

respectively). No differences were identified for all other clinical and radiological factors assessed. *Conclusions:* This study supports the growing body of evidence for anterior fixation alone for flexion-distraction injuries. Findings suggest that measurements including segmental translation and kyphosis may predict radiographic failure and need for further surgical stabilization in some patients. Assessment for independent risk factors for anterior approach failure with a validated predictive scoring model should be considered.

## P.092

### Hirayama Disease: a diagnostic and therapeutic challenge

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*Background:* Hirayama disease (HD) is characterized by progressive cervical myelopathy caused by repetitive neck flexion leading to forward displacement of the posterior dural sack with compression and injury of the spinal cord. Typically, the C7-T1 myotomes become weak and atrophic, while sparing sensation. Here we present two Canadian cases of this rare entity. *Methods:* Two cases of HD are presented and literature reviewed, showing the diagnostic and therapeutic challenges of this disease. *Results:* Case 1 is a 17-year-old male professional singer and musician. He presented with bilateral progressive hand weakness, which was aggravated while playing the violin. Cervical MRI showed increased T2-weighted signaling at C5-7, but a correct diagnosis could not be identified. Eventually, dynamic cervical MRI showed the compression and he underwent an anterior cervical discectomy and fusion (ACDF) at C5-C6 and C6-C7 without complications.

Case 2 is a 19-year-old female with progressive right hand weakness. After numerous investigations, a dynamic cervical MRI diagnosed her with HD with classic findings and she underwent an ACDF at C6-C7 without complications. *Conclusions:* Hirayama's disease is rare, but should be kept in mind when cervical cord signal changes cannot be explained by standard MRI. Dynamic MRI is imperative to correct diagnosis and anterior fusion shows good outcomes in its management.

## P.093

### Thorascopic assisted resection of dumbbell nerve sheath tumors

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*Background:* Surgery to remove dumbbell nerve sheath tumors (NST) is complex, and is accompanied by significant operative and perioperative challenges. Historically, resection of dumbbell NST required large operations involving opening the chest and laminectomy, often accompanied by instrumentation. We describe a case series of 5 patients who underwent single stage thorascopic-guided resection of dumbbell schwannoma at our institution. *Methods:* 5 cases presented consisted of moderate to large NST, which contained intraforaminal components. Tumor location ranged from T3-T9, with most tumors spanning 2-3 vertebral bodies. Presentation ranged from discomfort/pain (most common) to one presentation of neurologic deficit with difficulty with ambulation. *Results:* Thorascopic assisted resection accomplished gross total resection in 4 of the 5 cases. In all

cases there was no significant neurologic deficit, although one patient reported transient numbness following the operation and all patients made significant improvement post operatively. The length of stay for these cases ranged from 1-6 days. *Conclusions:* Thorascopic assisted resection of dumbbell NST can be performed safely and with good outcomes by using the corridor the tumor produces. This approach reduces the need for instrumentation, length of stay and post operative complication rates relative to traditional approaches. To perform this approach effectively, good co-operation between the neurosurgeon and thoracic surgeon needs to be present.

## P.094

### Spinal dural repair: a Canadian questionnaire

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*Background:* Iatrogenic dural tear a complication of spinal surgery with significant morbidity and cost to the healthcare system. The optimal management is unclear, and therefore we aimed to survey current practices among Canadian practitioners. *Methods:* A questionnaire was administered to members of the Canadian Neurological Surgeon's Society designed to explore methods of closure of iatrogenic durotomy. *Results:* Spinal surgeons were surveyed with a 55% response rate (n = 91). For pinhole sized tears there is a trend toward sealant fixation(36.7%). Medium and large sized tears are predominantly closed with sutures and sealant(67% and 80%, respectively). Anterior tears are managed using sealant alone(48%). Posterior tears are treated with a combination of sutures and sealant(73.8%). Nerve root tears are treated with either sealant alone(50%). Most respondents recommended bed rest for at least 24 hours in the setting of medium(73.2%) and large(89.1%) dural tears. *Conclusions:* This study elucidates the areas of uncertainty with regard to iatrogenic dural tear management. There is disagreement regarding management of anterior and nerve root tears, pin-hole sized tears in any location of the spine, and whether patients should be admitted to hospital or on bed-rest following a pin-hole sized dural tear. There is a need for a robust comparative research study of dural repair strategies.

