severe sagittal deformity, larger corrections lead to better post-operative alignment and greater improvement in SRS-22 scores. However, this came at the cost of increased major complications, post-operative complications, and increased incidence of radiographic PJK.
1.15

Comprehensive analysis of SRS appearance domain score drivers and comparative relationship to satisfaction in adults

A Soroceanu¹, M Kelly², J Smith³, J Scheer⁹, V Lafage⁴, T Protopsaltis⁵, R Lafage⁴, R Hostin⁶, K Kebaish⁷, M Gupta², R Hart⁵, F Schwab⁴, C Ames⁵
¹University of Calgary, Calgary, Canada, ²Washington University, St Louis, USA, ³University of Virginia, Charlottesville, USA, ⁴Hospital for Special Surgery, New York, USA, ⁵New York University, New York, USA, ⁶Baylor Scoliosis Center, Plano, USA, ⁷Johns Hopkins University, Baltimore, USA, ⁸OHSU, Portland, USA, ⁹UCSF, San Francisco, USA

Objectives

The importance of appearance in adult spinal deformity (ASD) may be under appreciated. Little work has analyzed preoperative appearance determinants and drivers of postoperative appearance domain improvements in this population. This study aims to identify drivers of post-operative appearance scores, and assess the importance of appearance on patient satisfaction in adult spinal deformity.

Method

A multicenter prospective database of surgical ASD patients was reviewed. We included patients with 2-year follow up. Appearance was measured using the SRS22 appearance domain. We analyzed the impact of sagittal and coronal alignment on pre-operative appearance scores, the impact of deformity correction on post-operative improvement of appearance scores, and the relationship between improvement on the SRS appearance domain and patient satisfaction. Pearson correlation tests and t-tests were performed.

Results

260 patients met inclusion criteria. At baseline, global sagittal alignment was moderately correlated with SRS appearance (SVA -0.36, p<0.0001, TPA -0.38, p<0.0001). Baseline pelvic parameters correlated moderately with baseline SRS appearance (PT -0.31, p<0.0001, PI-LL -0.33, p<0.0001). There was no correlation between baseline appearance and thoracic kyphosis or cervical alignment. There was no correlation between SRS appearance and baseline coronal alignment. Postoperative improvement of the global sagittal alignment was associated with improvement on the SRS appearance domain (SVA -0.24, p<0.0001, TPA 0.20, p<0.0001). There was no correlation between postoperative improvement in the coronal plane and improvement in appearance scores. Shifting the apical lordosis lower was associated with improved appearance scores. Appearance had the greatest correlation to postoperative satisfaction (0.51, p<0.0001) of all SRS subdomains.

Conclusions

Appearance score has the highest correlation to post-op satisfaction of all domains. Those with larger sagittal malalignment at baseline had worse pre-operative satisfaction scores. Greater improvement of the global sagittal alignment resulted in greater improvement of appearance scores. Coronal alignment did not impact appearance scores.
# PODIUM PRESENTATIONS

**FRIDAY**

**FEBRUARY 26th, 2016**

## Abstracts for Oral Presentation

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<td>Page 109</td>
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<td>Page 36</td>
<td>Page 114</td>
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</tbody>
</table>
2.16

Incremental Cost to Canada's Healthcare System of Acute Complications Following Spinal Cord Injury

Barry White¹, Nicolas Dea², John Street³, Marcel Dvorak³
¹Rick Hansen Institute, Vancouver, British Columbia, Canada, ²Service de Neurochirurgie, Centre Hospitalier Universitaire de Sherbrooke, Sherbrooke, Quebec, Canada, ³Division of Spine, Department of Orthopedics, University of British Columbia, Vancouver, British Columbia, Canada

Objectives

Document the hospital cost of urinary tract infections and pressure ulcers in traumatic-SCI admissions at a specialized spine center in Vancouver, Canada.

Method

Matched case-control methodology (direct/probabilistic) was employed to estimate the excess cost of UTIs and PUs experienced by eligible case series participants in the Rick Hansen SCI Registry. The validated Spine Adverse Events Severity system was used to document complications. Prior to matching, participants were assigned to groups: 1) PUgroup - experienced one or more PU; 2) NoPUgroup - did not experience PUs; 3) UTIgroup - experienced one or more UTI and no other complications; and 4) No complication group – experienced no complications. Individuals assigned to the PUgroup (n=22) were matched with individuals assigned to the NoPU group (n=239) and individuals assigned to the UTIgroup (n=19) were matched with individuals assigned to the No complication group (n=77). Direct hospital costs were based on LOS, transitions between hospital units, and unit daily costs. The excess cost of UTIs and PUs was defined as the mean difference in hospital costs between matched case series participants.

Results

The mean difference in LOS and costs (expenditures for acute hospital accommodations, nursing services, and pharmaceuticals) between PU/noPU pairs was 15.8 d and $18,758. The mean difference in LOS and costs between UTI/no complication pairs was 6.8 d and $7,790. However, reviewed PUs and UTIs were largely described as complications requiring minor non-invasive treatment.

Conclusions

The case series analysis provides conservative estimates of the hospital costs of hospital-acquired UTI and PUs in tSCI admissions to the specialized spine center in Vancouver, Canada. Although the true extent of the personal and societal burden of hospital and community-acquired complications following tSCI is unknown, anecdotal and empirical evidence suggests significant opportunities for returns on investments in interventions and innovations aimed at preventing and treating/managing UTIs and PUs following SCI.
The prevalence and natural history of problematic spasticity following traumatic spinal cord injury

Kaila A. Holtz¹, Rachel Lipson³, Vanessa K. Noonan⁴, Brian K. Kwon⁵, Patricia B. Mills¹
¹University of British Columbia, Division of Physical Medicine and Rehabilitation, Vancouver, British Columbia, Canada; ²ICORD (International Collaboration on Repair Discoveries), Vancouver, British Columbia, Canada; ³Emmes Canada, Burnaby, British Columbia, Canada; ⁴Rick Hansen Institute, Vancouver, British Columbia, Canada; ⁵University of British Columbia, Division of Orthopaedic Spine Surgery, Vancouver, British Columbia, Canada

Objectives

To describe the prevalence of spasticity and anti-spasmodic medication use following traumatic spinal cord injury (SCI) in a large prospective cohort.

Method

A prospective database, the Rick Hansen SCI Registry (RHSCIR). Individuals with a traumatic SCI prospectively enrolled between 2005 and 2014 in the Vancouver site of RHSCIR were eligible for inclusion. Outcome measures included self-report measures of spasticity and abstracted anti-spasmodic medication use from patient charts.

Results

N=465. On community discharge, the prevalence of reported spasticity was 65%. The prevalence of problematic spasticity (defined as being on an anti-spasmodic medication) was 35%. Both values remained stable in community follow-up at 1, 2 and 5 years post-injury. Being discharged on anti-spasmodic medications was significantly associated with patients reporting ongoing spasticity treatment in community follow-up. Relative to all others, patients with cervical and thoracic motor incomplete (AIS C) injuries had the highest prevalence of ongoing problematic spasticity.

Conclusions

Spasticity is a significant medical consequence of SCI. It can be problematic even 5 years post-injury, particularly in patients with incomplete cervical and thoracic injuries. Ongoing spasticity treatment in the community is required in one third of patients with traumatic SCI. Future research is needed to determine optimal clinical management strategies to identify and treat individuals with the highest risk of problematic spasticity.
2.18

Exploring the possibility of using artificial neural networks to predict mortality after spinal cord injury

Nader Fallah\textsuperscript{1,2}, Vanessa Noonan\textsuperscript{1,2}, Jeffery Shum\textsuperscript{1}, Carly Rivers\textsuperscript{1}, John Street\textsuperscript{3}, So Eyun Park\textsuperscript{1}, Elaine Chan\textsuperscript{1}, Tova Plashkes\textsuperscript{1}, Marecek Dvorak\textsuperscript{3}

\textsuperscript{1}Rick Hansen Institute, Vancouver, Canada, \textsuperscript{2}University of British Columbia, Vancouver, Canada, \textsuperscript{3}Division of Spine, Department of Orthopaedics, University of British Columbia, Vancouver, Canada

Objectives

The objective of this study was to determine whether Abbreviated Injury Scale Score (AISS) data in individuals with traumatic spinal cord injury (tSCI) exhibited non-linearity, to propose a new methodology to compute the AISS that accounts for non-linearity and compare with the conventional Injury Severity Score (ISS) (which also utilizes AISS data) in its ability to predict in-patient mortality.

Method

We used demographic and clinical data from persons with tSCI, excluding those with complete injuries, treated at an acute spine centre from 2004-2012. Linear principal component analysis (PCA), non-linear PCA (NLPCA) and neural networks (NN) were used to compute the AISS. The NLPCA was based on a feed-forward back-propagation NN with five layers: input, three hidden, and output. Multivariable logistic regression models were used to assess mortality prediction.

Results

The study cohort consisted of 500 persons with tSCI: 79\% male, mean age 49.3±19.2, and 13.2\% in-patient mortality incidence. We identified that due to the non-linearity of AISS data, NLPCA outperformed ISS and linear PCA in predicting in-patient mortality. The regression coefficients were: 0.44, 0.48 and 0.56 for ISS, linear and non-linear PCA respectively (p<0.01). Additional NNs were used to explore interactions among all risk factors and AISS-NLPCA. These confirmed that age, completeness and neurological level of injury, AISS-NLPCA and classification of spinal column fracture exhibit non-linearity, influence mortality prediction, and need to be considered in the development of future prediction models.

Conclusions

Use of NN methodology to compute the AISS improved the accuracy of predicting acute in-patient mortality following tSCI by accounting for non-linearity. Results of this study will inform the development of new prediction models for mortality after SCI that can inform clinical decision-making and be utilized in SCI research. This approach may also be suitable for other clinical measures where the data exhibits non-linearity.
2.19

**Developing a new index to predict mortality after spinal cord injury using machine learning techniques**

Vanessa Noonan¹,², Nader Fallah¹,², Manekta Bedi¹, Elaine Chan¹, Carly Rivers¹, John Street³, Tova Plashkes¹, Marcel Dvorak³

¹Rick Hansen Institute, Vancouver, Canada, ²University of British Columbia, Vancouver, Canada, ³Division of Spine, Department of Orthopaedics, University of British Columbia, Vancouver, Canada

**Objectives**

The objective of this study was to develop an index [the Spinal Cord Injury Risk Score (SCIRS)] to determine the risk of in-hospital mortality in persons who arrive at an SCI Centre with a traumatic SCI (tSCI).

**Method**

Data from persons with a tSCI enrolled in the Vancouver Rick Hansen SCI Registry from 2004-2012 were included in the development of SCIRS. Using machine learning techniques, non-linear combination of demographic, clinical, and associated injury [measured by the Abbreviated Injury Scale (AIS)] factors was evaluated. Potential factors were identified from bivariate analysis and had statistically significant non-linear relations to mortality prediction. Continuous variables were divided into ranges based on logistic regression, neural network and decision tree models. Weights were assigned to each range and to categorical variables according to their ability to predict mortality. Validation involved comparing accuracy of acute mortality prediction of the SCIRS with the Injury Severity Score (ISS) and the Trauma Injury Severity Score (TRISS) using area under the receiver operating characteristics curve (AUROC).

**Results**

The cohort consisted of 849 persons: 82% male, mean age 46.3±19.8, 39% complete injuries, and 17% incidence of in-hospital mortality. Variables included in the SCIRS, which is scored out of 25, were age, neurological level and completeness of injury, classification of spinal column fracture and the AIS (excluding spine). The values for AUROC, where higher values show greater overall accuracy and performance of each index, were 0.820 (SCIRS), 0.600 (ISS) and 0.699 (TRISS). Additionally, the correctly predicted percentages based on a concordance matrix from logistic regression were 85.4%, 20.4% and 76.2%, respectively.

**Conclusions**

Use of a new instrument (SCIRS) improved accuracy in predicting acute in-patient mortality after tSCI compared to conventional injury severity scores. SCIRS will help clinicians in early decision making for SCI patients; however, further validation is needed.
2.20

The impact of complications and opportunities to improve function, health and quality of life: our best approach to ‘cure’ SCI today

Joel Finkelstein¹, Vanessa Noonan²,³, Nader Fallah²,³, Chester Ho⁴, Eve Tsai⁵, Carly Rivers², Catherine Truchon², A.G. Linassi¹, Colleen O’Connell⁶, Andrea Townson³, Henry Ahn⁷, Brian Drew¹⁰, Marcel Dvorak³, Michael G. Fehlings¹¹,⁹, Carolyn Schwartz¹², Luc Noreau⁰

¹Sunnybrook Health Sciences Centre, Toronto, ON, Canada, ²Rick Hansen Institute, Vancouver, BC, Canada, ³University of British Columbia, Vancouver, BC, Canada, ⁴University of Calgary, Calgary, AB, Canada, ⁵University of Ottawa, Ottawa, ON, Canada, ⁶Institut National d’Excellence en Santé et Services Sociaux (INESSS), Quebec City, QC, Canada, ⁷University of Saskatchewan, Saskatoon, SK, Canada, ⁸Dalhousie Faculty of Medicine, Fredericton, NB, Canada, ⁹University of Toronto, Toronto, ON, Canada, ¹⁰McMaster University, Hamilton, ON, Canada, ¹¹Toronto Western Hospital, Toronto, ON, Canada, ¹²Delta Quest Foundation Inc., Concord, MA, USA, ¹³Université Laval, Centre for Interdisciplinary Research in Rehabilitation and Social Integration, Quebec City, QC, Canada

Objectives

To analyze relationships among injury and demographic variables, health status, and life satisfaction in persons with traumatic spinal cord injury (tSCI).

Method

Patients admitted with tSCI enrolled in the Rick Hansen Spinal Cord Injury Registry (RHSCIR) from 2004-2014 were included. A 5-layer path analysis was used to examine relationships among: Layer 1-tSCI severity [ASIA Impairment Score (AIS), AIS A (complete) to AIS D (incomplete)] and anatomical level (cervical, thoracolumbar), age, marital status, education, living situation/setting; Layer 2-number of complications at follow-up; Layer 3-1 year post-discharge Functional Independence Measure (FIM); Layer 4-physical (PCS) and mental (MCS) component scores of the SF-36v2; and Layer 5-Life Satisfaction-11 score. Path analysis was conducted using Mplus 7.1. Model fit was assessed using Chi-square, Comparative Fit Index, Root Mean Square Error, and Standardized Root Mean Square Residual.

Results

599 participants were included: 79.5% were male; mean age was 44.8 (± 18.2); 33.2% were motor/sensory complete (AIS A). Model fit was excellent. Complications increased with age, more severe injuries, higher BMI, unemployment, and assisted living. FIM decreased (lower function) with more severe injuries, unemployment, living alone, and with having multiple complications. PCS and MCS decreased (worse physical/mental health) with lower education, and more complications; PCS was lower in participants with more severe injuries, but MCS was not. A higher MCS was associated with a lower FIM (surrogate of injury severity) and higher LISAT score (greater life satisfaction) was associated with being married, higher FIM, and fewer complications.

Conclusions

Older age, unemployment, living setting and more severe injuries are associated with greater complications and poorer function. Participants with severe injuries better adapt which is likely due to participants with incomplete injuries having higher expectations for recovery. Complications negatively impact function, health (mental/physical) and life satisfaction and provide an opportunity for clinicians to significantly improve patient outcome.
2.21

Delays in time from injury to specialized SCI centres increase in-hospital mortality in acute SCI.

Carly Rivers¹, Freda Warner², Vanessa Noonan¹,², Nader Fallah¹,², Charles Fisher², Colleen O'Connell³, Eve Tsai⁴, Henry Ahn⁵, Najmedden Attabib⁶, Sean Christie⁶, Brian Drew⁷, Joel Finkelstein⁸, Daryl Fourné⁹, Jérôme Paquet¹⁰, Stefan Parent¹¹, Dillinuer Kuerban, Marcel Dvorak¹², Rick Hansen Institute, Vancouver, BC, Canada, University of British Columbia, Vancouver, BC, Canada, Stan Cassidy Centre for Rehabilitation, Saint John, NS, Canada, University of Ottawa, Ottawa, ON, Canada, University of Toronto, Toronto, ON, Canada, Dalhousie University, Halifax, NS, Canada, McMaster University, Hamilton, ON, Canada, Sunnybrook Health Sciences Centre, Toronto, ON, Canada, University of Saskatchewan, Saskatoon, SK, Canada, Laval University, Quebec City, QC, Canada, Université de Montréal, Montréal, QC, Canada

Objectives

Despite improvements in prevention and care, the life expectancy of those with traumatic SCI (tSCI) remains lower than able-bodied individuals. The objectives of this study are to determine the incidence of in-hospital mortality and the importance of patient, injury and system level risk factors on in-hospital mortality.

