Global Spine Forum Updates: Research Supports Early Intervention

Written by Phil Vinall

Michael P. Grevitt, MD, Nottingham University Hospital, Nottingham, United Kingdom, opened the session with an introduction to AOSpine and the AOSpine Knowledge Forums.

AOSpine is an international community of spine surgeons generating, distributing, and exchanging knowledge to advance science and the spine care profession through research, education, and community development [AO Foundation. https://www.aofoundation.org/Structure/Pages/default.aspx. Accessed November 25, 2014]. The AOSpine Knowledge Forums are focused working groups acting to foster innovation and evidence-based clinical practice in all pathologies, including tumor, deformity, spinal cord injury (SCI) and trauma, and degenerative and biologics. A steering committee of up to 10 international spine experts governs each forum. Table 1 provides an update on the status and achievements of each forum.

Carlo Bellabarba, MD, University of Washington, Seattle, Washington, USA, discussed the new AOSpine thoracolumbar fracture classification system [Vaccaro AR et al. *Spine (Phila Pa 1976)*. 2013].

Thoracolumbar fracture classification assists in teaching, provides a way to communicate the relative severity of the injury, and offers a conceptual framework for diagnosis and treatment. A good classification system must be functional, practical, and reproducible. In the spine, there are 4 anatomic regions of interest: the occipitocervical junction (C0 to C2), for which there is no unifying concept at this time; the subaxial region (C3 to C7), for which, again, there is no universally accepted system; the thoracic and lumbar regions, which have the best systemic approaches; and the sacrum, which is usually a part of pelvic injuries.

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The Magerl-AO classification system was developed in 1994. While it has many good points, it was designed primarily for thoracic and lumbar injuries. The purpose of the new system is to make the scheme applicable throughout the entire spine, to improve hierarchical consistency, and to improve the ability to guide treatment.

Radiographic or presumed mechanical information is not always sufficient to make a diagnosis. A new AO Foundation classification was needed to achieve global acceptance, resolve hierarchical inconsistencies, integrate neurologic exam and modifiers for specific conditions, and integrate with a severity scoring system. The revised classification and injury severity system is based on the evaluation of morphologic classification of the fracture, neurologic injury, and clinical modifiers.

Morphologic classification is divided into types A, B, and C. Type A covers failure of anterior compression fractures with intact tension band injuries and includes 5 subtypes: inconsequential process fractures, wedge compression, splits, incomplete burst, and complete burst. Type B is a failure of the posterior or anterior tension band and includes 3 subtypes: a monosegmental bony failure of the tension band, a bony and/or ligamentous failure of the tension band with a type A fracture, and an injury through the disk or vertebral body leading to a hyperextended position of the spinal column. Type C is failure of all elements, leading to dislocation or displacement, and has no subtypes.

The grading system for neurologic status has 6 subtypes—described as neurologically intact, transient neurologic deficit, radicular symptoms, incomplete SCI, complete SCI, and unknown status. Patient-specific clinical modifiers include fractures with indeterminate injury to posterior tension band based on spinal imaging, with or without magnetic resonance imaging (MRI; M1), and patient-specific comorbidity that may dictate type of treatment (M2). In summary, the new classification system combines the evaluation of morphology, neurology, and modifiers into a scoring scheme that will help guide treatment and predict outcome.

New evidence regarding the timing of surgery and the outcomes for acute SCI is encouraging. Michael G. Fehlings, MD, PhD, University of Toronto, Toronto, Ontario, Canada, discussed

Table 1. 2014 Status and Achievements of the AOSpine Knowledge Forums

	Studies				Manuscripts		Presentations	
	Completed	Ongoing	Planned	Original Publications	Submitted	In Preparation	Podium	Poster
Tumor	1	3	2	5	4	n/a	43	14
Deformity	1	2	1	1	1	n/a	9	0
Spinal cord injury and trauma	n/a	5	1	1	1	n/a	2	0
Degenerative and biologics	n/a	4	n/a	n/a	n/a	5	n/a	n/a

Source: AO Foundation. AOSpine Research Achievements. Available at https://aospine.aofoundation.org/Structure/research/achievements/Pages/achievements.aspx. Accessed December 9, 2014.

how the timing of surgical intervention affects safety, neurologic outcomes, and cost-effectiveness. Starting from the primary injury (compression/contusion, bone/disc displacement, or fracture/dislocation), Prof Fehlings examined the findings for timing of decompression, outcomes, safety, and the neuroprotective benefits of sodium channel blockers.

A meta-analysis of 14 preclinical and 22 clinical studies concluded that early surgical decompression (within 24 to 72 hours after injury) is safe and feasible, improves clinical and neurologic outcomes, and reduces hospital stay, health care costs, and pulmonary complications [Furlan JC et al. *J Neurotrauma*. 2011]. Another preclinical meta-analysis confirmed this finding and suggested that early decompression improves neurobehavioral deficits in animal models of SCI [Batchelor PE et al. *PLoS One*. 2013]. In a systematic review and meta-analysis of 18 studies, investigators found a significant association with improved neurologic and length-of-stay outcomes for early decompression [van Middendorp JJ et al. *J Neurotrauma*. 2013]. However, the findings were seen as less robust than those reported in other meta-analyses, resulting from different sources of heterogeneity within and among original studies.

In the prospective STASCIS study [Fehlings MG et al. *PLoS One*. 2012] of 313 patients, Prof Fehlings analyzed the effect of timing of decompression on SCI outcome. In the comparison of early (< 24 hours after injury) and delayed (≥ 24 hours) decompression surgery for traumatic cervical SCI, the odds of having an American Spinal Injury Association (ASIA) impairment scale improvement of ≥ 2 grades were 2.8 times higher among patients who underwent early surgery compared with those who underwent late surgery (OR, 2.83; 95% CI, 1.10 to 7.28; $P = .03$) at 6-month follow-up. Higher complication rates were seen in the late group (46%) compared with the early group (36%) mainly in the area of ventilator-associated pneumonia. These findings were supported by a Canadian study [Wilson JR et al. *Spinal Cord*. 2012]. O'Boynick and colleagues [*Neurosurg Focus*. 2014] reported a savings of $80 000 per patient with early treatment of thoracolumbar spine fractures.

A model to predict outcome after SCI surgery has been developed that relates acute clinical imaging information to functional outcome at 1 year [Wilson JR et al. *J Neurotrauma*. 2012]. The model uses age, American Spinal Injury grade, and ASIA motor score at admission, and MRI results to produce a functional independence score.

Prof Fehlings discussed the neuroprotective benefits of using the sodium channel blocker riluzole after primary SCI. Following SCI, cellular swelling occurs, followed by an influx of calcium that triggers pathologic glutamatergic release. When administered shortly after injury, riluzole inhibits the release of glutamic acid from neurons and spares them from secondary damage. In a recent prospective multicenter phase 1 trial [Grossman RG et al. *J Neurotrauma*. 2014], patients (n = 36) with ASIA impairment scale, grades A-C, treated with riluzole (50 mg, BID) within 12 hours of SCI for 14 days had more robust conversions of impairment grades to higher grades than a comparison group. A phase 3 study [NCT01597518] with riluzole is ongoing.

Current data on the role and timing of surgical intervention shows that early intervention is safe, can improve neurological outcomes, and is cost-effective. Recent data showing that riluzole may improve lower extremity motor scores are promising.