Method

In-hospital mortality was defined as death which occurred during an in-hospital admission at a specialized SCI centre following tSCI. 3,446 tSCI patients in the Rick Hansen Spinal Cord Injury Registry were identified (2004-2014). Kaplan-Meier curves and Cox regression were used to examine the effect (unadjusted and adjusted) of age, gender, etiology, level of injury (C1-T9), AIS grade (A-D), Injury Severity Score (ISS), Charlson Comorbidity Index (CCI), and time to acute care admission at a RHSCIR site in identifying risk of in-hospital mortality.

Results

The overall incidence of in-hospital mortality was 6% (207/3446); 1499 had all model data available, of which 79 (5.3%) died in-hospital. Significant predictors of mortality identified in the multivariable model included increasing age (Hazard ratio (HR)=3.24 for 61-75y, HR=19.07 for 76y+), CCI≥3 (HR=4.31), cervical injuries (low cervical HR=3.14, high cervical HR=6.36), AIS A injuries (HR=3.46), and time to acute care >12h (HR=1.73). Available ICD-10 codes identified head trauma in 7.2% of non-mortality cases and 17.6% of mortality cases.

Conclusions

As expected in-hospital mortality is influenced by multiple factors including age, injury level/completeness, and comorbidities can be used to identify high-risk patients. Delays in transport to specialized SCI centres was an important unexpected factor associated with increased mortality (73% increased risk in those transported >12h), which supports previous evidence supporting the need for specialized care for these patients.
2.22

The Modified Extremity Motor (MEM) Classification: A Neurological Classification Of Traumatic Central Cord Syndrome (TCCS)

Jin Tee¹, Jérôme Paquet², Vanessa Noonan¹,³, Brian Kwon¹, Eve Tsai⁴, Sean Christie⁵, Carly Rivers³, Dilinuer Kuerban³, Henry Ahn⁶, Najmedden Attabib⁵, Christopher Bailey¹, Brian Drew⁶, Michael Fehlings⁶, Joel Finkelstein³, Daryl Fourney³, R. John Hurlbert¹⁰, Stefan Parent¹¹, Charles Fisher¹, Marcel Dvorak¹, University of British Columbia, Vancouver, BC, Canada, "Laval University, Quebec City, QC, Canada, "Rick Hansen Institute, Vancouver, BC, Canada, "University of Ottawa, Ottawa, ON, Canada, "Dalhousie University, Halifax, NS, Canada, "University of Toronto, Toronto, ON, Canada, "Western University, London, ON, Canada, "McMaster University, Hamilton, ON, Canada, "University of Saskatchewan, Saskatoon, SK, Canada, "University of Calgary, Calgary, AB, Canada, "University of Montreal, Montreal, QC, Canada

Objectives

To introduce a neurological classification of TCCS based on the difference of upper and lower extremity motor scores (UEMS< LEMS).

Method

The Rick Hansen SCI Registry was queried for cervical spine trauma patients with baseline AIS grades of C/D from registry conception till September 2015. Neurological standards were as defined by the International Standards for the Neurological Classification of Spinal Cord Injury (ISNCSCI). Two neurological classifications were devised and examined: (1) MEM with UEMS< LEMS of 1-10 and >10; and (2) Alternative with UEMS< LEMS of 1-4, 5-10, >10. Statistical methods included bivariate and multivariate regression modelling.

Results

RHSCIR query returned 240 patients with AIS C/D and UEMS< LEMS of ≥1. Both groups had similar demographics. The MEM classification was able to discriminate for neurological outcome on discharge (p=0.0197). The MEM classification was also able to discriminate for: (1) ratio of high to low cervical (C1-C4) injuries (p=0.0121); (2) mean admission UEMS (p<0.0001); and (3) total motor score on admission (p<0.0001). The Alternative TCCS classification group was not able to discriminate for outcome (p=0.0613). It was however able to discriminate for: (1) mechanism of injury (p=0.0224); (2) ratio of high cervical (C1-C4) to low cervical (C5-C7) injury levels (p=0.0258); and (3) mean admission UEMS (p<0.0001).

Conclusions

The Modified Extremity Motor (MEM) Classification, an AIS motor score based neurological classification of TCCS discriminates for neurological outcome and as such can be used for both research and clinical purposes.
2.23

The Stable Spine Central Cord Syndrome (SCCS): a prospective surgical cohort.

Jérôme Paquet¹, Vanessa Noonan²,³, Brian Kwon², Eve Tsai⁴, Sean Christie⁵, Carly Rivers³, Henry Ahn⁶, Najmedden Attabib⁵, Christopher Bailey⁷, Brian Drew⁸, Michael Fehlings⁶, Joel Finkelstein⁶, Daryl Fourniey⁵, R. John Hurlbert¹⁰, Stefan Parent¹ⁱ, Dilinuer Kuerban³, Marcel Dvorak², ¹Laval University, Quebec City, QC, Canada, ²University of British Columbia, Vancouver, BC, Canada, ³Rick Hansen Institute, Vancouver, BC, Canada, ⁴University of Ottawa, Ottawa, ON, Canada, ⁵Dalhousie University, Halifax, NS, Canada, ⁶University of Toronto, Toronto, ON, Canada, ⁷Western University, London, ON, Canada, ⁸McMaster University, Hamilton, ON, Canada, ⁹University of Saskatchewan, Saskatoon, SK, Canada, ¹°University of Calgary, Calgary, AB, Canada, ¹¹University of Montreal, Montreal, QC, Canada

Objectives

Traumatic central cord syndrome (TCCS) is a clinical diagnosis. Emergent surgical treatment is usually the gold standard treatment for tSCI. However, optimal treatment sequence for the central cord injury population with “isolated” spondylotic or “stable spine” (Stable spine Central Cord Syndrome (SCCS)) is uncertain. Literature specifically addressing this topic is sparse and poor quality. Similarly, few articles have clearly separated TCCS using spine stability as a variable for their analysis. The purpose of this study aimed to determine any demographic, surgical practice or outcome differences in the treatment of TCCS patients, using spine stability as the main variable, from a prospective tSCI database.

Method

tSCI patients from the Rick Hansen Spinal Cord Injury Registry (RHSCIR), prospectively recruited from 2004-2014 from 18 acute care participating centres across Canada were studied. Those with AIS A/B/C/D and cervical level of injury (C0-T1) were divided into a SCCS cohort (stable) and unstable cervical spine (UCS) cohort. Patient, surgical, and systems data and outcome (change in motor score) were compared using chi-squared or Wilcoxon tests as appropriate.

Results

533 participants were included, 176 (11.8%) with SCCS. Compared to the UCS cohort, SCCS were older (58.8 vs 44.1y), more likely male (86.4 vs 75.9%), injured by a fall (67.4% vs 35.1%), having comorbidities (41.6% vs 18.9%), and having AIS C/D (81.3% vs 47.3%) and high cervical injuries (58.5% vs 43.1%). SCCS were less likely to have surgery (67.6% vs 92.7%), and when having surgery had a longer delay from injury to surgery (77.2 vs 49.1h). The SCCS cohort had a significantly greater change in total motor score from admission to discharge (23.2 vs 17.0 points) compared to the UCS cohort.

Conclusions

SCCS population seems to be unique related to demographics, neurology, management and outcomes. Inclusion of spine stability with neurology variables is a more accurate way to classify CCS.
Changes following acute traumatic spinal cord injury: A prospective pilot study on serial MRIs.

Joost Rutges, Brian Kwon, Marcel Dvorak
Vancouver General Hospital, Vancouver, BC, Canada

Objectives

The extent of spinal cord compression, haemorrhage, and edema on MRI scans of patients with acute spinal cord injury(SCI) have been reported to be potential predictors of neurological recovery. However little is known regarding the temporal changes of these MRI findings in the first weeks after injury. Therefore the objective of this study is to characterize the dynamic nature of these MRI findings during the first weeks following SCI. Our goal is to understand how these MRI changes relate to both early and late neurologic function.

Method

Patients with acute traumatic cervical SCI admitted within 24hrs after injury were eligible. Six serial scans were planned at 24hrs, 48hrs, 96hrs, 1, 2 and 3 weeks after injury. On each scan, vertical length of cord edema, anatomic point of cord compression, maximum spinal cord compression, maximum canal compromise, presence and length of hematoma were determined.

Results

Eight patients, mean age 54 years, with acute traumatic SCI were included. Injury level ranged from C4-C6 and the baseline ASIA Impairment Scale(AIS) grade ranged from A-D. Compared to the initial MRI, the length of cord edema increased in the first 96hrs with 40% followed by a gradual decrease, resulting in 20% less edema at three weeks. Hematoma was only found in the AIS-A patients. Length of hematoma was stable during the first two weeks and decreased till 60% at three weeks after injury. Spinal cord compression and bony spinal canal compromise were respectively 24% and 34% on the initial MRI and were both resolved at three weeks.

Conclusions

Although preliminary, this study identified a clear pattern of spinal cord changes in the first weeks after injury on MRI. The vertical length of edema peaks around 96hrs, and then begins to subside. Many of the acute changes have resolved by 3 weeks post-injury.
Next-Generation MRI Identifies Tract-Specific Injury And Predicts Focal Neurological Deficits in Degenerative Cervical Myelopathy: Development and Characterization of Accurate Imaging Biomarkers for Spinal Cord Pathologies

Allan R. Martin¹, Izabela Aleksanderek¹, Julien Cohen-Adad², David W. Cadotte¹, Sukhvinder Kalși-Ryan¹, Benjamin De Leener², Justin Wang³, Adrian Crawley¹, David J. Mikulis¹, Howard Ginsberg¹, Michael G. Fehlings¹
¹University of Toronto, Toronto, Ontario, Canada, ²Polytechnique Montreal, Montreal, Quebec, Canada, ³Queens University, Kingston, Ontario, Canada

Objectives

MRI techniques are emerging that can characterize aspects of spinal cord microstructure: diffusion tensor imaging (DTI), magnetization transfer (MT), and T2*-weighted imaging. This prospective study investigated if these techniques can quantify injury to individual tracts and predict focal neurological impairments in degenerative cervical myelopathy (DCM).

Method

Twenty-eight DCM patients (age 55.3; 68% male; 15 mild, 7 moderate, 6 severe) underwent detailed clinical assessments and multimodal MRI (3T GE), and 23 healthy subjects served as controls, undergoing MRI. Analysis with Spinal Cord Toolbox extracted fractional anisotropy (FA), mean diffusivity (MD), MT ratio (MTR), and T2* white matter(WM)/grey matter (GM) ratio (reflecting grey-white contrast) from lateral corticospinal tracts (LCSTs), dorsal columns (DCs), and spinothalamic tracts (STTs) at C1-C2. Spearman correlations were calculated between each metric in each WM tract and the following measures of focal neurological/functional impairment in DCM subjects: mJOA upper/lower extremity (UE/LE) motor scores, UE strength, JAMAR grip force, UE sensation, and Berg Balance (BB) scale.

Results

DCM subjects showed reduced FA (p<0.05), increased MD (p=0.07), decreased MTR (p<0.05), and increased T2*-WM/GM ratio (p<0.05) compared to healthy subjects. Among MRI metrics, FA provided the strongest correlations with all clinical measures (all p<0.05). The strongest correlation with mJOA motor scores was FA of the bilateral LCSTs (r=0.64). FA of the ipsilateral LCST predicted arm power (left: r=0.62, right: r=0.57) and grip strength (left: r=0.56, right: r=0.54). FA of the DCs correlated well with ipsilateral sensation (left: r=0.66, right: r=0.67, p<0.05) but the contralateral STTs did not (left: r=0.31, right: r=0.27, p=0.14). FA in the DCs correlated moderately with BB (r=0.51).

Conclusions

Advanced MRI techniques demonstrate pathological WM changes rostral to cord compression in DCM. In particular, the DTI metric FA can quantify tract-specific injury and predict focal deficits. This lays the groundwork for the establishment of accurate imaging biomarkers for spinal cord pathologies.
Translating State-Of-The-Art Spinal Cord MRI Techniques To Clinical Use: A Systematic Review Of Clinical Studies Utilizing DTI, MT, MWF, MRS, and fMRI

Allan R. Martin¹, Izabela Aleksanderek¹, Julien Cohen-Adad², Zenovia Tarmohamed³, Lindsay Tetreault¹, Nathaniel Smith⁴, David W. Cadotte¹, Adrian Crawley¹, Howard Ginsberg¹, David J. Mikulis¹, Michael G. Fehlings¹
¹University of Toronto, Toronto, Ontario, Canada, ²Polytechnique Montreal, Montreal, Quebec, Canada, ³Royal College of Physicians and Surgeons, Dublin, Ireland, ⁴McMaster University, Hamilton, Ontario, Canada

Objectives

A recent meeting of international imaging experts sponsored by the International Spinal Research Trust (ISRT) and the Wings for Life Foundation identified 5 state-of-the-art MRI techniques with potential to transform the field of spinal cord imaging by elucidating aspects of microstructure and function: diffusion tensor imaging (DTI), magnetization transfer (MT), myelin water fraction (MWF), MR spectroscopy (MRS), and functional MRI (fMRI).

Method

A systematic review was conducted using MEDLINE, Embase, and Cochrane databases to identify English language studies that investigated utility, in terms of diagnosis, correlation with disability, and prediction of outcomes, of these techniques in spinal cord pathologies. Data regarding study design, subjects, technical methods, clinical measures, and analysis techniques were extracted to identify trends. Studies were assessed for risk of bias, and overall quality of evidence was assessed using GRADE.

Results

Our search returned 6597 unique citations, and after full-text review of 274 articles, 104 were included. 69 DTI and 25 MT studies were identified, with both recently showing sharp increases, in addition to 1 MWF, 11 MRS, and 8 fMRI studies. Most studies were exploratory, showing high (73%) or moderately high (21%) risk of bias. Acquisition techniques varied widely across studies. The DTI metric fractional anisotropy (FA) showed moderate evidence of correlating with disability in several pathologies, low evidence of group differences vs. controls, and insufficient evidence for diagnosis or prognosis. Numerous other metrics show very low evidence to demonstrate group differences, and insufficient evidence as diagnostic tests, biomarkers, or prognostic tools.

Conclusions

Novel MRI techniques have tremendous potential to enhance management of spinal pathologies, but current evidence shows limited clinical utility. DTI is the most mature, but requires further refinement and standardization prior to widespread utilization. Studies with a priori hypotheses, standardized acquisitions, detailed clinical assessments, and automated analysis tools are needed to facilitate clinical translation.
2.27

Motor Cortex Electrical Stimulation to Promote Spinal Cord Injury Recovery in an Animal Model

Andrew Jack, Andrew Nataraj, Karim Fouad

University of Alberta, Alberta, Canada

Objectives

Many treatment regimens for spinal cord injury (SCI) have been trialed with limited success. Electrical stimulation (ES) to promote corticospinal tract (CST) repair has been more recently examined, though remains under investigated. We examine the role of motor cortex ES on axonal re-growth, plasticity, and functional recovery in a SCI rat model.

Method

A dorsal lateral quadrant SCI was performed at C₄ in 50 rats. Animal groups consisted of ES333 rats (333Hz, biphasic pulse, 0.2ms duration every 500ms), ES20 (20Hz, biphasic pulse, 0.2ms duration every 1ms), SCI only rats, and sham rats (insertion of electrodes without stimulation). Rats were trained in the Montoya grasping stairwell task with subsequent SCI and ES. Post-injury reaching scores were recorded weekly, and histological and lesion analysis completed quantifying axonal re-growth (both collateralization and regeneration).

Results

Each respective animal group’s post-lesioning grasping success (p-value<0.001, ANOVA) and farthest well reached was significantly lower than baseline values (p-value<0.001, ANOVA). No significant difference was found between groups for CST lesion size, nor post-injury reaching success (p-value=0.48, ANOVA). However, an inadequate sample size cannot be ruled out in explaining the lack of effect seen from ES on clinically relevant functional outcomes (post-hoc power analysis: 0.59).

Significantly more collaterals (axonal sprouts rostral to lesion) were found in the ES animals compared to control animals (ES333 p-value<0.001 and ES20 p-value=0.02, ANOVA), although no difference was found between the two ES groups (p-value=0.86, ANOVA). Furthermore, no difference was found with respect to the degree of axonal regeneration into the lesion between groups (p-value=0.51, ANOVA)

Conclusions

A greater extent of outgrowth (collateralization) was found in ES treated rats suggesting increased axonal plasticity, though functional outcomes were no different. ES is a promising SCI therapy, however further investigation is required before translation to human models can take place.
2.28

Role of Muscle Damage on Loading at the Level Adjacent to a Lumbar Spine Fusion: A Biomechanical Analysis

Masoud Malakoutian\textsuperscript{1}, John Street\textsuperscript{2}, Hans-Joachim Wilke\textsuperscript{3}, Ian Stavness\textsuperscript{4}, Marcel Dvorak\textsuperscript{2}, Sidney Fels\textsuperscript{5}, Thomas Oxland\textsuperscript{1,2}

\textsuperscript{1}Department of Mechanical Engineering, University of British Columbia, Vancouver, BC, Canada, \textsuperscript{2}Department of Orthopaedics, University of British Columbia, Vancouver, BC, Canada, \textsuperscript{3}Center of Musculoskeletal Research, University of Ulm, Ulm, Germany, \textsuperscript{4}Department of Computer Science, University of Saskatchewan, Saskatoon, SK, Canada, \textsuperscript{5}Department of Electrical and Computer Engineering, University of British Columbia, Vancouver, BC, Canada

Objectives

It is well-established that posterior spinal surgery results in damage to the paraspinal musculature. The effects of such iatrogenic changes on spinal loading have not been previously investigated, particularly at levels adjacent to a spinal fusion. Therefore, the objective of this study was to investigate the effect of simulated muscle damage on post-operative spinal loading at the adjacent levels to a spinal fusion during upright postures using a mathematical model.

Method

A musculoskeletal model of the spine using Artisynth with 210 muscle fascicles was used to predict spinal loading in an upright posture. The loading at L1-L2 and L5-S1 were estimated before and after simulated paraspinal muscle damage (i.e. removal of muscle attachments at L2-L5) along the lumbar spine, both with a spinal fusion at L2-L5 and without a spinal fusion.

Results

The axial compressive forces at the adjacent levels increased after simulated muscle damage, with the largest changes being at the rostral level (78\% increase in presence of spinal fusion; 73\% increase without spinal fusion) compared to the caudal level (41\% in presence of fusion and 32\% without fusion). Shear forces increased in a similar manner at both the rostral and caudal levels. These changes in loading were due to a redistribution of muscle activity from the local lumbar to the global spinal musculature.

Conclusions

The results suggest that the paraspinal muscles of the lumbar spine play an important role in adjacent segment loading of a spinal fusion, independent of the presence of rigid spinal instrumentation.
Classifying Injury Severity and Predicting Neurologic Outcome after Acute Human Spinal Cord Injury with Cerebrospinal Fluid Biomarkers.

Brian Kwon¹, Femke Streijger¹, Nader Fallah², Vanessa Noonan², Scott Paquette¹, Michael Boyd¹, Tamir Ailon¹, John Street¹, Charles Fisher¹, Marcel Dvorak¹

¹University of British Columbia, Vancouver, BC, Canada, ²Rick Hansen Institute, Vancouver, BC, Canada

Objectives

Neurologic impairment after spinal cord injury (SCI) is currently measured and classified by functional examination (i.e. the ASIA Impairment Scale (AIS) and ISNCSCI exam). These are gross measures of spinal cord pathology and imprecise predictors of neurologic outcome. The objective of this study was to determine how well inflammatory and structural proteins within the CSF of acute SCI patients predicted their AIS grade conversion and motor score improvement.

Method

Fifty individuals with acute SCI (29 AIS A, 9 AIS B, 12 AIS C) were prospectively enrolled at our level one trauma institution (32 cervical, 18 thoracic). Lumbar intrathecal catheters were inserted at the time of surgery to obtain CSF samples over 3 to 5 days. A bead multiplex array and ELISAs were performed for inflammatory cytokines and structural proteins: IL-6, IL-8, MCP1, IL-16, IP-10, IL-16, TNF-R1, Tau, S100β, and GFAP. The 24-hour post-injury CSF concentrations were analyzed in relation to baseline AIS grade, AIS grade improvement (“conversion”) over 6 months, and motor score improvement over 6 months.

Results

The 24-hour post-injury CSF levels of IL-6, tau, S100β, and GFAP were each strongly correlated with baseline AIS grade of A, B, or C. For both cervical and thoracic SCI, the IL-6, IL-8, MCP1, Tau, S100β, and GFAP concentrations strongly predicted AIS conversion at 6 months post-injury. Using locally weighted linear regression (Lowess) modelling, the combination of IL-6 and S100β clearly identifies cervical and thoracic SCI patients who will not spontaneously recover motor function.

Conclusions

The analysis of CSF can provide valuable biological information about injury severity after acute SCI. Such biological markers may be valuable tools for stratifying individuals in acute clinical trials where variability in spontaneous recovery requires large recruitment cohorts for sufficient power.
2.30

Spine Surgery a mari usque ad mare

Godefroy Hardy St-Pierre, John Hurlbert
University of Calgary, Calgary, AB, Canada

Objectives

CSORN is the spine registry of the Canadian Spine Society. For the first time, we use this powerful tool to directly compare outcomes of thoraco-lumbar procedures between 5 surgical centers across the country: Vancouver, BC, Calgary AB, Edmonton, AB, Toronto, ON and St-Johns, NB.

Method

We extracted data from the main CSORN database concerning outcome metrics pre-operatively and at 6 months post-op. Those metrics were VAS back pain, VAS leg pain, SF-12 physical component, SF-12 mental component, EuroQol5D index, Health scale, PHQ9 and ODI. Five additional metrics were retrieved, namely OR time, estimated blood loss, dural tear, perioperative adverse event and first follow-up adverse event. Average difference in VAS LE, EQ5D index and ODI were computed. ANOVA was used as a preliminary analysis.

Results

There was a total of 1534 patients across the 5 centers. Calgary and Edmonton were agglomerated under Alberta for analysis. Average pre-op VAS back pain was 7.08/6.13/6.77/6.63 and VAS for leg pain was respectively 7.30/7.17/7.54/7.58 for St-Johns, Toronto, Alberta and Vancouver. Average EQ5D index was 0.57/0.54/0.42/0.67 and average pre-op ODI was 48.05/43.09/50.70/47.30. Average improvement in VAS LE at 6 months was 3.59/4.63/3.99/5.61, improvement for EQ5D was 0.12/0.18/0.41/0.01 and improvement for ODI was 14.22/14.09/26.46/23.14. Average OR time (min) was 123.38/166.52/155.22/253.84. Average blood loss (mL) was 379.44/337.46/291.33/653.17. Rate of dural tear was 5%/12%/3%/13%, peri-op AE 30%/4.8%/13%/40% and FUP AE 16%/0%/3%/25%. ANOVA showed no difference between pre-op VAS back, LE or EQ5D (p =0.124/0.525/0.07) but a difference in pre-op ODI (p = 0.048), and improvement at 6 months in VAS LE, EQ5D and ODI (p < 0.005 for all 3).

Conclusions

Further statistical analysis is necessary to properly characterize the difference in outcome between the surgical centers, notably subgroup analyses and stratification per procedure performed. Preliminary analysis suggests there are statistically significant differences between centers.
## PODIUM PRESENTATIONS

**SATURDAY**

**FEBRUARY 27th, 2016**

### Abstracts for Oral Presentation

<table>
<thead>
<tr>
<th>ABSTRACT #</th>
<th>PROGRAM CODE</th>
<th>PRESENTER LAST NAME</th>
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<th>AWARDS TO BE CONSIDERED FOR</th>
<th>Part I ABSTRACTS PAGE</th>
<th>Part II CONFLICT OF INTEREST DISCLOSURE</th>
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<td>Page 38</td>
<td>Page 115</td>
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<td>0030</td>
<td>3.32</td>
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<td>Best Overall Paper</td>
<td>Page 39</td>
<td>Page 116</td>
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<td>3.33</td>
<td>Pahuta</td>
<td>Markian</td>
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<td>Page 40</td>
<td>Page 117</td>
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<td>3.34</td>
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<td>Best Overall Paper</td>
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<td>Page 119</td>
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<td>0025</td>
<td>3.36</td>
<td>Tetreault</td>
<td>Lindsay</td>
<td>Best Overall Paper&lt;br&gt;<strong>Fellow's Best Paper</strong></td>
<td>Page 43</td>
<td>Page 120</td>
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<td>Page 44</td>
<td>Page 121</td>
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<td>3.38</td>
<td>Santaguida</td>
<td>Carlo</td>
<td>Best Overall Paper</td>
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<td>Page 122</td>
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<td>3.39</td>
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<td>Best Overall Paper&lt;br&gt;<strong>Resident's Best Paper</strong></td>
<td>Page 46</td>
<td>Page 123</td>
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<td>0062</td>
<td>3.40</td>
<td>Khashan</td>
<td>Morsi</td>
<td>Best Overall Paper&lt;br&gt;<strong>Fellow's Best Paper</strong></td>
<td>Page 47</td>
<td>Page 124</td>
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<td>0078</td>
<td>3.41</td>
<td>Tomkins-Lane</td>
<td>Christy</td>
<td>Best Overall Paper</td>
<td>Page 48</td>
<td>Page 125</td>
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<td>0082</td>
<td>3.42</td>
<td>Miyanji</td>
<td>Firoz</td>
<td>Best Overall Paper</td>
<td>Page 49</td>
<td>Page 126</td>
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<td>0091</td>
<td>3.43</td>
<td>Johnson</td>
<td>Michael</td>
<td>Best Overall Paper</td>
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<td>Page 127</td>
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<td>Page 52</td>
<td>Page 129</td>
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3.31

Prognostic Factors for Survival in Surgical Series of Symptomatic Metastatic Epidural Spinal Cord Compression: A Prospective North American Multi-Centre Study in 142 patients

Anick Nater¹, Michael Fehlings¹, Lindsay Tetreault¹, Branko Kopjar², Paul Arnold³, Mark Dekutoski⁴, Joel Finkelstein⁵, Charles Fisher⁵, John France⁷, Ziya Gokaslan⁸, Eric Massicotte¹, Laurence Rhines⁹, Peter Rose¹⁰, Arjun Sahgal⁵, James Schuster¹¹, Alexander Vaccaro¹²

¹University of Toronto, Toronto, Ontario, Canada, ²University of Washington, Seattle, WA, USA, ³Kansas University Medical Center, Kansas City, Kansas, USA, ⁴The Core Institute, Phoenix, Arizona, USA, ⁵Sunnybrook Health Sciences Center, Toronto, Ontario, Canada, ⁶University of British Columbia and Vancouver Coastal Health, Vancouver, BC, Canada, ⁷West Virginia University, Morgantown, WV, USA, ⁸The Rhode Island Hospital, Providence, RI, USA, ⁹MD Anderson Cancer Center University of Texas, Houston, TX, USA, ¹⁰Mayo Clinic, Rochester, MN, USA, ¹¹University of Pennsylvania, Philadelphia, PA, USA, ¹²Thomas Jefferson University, Philadelphia, PA, USA

Objectives

Symptomatic Metastatic Epidural Spinal Cord Compression (MESCC) afflicts up to 10% of all cancer patients and is associated with shortened survival and worsened quality of life. This study aims to identify the key survival prognostic factors in MESCC patients who were surgically treated for a single symptomatic lesion.

Method

142 MESCC patients were enrolled in a prospective North American multi-center study and followed postoperatively for 12 months. Using univariate analyses, Kaplan-Meier methods, and log-rank tests the prognostic value of various clinical predictors were assessed. Non-collinear predictors with p < 0.05 in univariate analyses were included in the final Cox proportional hazards model.

Results

The overall median survival was 7.7 months (range: 3 days – 35.6 months); breast cancer had the longest median survival (12.1 months). Ten patients (7%), whose primary cancer were lung (3), kidney (3), sarcoma (2), prostate (1), and breast (1), died within 30-days postoperatively and 88 had died at 12 months (62%). Univariate analyses yielded eight significant predictors for survival: the growth of primary tumor (Tomita Grade 1 vs Grade 2 and 3), BMI, gender, preoperative SF-36 physical component, EQ-5D, and ODI scores as well as the presence of either visceral or extraspinal bony metastasis. The multiple regression analysis revealed that the Tomita grade (Grade 1 vs Grade 2 and 3), BMI, gender, preoperative SF-36 physical component, EQ-5D, and ODI scores as well as the presence of either visceral or extraspinal bony metastasis. The multiple regression analysis revealed that the Tomita grade (Grade 1 vs Grade 2 and 3; HR: 2.81, p=0.007), the absence of visceral metastasis (HR: 2.01; p=0.0044), and higher score on SF-36 physical component (HR: 0.95, p=0.0001) were independent predictors for longer survival regardless of the selection method used (backward, forward, or stepwise).

Conclusions

Slow growing tumor (Tomita Grade 1), absence of visceral metastasis, and lower degree of preoperative physical disability, as reflected by a higher score on the SF-36 physical component questionnaire, are good prognostic factors for survival in selected patients who underwent surgical treatment for a focal symptomatic MESCC lesion.
3.32

Surgical Management of Spinal Osteoblastomas

Anne Versteeg¹, Nicolas Dea², Stefano Boriani³, Peter P. Varga⁴, Alessandro Luzzati⁵, Michael Fehlings⁶, Mark Bilsky⁷, Laurence Rhines⁸, Jeremy Reynolds⁹, Mark Dekutoski¹⁰, Ziya Gokaslan¹¹, Nicole Germscheid¹², Charles Fisher¹³

¹University medical Center Utrecht, Utrecht, The Netherlands, ²Université de Sherbrooke, Sherbrooke, Quebec, Canada, ³Rizzoli Institute, Bologna, Italy, ⁴National Center for Spinal Disorders and Buda Health Center, Budapest, Hungary, ⁵Oncologia Ortopedica e Ricostruttiva del Rachide, Istituto Ortopedico Galeazzi, Milan, Italy, ⁶University of Toronto and Toronto Western Hospital, Toronto, Ontario, Canada, ⁷Memorial Sloan Kettering Cancer Center, New York, New York, USA, ⁸MD Anderson Cancer Center, Houston, Texas, USA, ⁹Oxford University Hospitals NHS Trust, Oxford, UK, ¹⁰The CORE Institute, Phoenix, Arizona, USA, ¹¹The Warren Alpert Medical School of Brown University, Providence, Rhode Island, USA, ¹²AOSpine International, Davos, Switzerland, ¹³University of British Columbia, Vancouver, BC, Canada

Objectives

Osteoblastoma is a rare primary benign bone tumor with a predilection for the spinal column. Although of benign origin, osteoblastomas tend to behave clinically more aggressive. Due to the low incidence, evidence based treatment guidelines and high quality research are lacking, resulting in inconsistent treatments.

The aim of this multicenter cohort study was to assess rates of local recurrence and mortality following surgical intervention for spinal osteoblastomas and to identify prognostic variables for local recurrence and mortality.

Method

A multicenter ambispective database of patients who underwent surgical intervention for spinal osteoblastoma was developed by the AOSpine Knowledge Forum Tumor. Patient data pertaining to demographics, diagnosis, treatment, cross-sectional survival, and local recurrence were collected. Patients were analyzed in two cohorts based on the Enneking classification of the tumor: Enneking appropriate (EA) and Enneking inappropriate (EI). EA was defined by the final pathology margin matching the Enneking recommended surgical margin, if otherwise it was defined as EI.

Results

A total of 102 patients diagnosed with a spinal osteoblastoma were identified between November 1991 and June 2012. Twenty-eight patients were omitted from the analysis due to short follow-up or incomplete survival data, leaving 74 patients for final analysis. Thirteen (18%) patients suffered a local recurrence and six (8%) patients died during the study period. Local recurrence is strongly associated with mortality with a relative risk of 9.4 (P=0.007). When adjusting for Enneking appropriateness, the result was not significantly altered. No significant differences were found between the EA and EI group for local recurrence and mortality.

Conclusions

Upon evaluating the largest multicenter collection of spinal osteoblastomas, the application of the Enneking classification as a treatment guide for spinal osteoblastomas could not be confirmed. Considering the strong relation between local recurrence and mortality, a complete radical resection, either through en-bloc or complete intra-lesional excision followed by adjuvant radiotherapy, is recommended for aggressive osteoblastoma.
3.33

General population utilities for metastatic epidural spinal cord compression health states

Markian Pahuta, Carl van Walraven, Doug Coyle, Joel Werier, Eugene Wai

University of Ottawa, Ottawa, Canada

Objectives

A particularly disabling consequence of cancer is metastatic epidural spinal cord compression (MESCC). Few prospective studies on the treatment of MESCC have collected quality-adjusted-life-year weights (termed “utilities”). Utilities are an important summative measure which distils health outcomes to a single number that can be used by healthcare providers to counsel patients and policy makers to make funding decisions.

We sought to measure utilities for MESCC health states from the Canadian general population perspective.

Method

We recruited a sample of 822 adult Canadians from a market research company. Quota sampling was used to ensure that the participants were representative of the Canadian population in terms of age, gender, and province of residence. Participants were asked to rate 6 of the 32 MESCC health states using the validated SOAP tool.

Results

Sixty-six percent of participants provided logical ratings (for example perfect health was rated higher than non-ambulatory health states). Unadjusted mixed-effects regression analysis demonstrated that participants valued ambulation, continence, pain, other symptoms, and independence equally. Adjusted analysis showed no significant association between utility valuations and age, gender, or province of residence.

Conclusions

This general population sample provided valid responses; the proportion of logical ratings was greater than that for the survey used to derive Canadian EQ-5D weights. These results demonstrate that from the societal perspective, physical function is valued equal to other facets of well-being. Ambulation and continence, which are dysfunctions addressed by surgery, are no more important than other attributes evaluated (pain, other symptoms, and level of independence). Thus formal utility elicitation can provide useful insights for patient counselling and health program planning.
3.34

Instrumentation following decompression for spinal metastases - is there a need for fusion in addition to internal fixation?

Eoin Fenton¹, Philippe Mercier², Ish Bains¹, W. Bradley Jacobs¹
¹University of Calgary, Calgary, Alberta, Canada, ²Saint Louis University, St. Louis, Missouri, USA

Objectives

Decompression and instrumentation has proven beneficial to the neurological outcome and quality of life for selected patients with spinal metastases. Due to the limited expected survival of this population and the lack of suitable local bone graft it remains unclear what, if any, fusion construct should be placed. This factor combined with post-operative radiotherapy that these patients invariably receive puts the vertebral column at risk. The failure rate for instrumentation in these patients varies widely with reports in the literature (within the last 10 years) of 3.5% to 43%. Our goal with this study is to clarify the need, if any, for fusion adjuncts.

Method

A retrospective chart review was conducted of consecutive patients who had undergone decompression and instrumentation for spinal metastases in a large multi-surgeon spine practice to determine the rate of instrumentation failure.

Results

104 procedures in 93 patients (38 female and 55 male) were performed over a 5-year period (2007-2011). The mean patient age was 61 (33-86 years). The primary endpoint was last known follow-up, instrumentation failure or death (2-2924 days). 10 patients had multiple procedures but only 1 of those had a second procedure due to instrumentation failure (0.96%). Pedicle screw and rod +/- synthetic cage constructs were augmented with graft (cement, autograft, BMP, allograft) in 62.5% of cases. No fusion or cement augmentation was performed in 37.5% of cases. In the one case of instrumentation failure, a Steinmann pin and methylmethacrylate were used as an anterior strut following a two level thoracic vertebrectomy.

Conclusions

This study suggests that symptomatic failure of spinal instrumentation necessitating revision surgery in patients with spinal metastases is an uncommon occurrence (0.96%) despite the lack of bone graft in the constructs used to stabilize the vertebral column. This finding is of particular significance in patients whose primary malignancy is associated with longer survival.
3.35

Do Racial Differences Affect Surgical Outcomes in Patients with Degenerative Cervical Myelopathy? Results from the Prospective, Multicenter AOSpine International Study on 479 Patients

Narihito Nagoshi, Lindsay Tetreault, Hiroaki Nakashima, Aria Nouri, Michael Fehlings
University of Toronto, Toronto, Ontario, Canada

Objectives

Previous studies have highlighted racial differences in the pathology of degenerative cervical myelopathy (DCM), including a higher prevalence of ossification of the posterior longitudinal ligament (OPLL) in Asian populations. The objective of this study is to compare surgical outcomes between Caucasians and Asians with DCM and to determine whether race is an independent predictor of surgical outcomes.

Method

Patient demographics, causative pathology and surgical summaries were statistically compared between the two races. A mixed model analytic approach was used to evaluate differences in surgical outcome between Caucasians and Asians, while controlling for relevant baseline characteristics and surgical factors.

Results

Of the 479 DCM patients enrolled in the AOSpine CSM-International study, 324 (67.64%) were Caucasian, and 106 East Asian (22.13%). Caucasians had a significantly longer duration of symptoms and a greater number of co-morbidities than East Asians. Surprisingly, there was no difference in the incidence of OPLL between the two races; however a greater percentage of Caucasians in Asia exhibited OPLL than Caucasians in Europe or North America. With respect to outcome, patients from East Asia had significantly higher scores on the mJOA, Nurick and SF-36v2. After adjusting for key differences in patient characteristics and surgical features, these differences in functional status and quality of life between the two races remained significant. However, when adjusting for region, the differences in the mJOA and SF-36v2 became insignificant.

Conclusions

Based on these results, environmental or societal factors may influence surgical outcome. Race is therefore not an independent predictor of functional status or quality of life.
Is Preoperative Duration of Symptoms a Significant Predictor of Functional Status and Quality of Life Outcomes in Patients Undergoing Surgery for the Treatment of Degenerative Cervical Myelopathy?

Lindsay Tetreault¹, Branko Kopjar², Jefferson Wilson¹, Paul Arnold³, Michael Fehlings¹
¹University of Toronto, Toronto, Ontario, Canada, ²University of Washington, Seattle, WA, USA, ³Kansas University Medical Center, Kansas City, Kansas, USA

Objectives

Longstanding compression of the spinal cord in patients with degenerative cervical myelopathy (DCM) may result in irreversible neural tissue damage. This study aims to analyze whether a longer duration of symptoms influences surgical outcomes and to determine the optimal timing for decompressive surgery.

Method

Three hundred and fifty patients with symptomatic DCM were prospectively enrolled in either the CSM-North America or International study at 12 sites in North America. For each patient, pre- and post-operative functional status were evaluated at 12-months using the mJOA. Duration of symptoms was dichotomized into a “short” and “long” group at several cut-offs. An iterative mixed model analytic approach procedure was used to evaluate differences in change scores on the mJOA between duration groups in 1-month increments.

Results

Our cohort consisted of 201 men and 149 women, with a mean duration of symptoms of 25.71±36.68 months. In unadjusted analysis, patients with a duration of symptoms shorter than 4 months had significantly better functional outcomes based on the mJOA (p=0.04) than patients with a longer duration of symptoms (>4 months). On average, patients with <4 months symptom duration improved by 3.71 on the mJOA, whereas those with a duration =4 months only exhibited a 2.96 mean gain, difference of 0.75 (95%C.I. 0.03 to 1.47). Twelve months was identified as the next important cut-off beyond which patients had a significantly worse outcomes on the mJOA. In adjusted model, patients with <12 months symptom duration improved by 3.37 on the mJOA, whereas those with a duration 12 months or longer exhibited a 2.85 mean gain, difference of 0.52 (95%C.I. 0.01 to 1.03).

Conclusions

Patients who are operated on within 4 months of symptom presentation have better mJOA outcomes. It is recommended that patients with DCM are diagnosed in a timely fashion and referred early for surgical consultation.
Surgery for Degenerative Cervical Myelopathy from an Economic and Outcome Perspective: A Cost-utility Analysis of the Combined Data from the AOSpine North America and International Studies

Christopher Witiw¹, Lindsay Tetreault¹, Branko Kopjar², Eric Massicotte¹, Michael Fehlings¹
¹University of Toronto, Division of Neurosurgery, Toronto, Ontario, Canada, ²University of Washington, Department of Health Services, Seattle, Washington, Canada

Objectives

Surgery for degenerative cervical myelopathy (DCM) has been shown to improve neurological status and quality of life, yet the intervention is costly. Concerns regarding sustainability of healthcare delivery have placed value-based purchasing at the forefront of policy decision-making. We aim to estimate the lifetime incremental cost-utility of surgery for DCM, which may help guide future healthcare resource allocation.

Method

This evaluation was based on prospective data from patients participating in one of two multicenter, international studies who had surgery for DCM at a single center between 2005 and 2011. SF-6D health utility scores were modelled over 6, 12 and 24-months following surgery. Individual quality adjusted life year (QALY) gains were calculated from the area under the curve; lifetime estimates were discounted at 3%/year. Costs from a hospital as a payer perspective were obtained from a local micro-costing database for each individual. The costs captured include total direct (operating room costs, nursing, laboratory, pharmacy and imaging) and indirect costs (administrative and support departments). Multiway sensitivity analysis included variation of the discount rates (0-5%) and revision rates (1.5-2.5%). Costs are reported in Canadian dollars and inflated to 2015 values.

Results

The analysis included 171 patients. Mean age, 58.2±12.0 years; baseline modified Japanese Orthopaedic Association score, 12.4±2.7. At 2-years, utility gain was 0.083 (95% CI: 0.063-0.103), p<0.0001. Lifetime discounted QALY gain was 1.573 (95% CI: 1.320-1.825), p < 0.0001. The mean direct costs of medical treatment were estimated at $19,217 ±$12,404. Median estimated lifetime incremental cost-utility ratio (ICUR) was $13,032/QALY. Multiway sensitivity analysis provided a range of $6,552/QALY to $22,307/QALY. This falls within general willingness-to-pay thresholds (<$50,000/QALY gained).

Conclusions

Surgery for DCM is associated with significant improvements in health utility and is cost-effective from a hospital payer perspective.
Laminoplasty versus Laminectomy and Fusion to Treat Cervical Spondylotic Myelopathy: Outcomes of the Prospective Multicenter AOSpine North America and International CSM Studies

Carlo Santaguida¹, Michael Fehlings², Branko Kopjar³, Paul Arnold⁴, Helton Defino⁵, Shashank Kale⁶, S. Tim Yoon⁷, Giuseppe Barbagallo⁸, Ronald Bartels⁹, Qiang Zhou¹⁰, Alexander Vaccaro¹¹

¹McGill University, Montreal, Canada, ²University of Toronto, Toronto, Canada, ³University of Washington, Seattle, USA, ⁴University of Kansas, Kansas City, USA, ⁵University of Sao Paulo, Ribeirao Preto, Bouvet Island, ⁶AIIMS, New Delhi, India, ⁷Emory University, Atlanta, USA, ⁸Universitaria Policlinico, Catania, Italy, ⁹Radboud University, Nijmegen, The Netherlands, ¹⁰South Western Hospital, ChongQing, China, ¹¹Thomas Jefferson University, Philadelphia, USA

Objectives

We present the results from the pooled analysis of the two largest prospective CSM studies to determine the outcomes of cervical laminectomy and fusion (CLF) and laminoplasty (CLP).

Method

The AOSpine North America and International prospective multicenter studies enrolled 166 participants who underwent CLF and 100 patients who underwent CLP from a pool of 757 patients. 83% of participants completed 1 year follow up. Primary outcomes included Nurick Score, modified Japanese Orthopedic Association Score (mJOA), Neck Disability Index (NDI) and secondary outcomes included the Short form-36 v2 physical (SF-36PCS) and mental component (SF-36MCS) scores at 1 year following treatment. The data was analyzed by 1-way ANOVA and ANCOVA adjusting for covariates: gender, age, smoking, # of operative level, region, and baseline scores.

Results

Study participants who underwent a CLF were found to have a mean improvement in Nurick score 0.90 (0.57, 1.23), mJOA 2.45 (1.55, 2.71), NDI 9.77 (5.07, 14.47), SF-36 PCS 4.85 (2.47, 7.23), and SF-36 MCS 5.15 (2.07, 8.23) at 1 year following treatment. Participants who underwent CLP were found to have a mean improvement in Nurick score 1.00 (0.60, 1.41), mJOA score 2.51 (1.78, 3.25), NDI improvement of 9.72 (4.17, 15.26), SF-36 PCS 3.87 (0.84, 6.90), SF-36 MCS 6.06 (2.58, 9.53) at 1 year following treatment. The adjusted analysis did not reveal a statistically significant difference in outcome measures between surgical groups.

Conclusions

CLF and CLP were effective in the treatment of CSM. The pooled analysis of these prospective multicenter CSM studies revealed no difference in outcome measures (mJOA, Nurick, NDI, SF-36PCS and MCS) between patients treated with CLF and CLP.
The Impact of Spinal Manipulation on Lower Extremity Motor Control in Lumbar Spinal Stenosis Patients: a Single-Blind Randomized Clinical Trial

Mina Aziz, Michael Johnson, Steven Passmore, Michael Goytan, Cheryl Glazebrook
University of Manitoba, Winnipeg, Manitoba, Canada

Objectives

Spinal manipulation (SM) can offer lumbar spinal stenosis (LSS) patients a degree of pain relief and improve self-reported disability. Our objective is to quantify the impact of a single SM intervention on patients with LSS using a Fitts’ Law lower extremity movement task. Our findings will inform surgeons of potential objective treatment outcomes when considering non-operative care. We hypothesize that patients who receive spinal manipulation will demonstrate improved motor performance compared to a non-intervention (NI) group.

Method

Participants with LSS (N=14) performed baseline testing and underwent a covariate-adaptive randomization. Each participant performed a foot-pointing task to 4 targets with different indexes of difficulty. Participants completed 10 trials per target, per foot, resulting in 80 total trials both pre and post-intervention. Pain, lumbar range of motion (LROM), and motor performance were assessed at baseline and following lumbar SM or NI. Experimenters were blinded to patient group allocation.

Results

Significant main effects for movement time (MT), peak velocity, time to peak velocity, and peak acceleration were observed across task difficulty as predicted by Fitts’ Law. Planned comparisons of the MT main effect revealed significant differences between the two most difficult targets post-SM (M=740 ms, SD=230 and M=780 ms, SD=240; t(6)=3.042, p=0.02). For all other comparisons, gross movements required to attain appropriate target amplitude superseded any precision movements associated with coordinated movement to targets of different sizes. No significant differences in pain, or LROM were found within or between groups.

Conclusions

Participants undergoing SM demonstrated immediate improvement in MT, specifically in their motor performance in the most challenging movement contexts. There were no immediate differences in pain, LROM, or kinematic performance. In the future, research on the impact of SM on LSS patients should quantify the impact of a course of care (multiple SM treatments over multiple days) which more closely reflects non-operative clinical practice.
3.40

Predictors of Improved Pain, Function and Quality of Life Following Elective Lumbar Spine Fusion Surgery

Morsi Khashan¹, Jeff Golan¹, Greg McIntosh², Joy Barker¹, Michael Weber¹
¹McGill University, Montreal, Quebec, Canada, ²Canadian Spine Society, Markdale, Ontario, Canada

Objectives

The main indication for elective lumbar spine fusion is improving pain and life quality, yet outcomes of these procedures may vary widely. In order to identify predictors of improved pain levels, function, and quality of life, we analyzed elective lumbar fusion surgery cases using the Canadian Spine Outcomes and Research Network (CSORN).

Method

All cases of elective lumbar spine fusion entered into CSORN between October 2008 and September 2015 were investigated. We analyzed demographic, preoperative and intraoperative parameters. Change in Numeric Pain Rating (VAS) for back and leg pain, change in EuroQoL-5 Dimension Questionnaire (EQ-5D) and change in the Oswestry Disability Index (ODI) from baseline to three months following surgery were calculated. The required data was available for 1083 cases. Multivariable linear regression was used with data-splitting technique to develop and validate the multivariable models. A 67% random sample of the dataset was used for model development, and the entire dataset was used for model validation.

Results

Principal pathology of spinal stenosis, the presence of spondylolisthesis and fusions above the sacrum predicted increased improvement of VAS rating for back and leg pain. Principal pathology other than deformity and the presence of extra comorbidities were associated with increased improvement in both ODI and the EQ-5Q scores. Fusion of less than three levels and smoking predicted increased improvement of ODI score and procedures without osteotomy predicted improved EQ-5Q score (p<0.05).

Conclusions

Our study identified a number of predictors of improved outcome. The results shed light on patient selection criteria and on the potential for bias. The improved outcome in smokers and patients with several comorbidities may be explained by the application of rigid selection criteria in these populations and the selection of patients with more surgically amenable pathologies to justify intervention.
3.41

Objective measurement of free-living physical activity (performance) in lumbar spinal stenosis: Are physical activity guidelines being met?

Christy Tomkins-Lane\textsuperscript{1,3}, Richard Hu\textsuperscript{2}, Justin Norden\textsuperscript{3}, Aman Sinha\textsuperscript{3}, Matthew Smuck\textsuperscript{3}
\textsuperscript{1}Mount Royal University, Calgary, Canada, \textsuperscript{2}University of Calgary, Calgary, Canada, \textsuperscript{3}Stanford University, Palo Alto, USA

Objectives

It is likely that people with lumbar spinal stenosis (LSS) would benefit from physical activity, yet we do not have disease specific guidelines, nor do we fully understand the nature of free-living physical activity (performance) in LSS. Care providers could endorse the 2008 US Physical Activity Guidelines, but we do not know if this is realistic for people with LSS.

Objective: Determine the proportion of individuals with LSS meeting the 2008 US Physical Activity Guidelines, and better understand the nature of performance in LSS.

Method

Retrospective analysis of the Lumbar Spinal Stenosis Accelerometry Database, which includes 75 people with LSS diagnosed clinically and on imaging, with 4 valid days of accelerometry data. We determined the proportion of individuals meeting the 2008 US Physical Activity Guidelines of at least 150 minutes of moderate-vigorous (MV) activity per week in bouts of 10 minutes or more. We also used the novel Physical Performance analysis designed by our group to determine time spent in varying intensities of activity, with a focus on light activity.

Results

We analyzed data from 75 individuals with a mean age of 68 (SD 9), and 37% male. Three people (4%) were considered Meeting Guidelines (at least 150 MV minutes/week), 16 (21%) were considered Low Active (1-149 MV minutes/week), and 56 (75%) were considered inactive (MV minutes/week). The average time spent in sedentary activity was 82%, and of time spent in non-sedentary activity, 99.6% was in light activity.

Conclusions

People with LSS are extremely inactive with only 4% meeting physical activity guidelines. There is an obvious need to intervene in people with LSS to improve sedentary behaviour, and prevent diseases of inactivity. Results of this study suggest that a focus on light intensity activity may be most appropriate. This study is one step toward a personalized medicine approach for people with LSS, focusing on increasing physical function.
3.42

2-year follow-up in spine clinical research: an adequate benchmark?

Firoz Miyanji¹, Sameer Desai¹, Amer F Samdani², Suken A Shah³, Jahangir Asghar⁴, Burt Yaszay⁵, Harry L Shufflebarger⁶, Randal R Betz⁶, Peter Newton⁷

¹BC Children's Hospital, Vancouver, Canada, ²Shriner's Hospital, Philadelphia, USA, ³Nemours/Alfred I DuPont Hospital for Children, Wilmington, USA, ⁴Miami Children's Hospital, Miami, USA, ⁵Children's Specialists, San Diego, USA, ⁶Institute for Spine and Scoliosis, Lawrenceville, USA, ⁷Rady Children's Hospital, San Diego, USA

Objectives

Most long-term follow-up studies report retrospective data, the quality of which remains limited due to their inherent biases. Prospective databases may overcome these limitations, however, feasibility and costs limit their application. To date there exists a paucity of evidence-based literature on which recommendations can be made for the ideal length of follow-up for spinal deformity research. Therefore, our aim was to evaluate the added value of follow-up of patients beyond 2 years following surgery for AIS.

Method

A database registry evaluating surgical outcomes for all consecutive AIS patients with post-op data-points of 6 months, 1 year, 2 year, and 5 year was analyzed. Surgeon-reported complications, SRS-22 scores, and radiographic data were evaluated. Complications requiring surgical or medical intervention were compared between patients in whom complications developed within 2 years to those in which newly developed complications occurred between >2-5 years.

Results

536 patients were analyzed. SRS-22 scores significantly improved at 2 years post-op with no change at 5-year follow-up. Overall complication rate was 33.2% with majority occurring within 2 years (24.8%). The rate of complications occurring >2-5 years requiring intervention was significantly lower than those requiring intervention within 2 years of surgery (4.7% vs 9.7%, p=0.000), however was not negligible. The most common newly observed complication beyond 2 years was pain (1.9%), followed by surgical site infection (SSI) (1.3%) and implant issues (0.56%). There were no significant differences in the rates of crankshaft (p=0.48), implant issues (p=0.56), pseudarthrosis (p=0.19), and SSI (p=0.13) between the 2 time points.

Conclusions

Although majority of complications following AIS surgery occurs within 2 years, a non-negligible rate of newly observed complications occur at >2-5 years post-op. Specifically crankshaft, pseudarthrosis, implant issues, and SSI have similar rates of occurrence at these 2 time points. Our study emphasizes the added value of prospective follow-up beyond 2 years in AIS.
3.43

The Impact Of Pre-Surgical Self-Reported Exercise Patterns On Post-Surgical Outcomes

Michael Johnson¹, Steven Passmore¹, James McCammon¹, Michael Goytan¹, Greg McIntosh²
¹University of Manitoba, Winnipeg, MB, Canada, ²CSORN Registry Manager, Hamilton, ON, Canada

Objectives

There is evidence that preoperative physical fitness impacts surgical outcomes. Specifically, supportive evidence for exercise preceding abdominal, cardiovascular and spine surgery. Walking ability prior to decompression surgery improves outcomes. To our knowledge there are no papers on self-reported exercise frequency as a predictor of thoracolumbar surgery outcomes.

We predict patients who report exercise prior to surgical intervention will demonstrate decreased pain, and disability but increased perceived health state following surgery compared to patients who do not exercise.

Method

Study design was a retrospective analysis of prospectively collected national spine registry data. Data was collected from the Canadian Spine and Outcomes and Research Network (CSORN) registry. Inclusion criteria specified all thoracolumbar patients who proceeded to spine surgery since the CSORN registry inception who completed the pre- and post-operative outcome measures up to 12 months post-surgery (N=992). Questionnaire measures included numeric rating scales for back and leg pain, health state and Oswestry Disability Index (ODI). Exercise frequency was self-reported as "none" (n=637) versus "some" (n=355). Student's T-tests were used to compare the mean scores of the outcome measures. Differences in the measures pre-and post-operatively were compared to the minimal clinically important differences (MCIDs) in other spine surgery literature.

Results

Those who reported "some" exercise had more favorable scores pre-operatively and post-operatively compared to those who report "none". Significant differences were noted 6 months post-operatively for back pain, leg pain, health state and ODI; and at 12 months post-operatively for health state ("some" M=73.62, SD=18.42; "none" M=68.18, SD=18.56; p=0.003). and ODI ("some" M=20.65, SD=17.32; "none" M=25.07, SD=18.97; p<0.001). The MCIDs were similar to previous studies considering questionnaire outcomes for thoracolumbar spine surgery.

Conclusions

Patients who reported at least "some" exercise had consistently more favorable scores in outcome measures pre-operatively and 6 months post-surgery. Beyond the 6 month findings at least some pre-surgical exercise decreases disability and improves health state up to 12 months post-thoracolumbar spine surgery.
3.44

Baseline And Postoperative Outcomes In Patients Undergoing Surgery For Degenerative Lumbar Spondylolisthesis: A Comparison Study Between Single-Payer And Multi-Tier Health Care Systems

Jin Tee\textsuperscript{1,2}, Charles Fisher\textsuperscript{0}
\textsuperscript{1}University of British Columbia, Vancouver, BC, Canada, \textsuperscript{2}National Trauma Research Institute, Melbourne, Australia

Objectives

1. To compare pre-/post-operative disease-specific and generic HRQoL measures in surgical degenerative lumbar spondylolisthesis (DLS) patients

2. To compare outcomes of surgical DLS patients in single-payer vs. multi-tier health-care-systems.

Method

The CSORN Registry was queried from 2004-2015. Baseline and postoperative data:(1)demographic; (2)specific expectation data (SED); (3)back/leg-pain scores; and (4)Oswestry-Disability-Index (ODI). Matching CSORN data were compared with the Spine Patients Outcomes Research Trial (SPORT) DLS surgical arm cohort. Statistical analysis was bivariate inferential regression modelling.

Results

CSORN query returned 471 patients. The SPORT cohort had 368 patients. The CSORN cohort was younger (60.9 vs. 64.7, $p<0.01$), had less females (62% vs. 69%, $p=0.03$), and had more smokers (20% vs. 9%, $p<0.01$). The SPORT cohort had more patients in the workforce (36% vs. 28%, $p=0.02$) and more workers’ compensation patients (9% vs. 4%, $p<0.01$). The CSORN cohort had poorer baseline function with higher ODI scores (48.2 vs. 45.0, $p<0.01$) and had more patients who were symptomatic for 6 months or longer (95% vs. 62%, $P<0.01$). The CSORN cohort was more satisfied with the surgical results at both the 3-month and 1-year postoperative mark ($p<0.01$). The SPORT cohort was less disabled at the 3-mth postoperative mark, however the CSORN were less disabled at the 1-year postoperative mark ($p<0.01$).

Conclusions

Patients with degenerative spondylolisthesis who undergo surgery have better 1-year outcomes in a single-payer health care system than in a multi-tier health care system, despite having poorer baseline disease specific disability and being symptomatic for longer.
3.45

An exploration of the inter-relationships between low back pain, obesity, inflammation, and diabetic status

Darren M. Roffey\textsuperscript{1,2}, Adbdulghader Alfasi\textsuperscript{2}, Emile L. Hashem\textsuperscript{3}, Gabrielle D. Papineau\textsuperscript{1,4}, Stephen P. Kingwell\textsuperscript{1,4}, Eugene K. Wai\textsuperscript{2,4}

\textsuperscript{1} Ottawa Combined Adult Spinal Surgery Program, The Ottawa Hospital, Ottawa, ON, Canada; \textsuperscript{2} Clinical Epidemiology Program, Ottawa Hospital Research Institute, Ottawa, ON, Canada; \textsuperscript{3} Faculty of Medicine, University of Ottawa, Ottawa, ON, Canada; \textsuperscript{4} Division of Orthopaedic Surgery, Department of Surgery, University of Ottawa, The Ottawa Hospital, Ottawa, ON, Canada

Objectives

Low back pain (LBP) is a common musculoskeletal disorder. Numerous potential sources of LBP have been identified, but the etiology remains ambiguous. Many studies have shown a relationship between obesity and LBP due to combinations of mechanical, structural, metabolic, and behavioral factors. Recently, associations between: 1) obesity and inflammation, 2) inflammation and pain signalling, and 3) LBP and inflammation have also been postulated. Our objective was to elucidate whether inflammatory, diabetic status and obesity related measures are related to LBP.

Method

In this retrospective chart study, we collected data on \( n = 62 \) consecutive, non-surgical, chronic LBP patients who presented for a consultation appointment with an orthopaedic spine surgeon. Patients completed pain questionnaires (i.e. 0-10 visual analogue score) and provided demographic details (e.g. height, weight, working status, and exercise levels). Blood work was collected at this baseline appointment, and the following inflammatory and diabetic status markers tested: white blood cell (WBC), erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and haemoglobin A1c (HbA1c).

Results

We found 47.5\% of patients had ESR values (average: 15.7 \( \pm \) 9.7 mm/hr) above normative values (6.0 mm/hr). Similarly, 47.1\% of patients had HbA1C values (average: 7.3 \( \pm \) 2.1\%) above normative values (6.0\%). Patients with high WBC, ESR, CRP or HbA1C values were more likely to be female, in their mid-50's, a non-smoker, have a BMI around 26 kg/m\(^2\) and clearly indicate predominant back pain (range: 7.5 - 8.7 out of 10) versus left or right leg pain (range: 2.8 - 5.9 out of 10).

Conclusions

Almost 50\% of non-surgical, chronic LBP patients presented with a significant inflammatory or pre-diabetic status. Larger studies need to be conducted to investigate the impact of systemic inflammation and/or poorly controlled blood glucose levels as contributors to LBP. Exploring the impact of exercise and its mediating effects in these patients may also be warranted.
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<tbody>
<tr>
<td>0005</td>
<td>P01</td>
<td>Evaniew</td>
<td>Nathan</td>
<td>THURSDAY</td>
<td>54</td>
<td>130</td>
</tr>
<tr>
<td>0023</td>
<td>P02</td>
<td>Nouri</td>
<td>Aria</td>
<td>THURSDAY</td>
<td>55</td>
<td>131</td>
</tr>
<tr>
<td>0026</td>
<td>P03</td>
<td>Tetreault</td>
<td>Lindsay</td>
<td>THURSDAY</td>
<td>56</td>
<td>132</td>
</tr>
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<td>P04</td>
<td>Tetreault</td>
<td>Lindsay</td>
<td>THURSDAY</td>
<td>57</td>
<td>133</td>
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<td>P05</td>
<td>Tetreault</td>
<td>Lindsay</td>
<td>THURSDAY</td>
<td>58</td>
<td>134</td>
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<td>P06</td>
<td>Fehlings</td>
<td>Michael</td>
<td>THURSDAY</td>
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<td>135</td>
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<td>P07</td>
<td>Wilson</td>
<td>Jefferson</td>
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<td>136</td>
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<td>P08</td>
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<td>Tamir</td>
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<td>137</td>
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<td>149</td>
</tr>
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<td>151</td>
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<td>153</td>
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P01

Methylprednisolone for the treatment of patients with acute spinal cord injuries: A systematic review and meta-analysis

Nathan Evaniew¹, Emilie P Belley-Côté¹, Nader Fallah²,³, Vanessa K Noonan²,³, Carly S Rivers²,³, Marcel F Dvorak²,³
¹McMaster University, Hamilton, ON, Canada, ²University of British Columbia, Vancouver, BC, Canada, ³Rick Hansen Institute, Vancouver, BC, Canada

Objectives

Previous meta-analyses of methylprednisolone for patients with acute traumatic spinal cord injuries (TSCIs) have not addressed confidence in pooled effect estimates and new primary studies have been recently published. We performed a systematic review and meta-analysis to determine whether methylprednisolone improves motor recovery and is associated with increased risks for adverse events.

Method

We searched MEDLINE, EMBASE, and The Cochrane Library for eligible randomized controlled trials (RCTs) and controlled observational studies. Two reviewers independently screened articles, extracted data, and evaluated risk of bias. We pooled outcomes from RCTs and controlled observational studies separately. We used the Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) approach to evaluate confidence.

Results

We included four RCTs and 17 observational studies. Methylprednisolone did not increase long-term motor score recovery (two RCTs: 335 participants, mean difference [MD] -1.11, 95% CI -4.75 to 2.53, p=0.55, low certainty; two observational studies: 528 participants, MD 1.37, 95% CI -3.08 to 5.83, p=0.55, very low certainty) or improvement by at least one motor grade (three observational studies: 383 participants, risk ratio [RR] 0.84, 95% CI 0.53 to 1.33, p=0.46, very low certainty). Evidence from two RCTs demonstrated superior short-term motor score improvement if methylprednisolone was administered within eight hours of injury (two RCTs: 250 participants; MD 4.46, 95% CI 0.97 to 7.94, p=0.01; low certainty), but risk of bias and imprecision limit confidence in these findings. Observational studies demonstrated a significantly increased risk for gastrointestinal bleeding (nine studies: 2857 participants, RR 2.18; 95% CI 1.13 to 4.19; p=0.02, very low confidence), but RCTs did not.

Conclusions

Pooled evidence does not demonstrate a significant long-term benefit for methylprednisolone in patients with acute TSCIs and suggests it may be associated with increased gastrointestinal bleeding. These findings support current guidelines against routine use, but strong recommendations are not warranted because confidence in the effect estimates is limited.
The Relationship Between Preoperative Clinical Presentation and Quantitative MRI features in patients with Degenerative Cervical Myelopathy

Aria Nouri1, Lindsay Tetreault1, Kristian Dalzell2, Juan Jose Zamorano3, Michael Fehlings1
1University of Toronto, Toronto, Ontario, Canada, 2Christchurch Public Hospital & Burwood Spinal Unit, Christchurch, New Zealand, 3Hospital del Trabajador, Santiago, Chile

Objectives

Degenerative Cervical Myelopathy (DCM) encompasses a group of degenerative conditions of the cervical spine, including cervical spondylotic myelopathy (CSM), that result in spinal cord pathology through static and dynamic injury mechanisms. While there are a constellation of degenerative findings that can present in patients with DCM on MRI, the clinical significance of these findings remains a subject of controversy and discussion.

Method

One hundred and fourteen patients enrolled in the prospective and multicenter AOSpine CSM North American study with complete MRI and clinical data were evaluated. Patients were enrolled if they had ≥1 clinical signs of myelopathy. Mid-sagittal MRIs were assessed for maximum spinal cord compression (MSCC) and maximum cord compromise (MCC). Additionally, the presence of T1 and T2 signal changes as well as the degree of T2 signal hyperintensity deviation was evaluated. MRI features were then statistically related with the presence of upper and lower limb neurological symptoms as well as generalized neurological dysfunction.

Results

Numb hands (p=0.01) and Hoffmann’s sign (p=0.003) were associated with greater MSCC; broad-based, unstable gait (p=0.042), impairment of gait (p=0.008) and Hoffmann’s sign (p=0.013) were associated with greater MCC; Numb hands (p=0.037), Hoffmann’s sign (p=0.017), Babinski sign (p=0.002), lower limb spasticity (p=0.011), L’Hermitte’s phenomena (p=0.045), hyperreflexia (p=0.004), and presence of T1 hypointensity were associated with a greater deviation of signal intensity on T2 MRI. Patients with the presence of T2 signal hyperintensity also had greater MSCC (p<0.001) and MCC (p<0.001).

Conclusions

MSCC and MCC were predominately associated with upper limb and lower limb manifestations, respectively. SCR was associated with upper limb, lower limb and general neurological deficits. Hoffmann’s sign occurred more commonly in patients with a greater MSCC, MCC and SCR. L’Hermitte’s phenomenon presented more commonly in patients with a lower SCR and thus may serve to indicate mild pathology and potential for reversibility.
P03

Change in Function, Pain and Quality of Life following Structured Non-operative Treatment in Patients with Degenerative Cervical Myelopathy: A Systematic Review

Lindsay Tetreault¹, Mohammed Shamji¹, John Rhee², Jefferson Wilson¹, Ian Andersson³, Anna Dembek³, Krystle Pagarigan¹, Joseph Dettori⁴, Michael Fehlings¹
¹University of Toronto, Toronto, Ontario, Canada; ²Emory University, Atlanta, GA, USA; ³University of Puget Sound, Tacoma, WA, USA; ⁴Spectrum Research Inc., Tacoma, WA, USA

Objectives

To conduct a systematic review of the literature to determine (1) the change in function, pain and quality of life following structured non-operative treatment for degenerative cervical myelopathy (DCM); (2) the variability of change in function, pain and quality of life following different types of structured non-operative treatment; (3) the differences in outcomes observed between certain subgroups; and (4) negative outcomes and harms resulting from structured non-operative treatment.

Method

A systematic search was conducted for articles published between January 1, 1950 and February 9, 2015. Studies were included if they evaluated outcomes following structured non-operative treatment, including therapeutic exercise, manual therapy, cervical bracing and/or traction. Outcomes of interest were functional status, pain in upper extremities and neck, quality of life, and/or conversion to surgery. The quality of each study was evaluated using the Newcastle-Ottawa Scale and the strength of the overall body of evidence was rated using guidelines outlined by the GRADE.

Results

There is very low evidence to suggest that structured non-operative treatment for DCM results in a positive or negative change in function, pain and quality of life as evaluated by the JOA score. There is also limited evidence from three studies indicating that early structured non-operative treatment (duration of symptoms <1 year) may be associated with positive clinical outcomes. There were no studies that directly compared structured non-operative treatment types and no studies that explored outcomes based on patient subgroups. The rate of conversion to surgery was reported to be between 23-54% in mostly cases of mild or moderate myelopathy (JOA≥12).

Conclusions

There is a lack of evidence to determine the role of non-operative treatment in patients with DCM. However, in the majority of studies, patients did not achieve clinically significant gains in functional status following structured non-operative treatment. Furthermore, rates of failed conservative treatment were between 23-54%.
P04

Tobacco Smoking and Outcomes following Surgical Decompression in Patients with Symptomatic Degenerative Cervical Myelopathy

Paul Arnold¹, Branko Kopjar², Lindsay Tetreault³, Hiroaki Nakashima³, Michael Fehlings³
¹Kansas University Medical Center, Kansas City, Kansas, USA, ²University of Washington, Seattle, WA, USA, ³University of Toronto, Toronto, Ontario, Canada

Objectives

Tobacco smoking has negative effects at the cellular level and has been associated with poor outcomes following anterior discectomy and fusion for radiculopathy. However, the impact of smoking on outcomes in patients undergoing surgery for degenerative cervical myelopathy (DCM) has not been extensively evaluated. This study aims to analyze the impact of tobacco smoking on functional and quality of life outcomes in DCM patients.

Method

749 patients with symptomatic DCM underwent surgical decompression at 24 global sites. Prospective data were collected for each participating subject, including smoking status. Preoperatively and at each follow-up, patients were evaluated using the modified Japanese Orthopaedic Association scale (mJOA), Nurick score, Neck Disability Index (NDI), and Short-Form-36 (SF-36). Analysis of covariance was used to evaluate differences in outcomes at 24-months between smokers and non-smokers, while controlling for relevant baseline characteristics.

Results

There were 547 (73.03%) non-smokers and 202 (26.97%) smokers. Smokers were on average younger (53.40±9.36 years) than non-smokers (57.42±12.45 years, p=0.0200) and had worse preoperative quality of life based on the NDI, SF-36 Physical Component Score (PCS) and SF-36 Mental Component Score (MCS) (p<0.1). There were no differences between the groups with respect to preoperative mJOA or Nurick, gender, race, duration of symptoms, causative pathology and number of operated levels. At 12-months following surgery, improvements in mJOA, NDI, SF-36v2 PCS scores were significantly better in non-smokers than in smokers. Specifically, mJOA, NDI and SF-36 PCS outcomes were 15.59%, 31.61% and 28.57% lower in smokers compared to non-smokers. Following adjustment for confounders, these differences remained statistically significant. There were no differences in rates of complications between smokers and non-smokers. However, smokers (4.95%) were more likely to undergo subsequent surgeries compared to non-smokers (2.56%), although this association did not reach statistical significance (p=0.0991).

Conclusions

Smoking is strongly associated with suboptimal surgical outcomes in patients with DCM.
P05

Predicting the Minimum Clinically Important Difference in Patients undergoing Surgery for the Treatment of Degenerative Cervical Myelopathy

Lindsay Tetreault¹, Branko Kopjar², Paul Arnold³, Mark Kotter¹, Michael Fehlings¹
¹University of Toronto, Toronto, Ontario, Canada; ²University of Washington, Seattle, WA, USA, ³Kansas University Medical Center, Kansas City, Kansas, USA

Objectives

The minimum clinically important difference (MCID) is defined as the minimum change in a measurement that a patient would identify as beneficial. Before undergoing surgery, patients are likely to inquire about the ultimate goals of the operation and of their chances of experiencing meaningful improvements. The objective of this study was to define significant predictors of achieving a MCID on the mJOA at 2-years following surgery for the treatment of degenerative cervical myelopathy (DCM).

Method

757 patients were prospectively enrolled in either the AOSpine North America or International study at 26 global sites. Data were collected for each participating subject, including demographic information, symptomatology, medical history, causative pathology and functional status. Univariate log-binominal regression analyses were conducted to evaluate the association between preoperative clinical factors and achieving MCID on the mJOA. Modified Poisson regression using robust error variances was used to create the final multivariate model and compute the relative risk for each predictor.

Results

The sample consisted of 463 (62.31%) men and 280 (37.69%) women, with an average age of 56.48±11.85 years. At 2-years following surgery, the mean change in functional status was 2.71±2.89. Four hundred and eight-one (70.01%) patients exhibited meaningful gains on the mJOA, whereas 206 (29.98%) failed to improve by ≥ MCID. Based on univariate analysis, the significant predictors of achieving the MCID on the mJOA were younger age; female gender; shorter duration of symptoms; non-smoking; a lower co-morbidity score and absence of cardiovascular disease; and absence of upgoing plantar responses, lower limb spasticity and broad-based unstable gait. The final model included age (RR: 0.991, p<0.0001), smoking status (RR: 0.836, p=0.0040), broad-based unstable gait (RR: 0.872, p=0.0044) and duration of symptoms (RR: 0.943, p=0.0003).

Conclusions

Patients are less likely to exhibit clinically meaningful improvements if they smoke, are older, have broad-based unstable gait and have a longer duration of symptoms.
Timing of Decompression in Patients with Acute Spinal Cord Injury: A Systematic Review

Michael Fehlings¹, Jefferson Wilson¹, Paul Arnold², Christopher Shaffrey³, Mohammed Shamji¹, Thomas Mroz⁴, Andrea Skelly⁵, Jens Chapman⁶, Lindsay Tetreault¹, Bizhan Aarabi¹, Steve Casha⁸

¹University of Toronto, Toronto, Ontario, Canada, ²Kansas University Medical Center, Kansas City, Kansas, USA, ³University of Virginia, Charlottesville, VA, USA, ⁴Cleveland Clinic, Cleveland, OH, USA, ⁵Spectrum Research Inc., Tacoma, WA, USA, ⁶Swedish Swedish Neuroscience Institute, Seattle, WA, USA, ⁷University of Maryland, Baltimore, MD, USA, ⁸Foothills Medical Center, Calgary, Alberta, Canada

Objectives

To perform a systematic review to assess the comparative effectiveness and safety of early (≤ 24 hours) versus later decompression (>24 hours) in adults with acute traumatic spinal cord injury.

Method

A systematic search was conducted for literature published through November 6th, 2014. Included studies were critically appraised and GRADE methods were used to determine the overall strength of evidence. Based on clinical expert opinion, an improvement of two or more grades for Frankel or ASIA grades or 5 point improvement in ASIA Motor Score was considered a priori to represent clinically meaningful improvement.

Results

Across studies and injury levels, early surgical decompression was not consistently associated statistically with clinically important improvement in neurological status. Isolated studies reported statistically significant and clinically important improvement at 6 months for cervical injury and following discharge from inpatient rehabilitation but not at other time points in a population comprised of injury at any level; another study reported a statistically significant 6 point improvement in ASIA Score only among patients with AIS B, C, or D, but not for those with AIS A. In one study of acute traumatic cord injury without instability, a clinically and statistically meaningful improvement in total motor scores was seen at six months but not 12 months and there were no statistical differences in ASIA Impairment Scale up to 12 months. Safety and harms were reported in only three studies; although no statistical differences between early and late decompression were seen.

Conclusions

The overall strength of evidence across studies was low to very low that early decompression may lead to clinically important improvement in neurologic status in some instances. Although no statistical or clinically significant differences were noted between early and late groups, firm conclusions regarding the safety of early versus delayed surgical decompression are difficult given small sample sizes.
P07

Defining the Pathway to Definitive Care and Surgical Decompression after Traumatic Spinal Cord Injury: Results of a Canadian Population Based Cohort Study

Jefferson Wilson¹,², Susan Jaglal², Jennifer Voth², Albert Yee², Michael Fehlings²
¹Thomas Jefferson University, Philadelphia, PA, USA, ²University of Toronto, Toronto, ON, Canada

Objectives

Our objectives were to characterize and quantify patients' pathway to definitive care and to surgery post traumatic spinal cord injury (SCI), and, to identify patient specific and system factors that may pose barriers to expeditious care.

Method

A population based cohort study was performed within the province of Ontario. Using provincial administrative health data, accessed through the Institute for Clinical Evaluative Sciences at the University of Toronto, adult patients with acute traumatic SCI who underwent surgery between 2002 and 2011 were identified using SCI specific ICD-10 codes. The two outcome variables of interest included time to arrival at the site of definitive care and time to decompressive surgery. Bivariate and multivariate statistics were used to quantify the relationship between patient specific and system related predictor variables and the outcomes of interest.

Results

Amongst 1,111 patients meeting eligibility, mean times to arrival at the site of definitive care and to surgery were 8.1 ± 25.5 and 49.4 ± 65.0 hours respectively, with 53.3% of patients having undergone surgery prior to 24 hours. While the vast majority of patients (88.4%) presented within 6 hours to the site of definitive care, only 34.2% reached surgery within 12 hours of arrival. In the multivariate analysis, older age (IRR=1.01;95%CI:1.01,1.02), increased number of stops at intermediate health care centers (IRR=7.70;95%CI:7.54,7.86), higher comorbidity index (IRR=1.43;95%CI:1.14,1.72) and fall related SCI etiology (IRR=1.16;95%CI:1.02,1.29) were associated with increased time to arrival at definitive care. For surgery, increased age (OR=1.02;95%CI:1.01,1.03) and increased number of stops at intermediate health centers (OR=2.48;95%CI:1.35,4.56) were associated with a greater odds of undergoing late surgery as defined by a 24 hour cut-off window.

Conclusions

These results should help to inform policy decisions and allow for the creation of a streamlined path to specialized care for those patients suffering an acute SCI.
Assessment of Surgical Treatment Strategies for Moderate to Severe Cervical Spinal Deformity Reveals Marked Variation in Approaches, Osteotomies and Fusion Levels

Justin S. Smith1, Eric Klineberg2, Christopher I. Shaffrey1, Virginie Lafage4, Frank J. Schwab4, Themistocles Protopsaltis3, Justin K. Scheer5, Tamir Ailon7, Subaraman Ramachandran1, Alan Daniels6, Gregory Mundis13, Munish Gupta2, Vedat Deviren9, Christopher P. Ames9, International Spine Study Group12

1University of Virginia, Charlottesville, VA, USA, 2University of California, Davis, Sacramento, CA, USA, 3NYU Hospital for Joint Diseases, New York, NY, USA, 4Hospital for Special Surgery, New York, NY, USA, 5University of California San Diego, San Diego, CA, USA, 6Brown University, Providence, RI, USA, 7University of British Columbia, Vancouver, BC, Canada, 8Baylor Scoliosis Center, Plano, TX, USA, 9University of California San Francisco, San Francisco, CA, USA, 10University of Pittsburgh, Pittsburgh, PA, USA, 11Oregon Health & State University, Portland, OR, USA, 12, ., USA, 13San Diego Center for Spinal Disorders, La Jolla, CA, USA

Objectives

To assess for consensus on recommended surgical plans for CSD treatment.

Background

Although previous reports suggest that surgery can improve the pain and disability associated with cervical spinal deformity (CSD), approaches and techniques are not standardized.

Method

18 CSD cases were assembled, including a clinical vignette, cervical imaging (x-rays, CT/MRI), and full-length standing x-rays. Fourteen deformity surgeons (10 orthopaedic, 4 neurosurgery) were queried regarding recommended surgical plan.

Results

There was marked variation in treatment plans across all deformity types. Even for the least complex deformities (moderate mid-cervical apex kyphosis), there was lack of agreement on approach (50% combined anterior-posterior, 25%, anterior-only, 25% posterior-only), number of anterior (range: 2-6) and posterior (range: 4-16) fusion levels, and types of osteotomies. As the kyphosis apex moved caudally (cervical-thoracic junction/upper thoracic spine) and for cases with chin-on-chest kyphosis, >80% of surgeons agreed on a posterior-only approach and >70% recommended a pedicle subtraction osteotomy (PSO) or vertebral column resection (VCR), but the range in number of anterior (4-8) and posterior (4-27) fusion levels was exceptionally broad. Cases of cervical/cervical-thoracic scoliosis had the least agreement for approach (48% posterior-only, 33% combined anterior-posterior, 17% anterior-posterior-anterior or posterior-anterior-posterior, 2% anterior-only) and had broad variation in number of anterior (2-5) and posterior (6-19) fusion levels, and recommended osteotomies (41% PSO/VCR).

Conclusions

Among a panel of deformity surgeons, there was marked lack of consensus on recommended surgical approach, osteotomies and fusion levels for CSD. Further study is warranted to assess whether specific surgical treatment approaches are associated with better outcomes and to develop improved treatment algorithms for these complex patients.
Frailty and Postoperative Outcomes in Patients Undergoing Surgery for Degenerative Spine Disease

Raphaële Charest-Morin ², John Street¹, Liam Stobart¹, Christopher J. Ryerson¹, Alana Flexman¹
¹University of British Columbia, Vancouver, British Columbia, Canada, ²Université Laval, Québec, Québec, Canada

Objectives

Frailty is defined as a state of decreased reserve and susceptibility to stressors. The relationship between frailty and outcomes after degenerative spine surgery has not been studied. Objectives: 1) Determine prevalence of frailty in the degenerative spine population; 2) Describe patient characteristics associated with frailty; 3) Determine the ability of frailty to predict postoperative outcomes.

Method

We analyzed 52,671 patients in the National Surgical Quality Improvement Program who underwent degenerative spine surgery. A modified frailty index (mFI) was used to determine the prevalence and severity of frailty as previously described. The association of frailty with postoperative outcomes was determined using multivariate logistic regression.

Results

Frailty was present in 2,041 patients within the total population (4%), and 8% of patients older than 65 years. Frailty severity increased with increasing age, male sex, African-American race, higher body mass index, recent weight loss, paraplegia or quadriplegia, ASA score, and pre-admission residence in a care facility. Frailty severity was an independent predictor of major complication (OR 1.15 for every 0.10 increase in mFI, 95%CI 1.09-1.22, p<0.0005), and specifically predicted re-operation for post-surgical infection (OR 1.3, 95%CI 1.16-1.46, p<0.0005). Prolonged length of stay and discharge to a new facility were also independently predicted by frailty severity (p<0.0005). Frailty severity predicted 30-day mortality on unadjusted (OR 2.05, 95%CI 1.69-2.47, p<0.0005) and adjusted analysis (OR 1.44, 95%CI 1.15-1.81, p<0.005).

Conclusions

Frailty is an important predictor of postoperative outcomes following degenerative spine surgery. Preoperative recognition of frailty may be useful for perioperative optimization, risk stratification and patient counselling.
P10

Does Sarcopenia as Assessed by the Normalized Total Psoas Area Predict Early Outcomes In Elderly Patients Undergoing Elective Surgery For Degenerative Spine Disease?

Raphaële Charest-Morin², John Street¹, Alana Flexman¹

¹University of British Columbia, Vancouver, British Columbia, Canada, ²Université Laval, Québec, Québec, Canada

Objectives

Sarcopenia measured by normalized total psoas area (NTPA) has been shown to predict mortality and adverse events (AE) in multiple settings. Its relation with postoperative outcomes after surgery for degenerative spine disease (DSD) has not been defined. Objectives: 1) Describe the distribution and predictors of NTPA 2) Determine relationship between NTPA and postoperative outcomes in the elderly DSD population.

Method

302 patients aged over 65 years old underwent elective surgery for DSD at Vancouver General Hospital between 2009 and 2013 with exclusion of deformity and revision surgery. 102 patients had preoperative imaging to measure total psoas area (TPA) at the L3 level. TPA was adjusted for height (NTPA). Surgical Invasiveness Index (SSI) and Modified Frailty Index (mFi) were calculated. Primary outcome was AE collected prospectively with the SAVE database. Hospital length of stay (LOS) and mortality were reported. Predictors of NTPA and its association with AEs was determined using multivariate logistic regression.

Results

Mean SII was 7.76 (0-20). 19 (18.6%) patients were frail (mFi> 0.21). Mean NTPA was 674mm²/m² (293.21- 1636.25) with intra and inter-observer reliability of 0.98 and 0.95. NTPA was predicted by gender and BMI. 42 (41.2%) patients had >1 AE. No in-hospital mortality occurred and mean LOS was 6.6 (range 1-59) days. AEs were predicted by SII on unadjusted (1.77, 95% CI 1.15-2.72 p= 0.01) and adjusted analysis (1.81, 95% CI 1.17-2.80 p= 0.008). NTPA did not predict AE on both adjusted (1.03, 95% CI 0.9-1.19 p= 0.62) and unadjusted analysis (1.06, 95% CI 0.91-1.23 p= 0.45). Age, BMI, mFI, and ASA were not associated with the primary outcome.

Conclusions

Sarcopenia assessed by NTPA was reliably estimated in our population. In contrast to other populations, NTPA did not predict complications. Further research is needed to determine the impact of sarcopenia and its optimal measure in the spine population.
The Relationship Between Pre-Existing Comorbidities and Post-Injury Adverse Events in Traumatic Spinal Cord Injury: A Prospective Canadian Cohort Study Focusing on Potentially Modifiable Conditions

Travis Marion¹, Carly Rivers², Dilinuer Kuerban², Christiana Cheng², Vanessa Noonan¹,², Marcel Dvorak¹, Charles Fisher¹, Brian Kwon¹, John Street⁰

¹University of British Columbia, Vancouver, BC, Canada, ²Rick Hansen Institute, Vancouver, BC, Canada

Objectives

Adverse events (AE) are common throughout the course of care in traumatic spinal cord injury (tSCI) patients. AEs disrupt care and negatively impact outcomes. Increased risk of AEs is linked to patient factors as well as the presence/number of pre-existing comorbidities. Our aim: establish relationships between pre-existing comorbidities and post-injury AEs, and identify potentially modifiable conditions.

Method

Adults with acute tSCI admitted for acute care at a level-I acute specialized spine centre included in the Rick Hansen SCI Registry (RHSCIR, prospective observational) with AE data collected using the Spine Adverse Events Severity (SAVES) system. Patient demographic and injury mechanism/severity data were obtained from RHSCIR. Comorbidities, Charlson/Elixhauser Comorbidity Indexes were collected from hospital administrative data. Negative binomial regression/multiple logistic regression were used to investigate the impact of patient characteristics on the number of AEs experienced and five most common AEs respectively. Chi-Square/Fisher extract tests were performed to investigate the association between most common AEs and modifiable comorbidities, these associations were also re-examined adjusting for age, gender and initial motor score with multiple logistic regression.

Results

444 patients were admitted in 2006-2014. 56.0% of patients reported ≥1 comorbidity, 12.8% had ≥3 comorbidities. 79.3% experienced at least one AE, 38.1% had 3+. Increased age (p<0.01), lower total motor score (p<0.001), and lower education (p<0.01) at admission were non-modifiable independent variables significantly associated with increased AEs. The top five AEs were UTIs (42.8%), pneumonia (39.2%), neuropathic pain (31.5%), delirium (18.2%), and pressure ulcers (11.0%). Risk of delirium was increased in those with alcohol/drug withdrawal or psychotic comorbidity; UTI risk increased with alcohol/drug withdrawal; and pneumonia risk increased with psychiatric comorbidities.

Conclusions

AEs are common in tSCI patients. Risk of AEs is associated with non-modifiable factors, however opportunity exists for increased AE surveillance in those at risk and potential reduction of incidence by addressing modifiable risk factors.
The Incidence, Severity, and Impact of Adverse Events in Adult Spinal Deformity Patients: An Ambispective Cohort Analysis.

Travis Marion, Tamir Ailon, Michael Boyd, Marcel Dvorak, Charles Fisher, Brian Kwon, Scott Paquette, John Street
University of British Columbia, Vancouver, BC, Canada

Objectives

We sought to determine the true incidence and type of adverse events (AEs) in adult persons consecutively admitted for complex spinal surgery, and to examine their impact on hospital length of stay (LOS).

Method

Consecutively enrolled adult patients treated for adult spinal deformity (ASD) at our institution between 2008 and 2015 were included. A previously published, validated system (Spine Adverse Events Severity System;SAVES) was used to collect, categorize and grade AE severity. Patient without complete SAVES data were excluded. Demographic data, medical comorbidities, Charlson and Elixhauser Comorbidity Indexes, intraoperative, and postoperative AEs were prospectively collected. We assessed the relationship between patient factors and AEs. Specifically, we analyzed their impact on the total number of AEs experiences, and the most common AE types. We also evaluated the correlation between AEs and hospital length of stay (LOS).

Results

132 patients were identified. Mean age was 59.0 years. All patients experienced at least 1 AE. Over half of patients (53.8%) experienced ≥1 intra-operative AE, and 75.8% experienced ≥1 post-operative AE. The most common AEs were UTI (33.3%), delirium (22.7%), post-operative neuropathic pain (19.7%), pneumonia (12.9%), and neurologic deterioration (8.3%). Univariate analysis revealed that patients who experienced ≥1 post-operative AE were, on average 6.0 years older than those that did not (p<.05). Increased age was a significant univariate predictor of delirium (p<.01), and pneumonia (p<.05) but was not associated with a higher incidence of any of the other most common AEs. The presence of ≥1 post-operative AE increased the mean LOS by 13.9 days (p<0.001).

Conclusions

AEs are common amongst patients admitted for deformity correction. Increased age is associated with a greater risk of experiencing postoperative AEs, and was found to be a significant risk factor for delirium and pneumonia. LOS was significantly greater in patients that experienced ≥1 post-operative AE.
P13

Factors Affecting Length of Stay Following Three Column Spinal Osteotomies in Paediatric Patients

So Kato, Stephen Lewis  
Toronto Western Hospital, Toronto, ON, Canada

Objectives

Little has been understood regarding length of stay (LOS) after three-column spinal osteotomy for the rigid spinal deformity in paediatric population. The objective of the present study was to identify factors affecting LOS in these patients.

Method

A retrospective review was performed of 38 posterior three-column osteotomies for the paediatric patients. Patients’ demographic data, preoperative comorbidities, details of operative procedures, intraoperative complications and postoperative complications were investigated, and LOS was compared among the groups.

Results

The mean LOS was 12.0 days and the median was 7 days (range, 4 – 85 days). Low body weight (< 5th percentile), non-ambulant patients, pulmonary dysfunction and neuromuscular deformity were associated with longer LOS. Multiple regression analysis revealed that non-ambulatory status and neuromuscular deformity were the risk factors for longer LOS (standardized coefficients beta: 0.57 and 0.35, p < 0.001 and 0.005, respectively). Those with postoperative respiratory complication (median: 21 days vs. 7 days, p = 0.009) and/or surgical site infection (54 days vs. 7 days, p = 0.02) stayed longer. Neurological complication did not affect the LOS.

Conclusions

Non-ambulatory status and neuromuscular deformity had longer LOS after three-column osteotomies. Respiratory complication and surgical site infection were the complications affecting LOS.
P14

The Rate and Risk of Curve Progression following Skeletal Maturity- Does the Story End with Curve Magnitude?

Firoz Miyanji\(^1\), Chris Reilly\(^1\), Suken A Shah\(^2\), David H Clements\(^3\), Amer F Samdani\(^4\), Sameer Desai\(^1\), Baron S Lonner\(^5\), Harry L Shufflebarger\(^6\), Randal R Betz\(^7\), Peter Newton\(^8\)

\(^1\)BC Children's Hospital, Vancouver, Canada, \(^2\)Nemours/Alfred I DuPont Hospital for Children, Wilmington, USA, \(^3\)Cooper Bone and Joint, Camden, USA, \(^4\)Shriners Hospital, Philadelphia, USA, \(^5\)Mount Sinai Beth Israel, New York, USA, \(^6\)Miami Children's Hospital, Miami, USA, \(^7\)Institute for Spine and Scoliosis, Lawrenceville, USA, \(^8\)Rady Children's Hospital, San Diego, USA

Objectives

Natural history of AIS \(\geq 30^\circ\) in skeletally mature patients is poorly defined. Studies reporting rates and risk factors for progression are predominantly of large curves in immature patients. Our aim was to determine the rate of curve progression in AIS following skeletal maturity, any associated changes in SRS-22 scores, and identify any potential predictors of curve progression.

Method

Patients enrolled in a prospective, longitudinal, multi-center non-surgical AIS database were evaluated. All patients had minimum 2 year follow-up, idiopathic scoliosis \(\geq 30^\circ\), and were skeletally mature. SRS-22 functional outcome scores and radiographic data were compared at baseline and 2-year follow-up. Patients were divided into 3 groups based on curve size: A=30°-39°, B=40°-49°, C=\(\geq 50^\circ\). Curve progression was defined as any change in curve magnitude.

Results

There were 80 patients, majority females (93.8%) with a mean age of 16.5+/-0.16. Mean BMI was 21+/-0.31 with 15.1% overweight. Mean major Cobb at baseline was 38.3°+/-0.88°. At 2 year follow-up 46.3% of curves had progressed an average 3.4°+/-0.38°. Of curves that progressed, patients in group A had the largest mean rate of progression followed by group B. SRS-22 scores on average declined significantly over 2 years in this cohort (4.23 to 4.08; p=0.002). Patients who progressed had on average a more significant decline in SRS outcome scores compared to those that did not (p=0.018, p=0.041 respectively), with the most significant change noted in the Self-Image domain (p=0.03). There was no significant difference in the change in SRS scores over 2 years based on curve size. Univariate analysis did not identify any factors predictive of curve progression in this cohort.

Conclusions

Skeletally mature patients with AIS \(\geq 30^\circ\) may continue to have a risk of progression at a mean rate of 1.7°/yr and significant decline in SRS-22 outcome scores, in particular Pain and Self-Image, over time. Further longer term follow-up may provide valuable insight into this patient population.
P15

Integration of a Spine Assessment Clinic Prior to Surgical Consult – A Program Description

Austin Enright, Mike Johnson, Steve Passmore, Mike Goytan
University of Manitoba, Winnipeg, MB, Canada

Objectives

Background: Lengthy surgical consult wait-times are an issue for many surgical specialties. Many patients wait 24-36 months for non-acute spine pain consultation. Often patients require only non-operative treatment. Traditional spine surgery referrals are inefficient for patients and referring, assessing and treating physicians.

Hypothesis: We predict that the majority of patients referred to the Spine Assessment Clinic (SAC) will not need spinal surgery upon referral, but instead warrant referral for non-operative management.

Method

Methods: For 2-months non-acute spine surgery referrals to two spine surgeons were prescreened by two advanced practice physiotherapists for their appropriateness for: 1) spine surgery referral; 2) non-operative management referral; 3) updated imaging request; or 4) discharge recommendation.

Results

Results: Average wait time for SAC assessment was under 30 days. There were 71 patients referred to the spine surgeons, who triaged non-acute patients to the SAC. A total of 61 patients (85.9%) attended the clinic for assessment. Of the assessed patients, 12 (19.7%) were referred for surgical consultation, 20 (32.8%) for pain clinic consultation, 24 (55.7%) for in-house physiotherapy, 2 (3.2%) for updated imaging, and 14 (19.7%) were discharged needing no further care.

Conclusions

Conclusions: The SAC improved the efficiency of clinic utilization of the two spine surgeons involved in the program and decreased wait-times for patients. Average time to initial spine assessment dropped from 24 months to less than 30 days, a 20-fold improvement.

Of the 61 patients, only 19.7% were appropriate for surgical consultation. Accordingly, prior to the SAC integration surgeons were seeing approximately 4 patients for every one appropriate surgical consult, an inefficient use of time and resources. The results also highlight the number of patients (80.3%) that are presently incorrectly referred for spine surgery consults when non-operative treatments are more appropriate.
Improved Data Capture and Quality Following Implementation of Standard Operating Procedures for a Single Site in the Canadian Spine Outcomes Research Network Database.

Eden Daly\textsuperscript{3}, Neil Manson\textsuperscript{1,2}, Erin Bigney\textsuperscript{3}, Kate Wagg\textsuperscript{3}, Edward Abraham\textsuperscript{1,2}

\textsuperscript{1}Canada East Spine Centre, Horizon Health Network, Saint John, N.B., Canada, \textsuperscript{2}Faculty of Medicine, Dalhousie University, Saint John Campus, Saint John, N.B., Canada, \textsuperscript{3}Canada East Spine Centre, Saint John, N.B., Canada

Objectives

Databases are challenged by high lost to follow-up rates leading to compromised validity and poor data quality. This affects the Levels of Evidence designation for any proposed research utilizing the database. The objective of the current study is to test the effectiveness of new Standard Operating Procedures (SOPs) to reduce patient attrition at a single CSORN centre.

Method

A data collection report was generated immediately prior to, and 9 months after SOP implementation examining 12 week, 12 month and 24 month time-points. Follow-up rates pre-SOP, post-SOP, and nationally were compared using the nonparametric t-test Man Whitney U. Significance was set at $\alpha > 0.05$.

Results

Significant differences were noted for follow-up rates compared nationally, pre-SOP, post-SOP: 12-months 79%, 75%, 85%; 24-months 73%, 72%, 81% respectively ($p=0.00$). No difference was observed at 12-weeks: 91%, 91%, 93% respectively ($p>0.05$). With exclusion of patients that were outside the capturable time frame at SOP initiation, the SOP proved very robust with significant improvement in follow-up rates: 12 weeks 99% ($p>0.05$), 12 months 98% ($p=0.00$), 24 months 95% ($p=0.00$). Data quality was also improved post-SOP due to increased data accuracy and decreased data points missed.

Conclusions

Formal introduction of this SOP at the single centre has decreased patient attrition, providing improved data collection at all study time points to 24 months. The new SOP included regular audits and training to ensure data accuracy. Adoption of SOPs at all CSORN sites could potentially improve follow-up rates and thus quality nationally.
Survival and Clinical Outcomes in Patients with Metastatic Epidural Spinal Cord Compression: Results from the AOSpine Prospective Multi-Centre Study of 142 patients

Michael Fehlings¹, Anick Nater¹, Lindsay Tetreault¹, Branko Kopjar², Paul Arnold³, Mark Dekutoski⁴, Joel Finkelstein⁵, Charles Fisher⁶, John France⁷, Ziya Gokaslan⁸, Eric Massicotte¹, Laurence Rhines⁹, Peter Rose¹⁰, Arjun Sahgal⁵, James Schuster¹¹, Alexander Vaccaro¹²

¹University of Toronto, Toronto, Ontario, Canada, ²University of Washington, Seattle, WA, USA, ³Kansas University Medical Center, Kansas City, Kansas, USA, ⁴The Core Institute, Phoenix, Arizona, USA, ⁵Sunnybrook Health Sciences Center, Toronto, Ontario, Canada, ⁶University of British Columbia and Vancouver Coastal Health, Vancouver, BC, Canada, ⁷West Virginia University, Morgantown, WV, USA, ⁸The Rhode Island Hospital, Providence, RI, USA, ⁹MD Anderson Cancer Center University of Texas, Houston, TX, USA, ¹⁰Mayo Clinic, Rochester, MN, USA, ¹¹University of Pennsylvania, Philadelphia, PA, USA, ¹²Thomas Jefferson University, Philadelphia, PA, USA

Objectives

Although surgery is being increasingly used in patients with Metastatic Epidural Spinal Cord Compression (MESCC) as a complementary strategy to radiation and chemotherapy, the impact of surgery on quality of life (QoL) is not well established. This study aimed to prospectively evaluate survival, neurological, functional, and QoL outcomes in MESCC patients undergoing operative management.

Method

A total of 142 surgically treated patients with a single symptomatic MESCC lesion enrolled in a prospective North American multi-center study were followed for 12 months. Clinical data, such as Brief Pain Inventory (BPI), ASIA, SF-36, Oswestry Disability Index (ODI), and EQ-5D scores, were obtained both pre- and post-operatively.

Results

The median survival was 7.7 months. The 30-day and 12-month mortality rates were 9% and 62%, respectively. Six weeks post-operatively, ambulatory status (p = 0.02) and bladder control (p = 0.03) were significantly improved. Overall, 67.5% of ASIA B, C, or D patients gained at least 1 grade after surgery, 25% remained stable, and 7.5% deteriorated. ODI, EQ-5D, BPI scores were significantly improved at each follow-up (p £ 0.01). SF-36 scores were generally higher after surgery for mental and physical components, and for all domains except energy/fatigue. The incidence of wound complications was 10% and 2 patients required a second surgery (screw malposition and epidural hematoma).

Conclusions

Surgical intervention, as a complementary adjunct to radiation and chemotherapy, provides immediate and sustained improvement in pain, neurological, functional, and QoL outcomes with acceptable risks in patients with a focal symptomatic MESCC lesion.
The clinical utility of the spinal instability neoplastic score (SINS) and its role in surgical management of patients with spinal metastatic disease

Ayoub Dakson, Erika Leck, Sean Christie
Queen Elizabeth II Health Sciences Centre, Dalhousie University, Halifax, Nova Scotia, Canada

Objectives

Metastatic destruction of integral spinal elements increases the risk of instability, pain and neurologic deficits. The Spinal Instability Neoplastic Score (SINS) is used to assess mechanical instability based on radiographic and clinical factors. We conducted this study to evaluate the clinical utility of SINS in surgical decision-making in spinal metastasis and its association with metastatic epidural spinal cord compression (MESCC).

Method

We allocated 285 patients with spinal metastatic disease using our local oncology database, with their disease characteristics identified through a retrospective review. SINS was calculated using good-quality computed tomography (CT) imaging studies. The degree of MESCC was assessed using 0 to 3 grading system.

Results

Based on SINS, patients were categorized into stable (34.7%), potentially unstable (52.6%) and unstable (12.6%) groups. There were no cases with esophageal or small cell lung carcinomas associated with unstable SINS suggesting that some metastatic malignancies may be less prone to spinal instability. Surgical interventions were employed in 20.7% of patients, and radiotherapy alone in 69.5%. In the surgical intervention group, there was 69.5% treated with decompression and instrumented fusion, 17% with decompression alone, 8.5% with percutaneous vertebral augmentation and 5% with instrumented arthrodesis. A significantly higher proportion of patients with stable SINS (63.6%) were treated surgically without instrumentation (X2=10.6, P=0.005), whereas instrumentation was utilized in 87.5% of patients with unstable SINS. Instability was associated with metastatic lesions at junctional spinal levels, mechanical pain, deformity, vertebral body collapse > 50% and bilateral posterolateral metastatic involvement (P<0.001). Grade 3 MESCC occurred in 65.5% of patients with unstable SINS, whereas 71.4% of patients with stable SINS had grade 0 MESCC (X2=42.1, P<0.001).

Conclusions

SINS is associated with higher degrees of MESCC and may play an important role in surgical decision-making, facilitating assessment and recognition of spinal instability in need of urgent appropriate surgical interventions.
P19

Patterns of spinal metastatic disease and mechanical instability: a retrospective correlation with tumor histology

Ayoub Dakson, Erika Leck, Sean Christie
Queen Elizabeth II Health Sciences Centre, Dalhousie University, Halifax, Nova Scotia, Canada

Objectives

Spinal metastatic disease develops in 40% of patients with cancer. Clinical manifestations include pain and/or neurologic deficits secondary to spinal instability and/or metastatic compression of the spinal cord/nerve roots. However, the rates of mechanical instability, metastatic epidural cord compression and patterns of spinal metastatic disease in different malignancies are not clear. This study aims to provide epidemiological data concerning spinal instability and patterns of metastatic invasion of the spine based on tumor histology.

Method

We allocated 285 patients with spinal metastatic disease using an oncology database, with disease characteristics identified through a retrospective review. The Spinal Instability Neoplastic Score was used to describe mechanical instability. SINS was calculated using good-quality computed tomography imaging studies. The Tomita anatomical classification of spinal metastasis was used to group metastasis into being either intra-compartmental, extra-compartmental or multiple metastases.

Results

The three most common malignancies with spinal metastasis were non-small cell lung (25.3%), Breast (17.5%) and prostate (14.4%) carcinomas; the least common pathologies were pancreatic (0.4%), thyroid (1.1%) and uterine (2.8%) cancers. Esophageal cancer was the least likely to be associated with instability with about 64% of cases being stable. The highest rates of instability scores were observed in breast carcinoma (18% graded as unstable). Renal cell carcinoma was associated with lytic spinal metastases, whereas blastic metastases mostly occurred in prostate carcinoma (P<0.001). Whilst multiple metastases were observed in 68.1% of cases, solitary lesions were intra-compartmental (13.3%) or extracompartmental (18.6%). The highest degrees of spinal instability (intermediate and unstable categories) were associated with extra-compartmental metastatic disease (P<0.001).

Conclusions

This study sheds light on the patterns of spinal metastatic disease and mechanical instability on the basis of tumor histology, utilizing standardized scoring systems. The utilization of such scoring systems allows for a standardized approach towards description and analysis of spinal metastasis facilitating clinical research in this avenue.
P20

A retrospective analysis of the clinical utility of the Tokuhashi scale, and its impact in surgical management of spinal metastatic disease

Erika Leck, Ayoub Dakson, Sean Christie
Queen Elizabeth II Health Sciences Centre, Dalhousie University, Halifax, Nova Scotia, Canada

Objectives

The evaluation of patients presenting with spinal metastatic disease is often challenging due to the diversity of disease and the variety of factors that influence decision-making. The Tokuhashi scale intends to facilitate this process, by incorporating a variety of patient and disease specific characteristics, in order to assess prognosis and guide intervention decisions. We conducted this study to investigate its clinical utility in surgical-decision making in patients with spinal metastasis.

Method

Our local oncology database was used to retrospectively allocate patients with spinal metastasis between 2010 and 2015. The Tokuhashi scale components were determined from a chart review.

Results

285 patients with spinal metastatic disease were allocated. The mean age was 65.3±11.5 years, with 53.3% of patients being males. Based on the Tokuhashi scale, there was 68.4% in the non-operative/radiation group (group 1), 23.9% in the palliative/excisional surgical group (group 2) and 7.7% in the surgical group (group 3). Using the Kaplan-Meiers estimate, survival time was significantly different across the three groups with means 238.3±408, 326.2±293.5 and 543.9±715.5 days, respectively. A significantly higher proportion of patients (84.6%) were treated non-surgically in group 1, compared to 45.5% in group 3 (X2= 19.5, P<0.001). However, there was no correlation between the type of surgical interventions (i.e. instrumented decompression, decompression alone, percutaneous vertebral augmentation and instrumented vertebral augmentation) and the Tokuhashi score.

Conclusions

The Tokuhashi scale represents a comprehensive prognostic system taking into account a number of disease and patient-related factors to aid prediction of prognosis and, thus, surgical interventions. This review illustrates the utility of the Tokuhashi scale in predicting survival and, hence, guiding subsequent management. However, it does not address the new role of emerging different surgical strategies for the treatment of spinal metastasis and lacks other important information concerning spinal mechanical instability, which influences surgical treatment.
Length of Hospital Stay Following Elective Lumbar Spine Fusion Surgery

Morsi Khashan¹, Michael Weber¹, Greg McIntosh², Joy Barker¹, Jeff Golan¹
¹McGill University, Montreal, Quebec, Canada, ²Canadian Spine Society, Markdale, Ontario, Canada

Objectives

Longer hospital stay following elective spinal procedures is associated with higher costs and may expose patients to nosocomial morbidity. In order to identify predictors for the length of hospital stay (LOS), we analyzed elective lumbar spine fusion surgery cases using the Canadian Spine Outcomes and Research Network (CSORN).

Method

All cases of elective lumbar spine fusion surgeries that consented to CSORN between October 2008 and September 2015 were investigated. We analyzed demographic, preoperative and intraoperative parameters. LOS from surgery to discharge was calculated. The required data was available for 926 cases. Multivariable linear regression was used to model the relationship between the outcomes and the prognostic variables of interest using a backward selection procedure. A data-splitting technique was used to develop and test the multivariable models, whereby a 67% random sample of the full dataset was used for model development (Build sample), and the entire dataset was used for model validation (Test sample).

Results

Younger age, principle pathology of degenerative disc disease, fusion of only one level, less blood loss, and less operative time were associated with shorter hospital stay. Surprisingly, smoking also predicted shorter hospital stay. All the parameters resulted in p-value<0.05.

Conclusions

Our study suggests a number of predictors for shorter hospital stay following lumbar fusion procedures. These results provide helpful evidence for setting hospital recovery expectations and goals. The unexpected effect of smoking on the LOS may be explained by the enhanced incentive of smokers to leave hospitals early after surgery.
P22


Edward Abraham\textsuperscript{1,2}, Kate Wagg\textsuperscript{4}, Maxwell Armstrong\textsuperscript{1,3}, Erin Bigney\textsuperscript{4}, Eden Daly\textsuperscript{4}, Neil Manson\textsuperscript{1,2}  
\textsuperscript{1}Canada East Spine Centre, Horizon Health Network, Saint John, N.B., Canada, \textsuperscript{2}Faculty of Medicine, Dalhousie University, Saint John Campus, Saint John, N.B., Canada, \textsuperscript{3}Dalhousie University, Saint John Campus, Saint John, N.B., Canada, \textsuperscript{4}Canada East Spine Centre, Saint John, N.B., Canada

Objectives

To compare patient and surgeon reported outcomes and peri-operative data for Interspinous process device (IPD) versus Decompression Fusion (DF) out to 24-months for patients suffering lower extremity symptoms with or without back pain due to degenerative lumbar spondylolisthesis.

Method

This is a retrospective review of prospective data. Ninety-six consecutive patients with stable lumbar degenerative spondylolisthesis received DF(n=48) or IPD(46). Numeric Rating Scales (NRS) for back and leg pain and Oswestry Disability Index were compared at 24 months. OR time, blood loss, length of hospital stay, rate of surgical revision, and patient satisfaction were also compared. Independent T-tests were utilized to detect between group differences. The study was powered to detect a 10 point change in ODI.

Results

Blood loss (IPDm=60.11; DFm=506.12; \( t_{[93]}=-7.723; p=0.000 \)) and OR time (IPDm=85.35; DFm=150.75; \( t_{[89]}=-7.801; p=0.000 \)) were significantly higher and length of stay in hospital was significantly longer (IPDm=0.91; DFm=6.24; \( t_{[93]}=-7.981; p=0.000 \)) in the DF group. There was no significant difference in amount of subsequent revision surgeries (IPDm=0.24; DFm=0.14; \( t_{[93]}=1.118; p=0.267 \)). Differences in ODI scores (IPDm=25.59; DFm=32.08; \( t_{[91]}=-1.595; p=0.114 \)), NRS scale for back pain (IPDm=3.61; DFm=4.00; \( t_{[91]}=-0.692; p=0.491 \)) and NRS scale for leg pain (IPDm=3.34; DFm=3.45; \( t_{[91]}=-0.177; p=0.860 \)) were not significant.

Conclusions

Surgical treatment of stable degenerative lumbar spondylolisthesis with IPD provides equivalent patient reported outcomes to that of DF with improved peri-operative factors. This may translate into improved resource utilization. A larger study powered to detect a small effect is warranted.
P23

The outcomes following decompression and fusion are compromised when it is preceded by a discectomy or decompression.

Neil Manson1,2, Erin Bigney3, Kate Wagg3, Eden Daly3, Edward Abraham1,2
1Canada East Spine, Horizon Health Network, Saint John, N.B., Canada, 2Faculty of Medicine, Dalhousie University, Saint John Campus, Saint John, N.B., Canada, 3Canada East Spine Centre, Saint John, N.B., Canada

Objectives

Persistent symptoms post discectomy or decompressions are often managed with revision decompression and fusion despite lack of neurocompression or instability. Aetiology of failure may be nerve signalling change (neuropathic pain) or non-physiologic (psychosocial) for example. The study objective is to quantify and compare the outcomes of primary decompression and fusion to revision decompression and fusion following unsuccessful discectomy or decompression.

Method

A retrospective review of prospectively collected data defined two cohorts: 91 patients received primary 1 or 2 level decompression and fusion (PF) and 135 received revision 1 or 2 level decompression and fusion following unsuccessful discectomy or decompression (RF). A multivariate analysis of variance was conducted with time of testing and surgical experience as the independent variables and SF-12, NRS back pain and leg pain at 1-year postoperative as the dependent variables. Significance was set at $\alpha < 0.05$.

Results

Outcomes improved on all measures from baseline to 1-year ($F(4, 336) = 87.98; p = 0.00$) for PF more so than RF ($F(4, 336) = 10.47; p = 0.00$). PF had significantly higher scores for PCS ($F(1, 339) = 15.57; p = 0.00$), MCS ($F(1, 339) = 26.68; p = 0.00$) and NRS Back ($F(1, 339) = 5.34; p = 0.021$) and NRS leg ($F(1, 339) = 17.98; p = 0.00$) as compared RF. A significantly higher ($p = 0.026$) proportion of the RF group (14.8%) failed to show any improvement at 1 year follow-up on two or more measures compared to the PF group (7.0%).

Conclusions

RF did not provide outcomes equivalent to PF. The high percentage of patients in the RF cohort displaying no improvement or deteriorating outcomes indicates it may be necessary to consider alternative treatment strategies when symptoms persist following discectomy or decompression.
Predictors of response following non-surgical treatment of low back pain (LBP)

Markian Pahuta\textsuperscript{1,2}, Anthony Perruccio\textsuperscript{1,2}, Elizabeth Badley\textsuperscript{2}, Raja Rampersaud\textsuperscript{1,2}  
\textsuperscript{1}University Health Network, Toronto, Canada, \textsuperscript{2}University of Toronto, Toronto, Canada

Objectives

Current ‘non-specific’ LBP treatment demonstrates poor response in many patients. While stratified care based on STarT Back and level of disability have been suggested, there remains little knowledge of what factors predict poor response to non-surgical LBP treatment. We sought to identify factors of response ≥6 months following non-surgical LBP treatment.

Method

Patients treated through the Inter-professional Spine Assessment and Education Clinics (ISAEC) completed a health questionnaire at initial visit and 6 months following non-surgical treatment. Patients were classified as responders (good outcome) if their 6 month ODI score improved by ≥ 10 units from enrollment. Covariates considered included: baseline age, sex, duration of LBP symptoms, LBP pattern, LBP intensity during activity, baseline ODI score, and STarT Back chronicity risk. Adjusted log-Poisson regression (with robust variance estimation) was used to identify independent risk factors for poor response.

Results

204 patients were included with mean age 52 (range: 18-93); and 66% female. The risk of poor response decreased by 3% for each unit increase in baseline ODI score, while it increased by 1% for every unit increase in pain intensity score. Females had 50% greater risk of poor outcome (vs. males; p=0.01), those with >12 months symptom duration a 46% increased risk (vs. <6 months duration; p=0.03), those with high chronicity risk a 83% increased risk (vs. ‘low’; p<0.005), and patients with back dominant pain aggravated by extension had a 55% increased risk of poor response (vs. back dominant pain aggravated by flexion; p<0.02).

Conclusions

Independent of baseline disability and chronicity risk, females and those with facetogenic/back dominant symptoms were at increased risk of poor response. These patients represent a growing demographic of the aging population that likely has symptomatic facet osteoarthritis (OA). Further study is needed to identify specific risk factors of poorer response in this group, including potentially confounding systemic OA features.
CONFICT OF INTEREST (COI) DISCLOSURE INFORMATION

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