## P.095

### Soft tissue preserving direct multilevel pars repair using the 'Smiley Face' technique with 3D optical imaging based intraoperative spinal navigation

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*Background:* Two broad categories for the surgical management of symptomatic spondylolysis exist: decompression, or direct reduction and fixation. Direct fixation can maintain mobility and leads to improved outcomes over spinal fusion. The 'smiley face' technique is a direct fixation method of pars defect repair that uses one bent rod to reduce the number of linkage points and simplify the construct. *Methods:* Bilateral pars defects at L3 and L5 were repaired using the 'smiley face' technique. Patient reported outcomes, including the Oswestry Disability Index (ODI) and visual analog scale (VAS) scores for back and leg pain were assessed preoperatively and again at 6

weeks postoperatively. *Results:* The patient underwent a soft tissue preserving multi-level bilateral L3 and L5 pars defect repair using the smiley face technique while utilizing radiation-free 3D optical imaging to capture multiple points for registration despite minimal laminar exposure. The patient's ODI and lower back VAS scores decreased from 25 to 8 and 7.5 to 4 respectively, after surgery, correlating to an excellent outcome on ODI. *Conclusions:* The smiley face technique can be used with soft tissue preserving techniques to achieve adequate bony reduction while maintaining intersegmental mobility in patients with multi-level pars defects. 3D imaging allows soft tissue preservation with increased registration points for intraoperative navigation.

## P.096

### Evaluation of Poly Vinyl Alcohol Cryogel (PVA-C) composites for mimicking biomechanical properties of the lumbar intervertebral disc

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*Background:* Current lumbar intervertebral disc prostheses provide suboptimal symptom relief with little natural load-cushioning. PVA-C is a promising biocompatible material, and our previous study finds that it can closely mimic the properties of nucleus pulposus. However, pure PVA-C does not possess adequate stiffness to mimic the annulus fibrosus. *Methods:* Composite particle-reinforced PVA-C formulations were tested to identify methods that could increase the elastic modulus. This included: sephadex, hydroxyapatite (stock) and hydroxyapatite (in-solution synthesis). All formulations were tested using 15% PVA-C and 5% reinforcing agent. Indentation and durometer tests were performed as well as simple compression, compressive stress relaxation and creep. *Results:* Indentation and durometer results did not clearly reveal any specific formulations that significantly improved stiffness. The addition of in-solution synthesized hydroxyapatite resulted in 1.15 to 2 time increase in elastic modulus (0.3-0.9 MPa) and associated decrease in stress relaxation and creep. The addition of stock hydroxyapatite and sephadex (G100f and G50sf) lowered the elastic modulus and increased stress relaxation and creep. *Conclusions:* In-solution synthesized hydroxyapatite is the only particle-reinforced composite PVA-C formulation that exhibited greater stiffness than pure PVA-C. The elastic modulus will need to be increased by 5-10x to adequately mimic the annulus fibrosus. A fiber-reinforced composite will likely be needed to accomplish this.

## P.097

### Tensile properties of Polyvinyl Alcohol Cryogel (PVA-C) formulations and generation of a tissue mimicking artificial lumbar intervertebral disc prototype

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*Background:* Current lumbar intervertebral disc prostheses provide suboptimal symptom relief with little natural load-cushioning. PVA-C is a promising biocompatible material, however previous

studies from our lab show that it does not have adequate elastic modulus to mimic the annulus fibrosus. Here we present a prototype of an artificial lumbar intervertebral disc. *Methods:* The tensile properties of pure (5-35% PVA-C) and particle-reinforced (15% PVA-C with 5% of either Sephadex or hydroxyapatite) composite PVA-C formulations were evaluated. Simple tension and tensile stress relaxation tests were performed. Woven Teflon mesh was embedded in PVA-C and tested under compression. Endplate pull-out tests were performed. *Results:* Tensile testing showed that all PVA-C formulations behaved linearly for physiologic levels of strain (<20%). Tensile elastic modulus is an order of magnitude lower than the annulus fibrosus. Teflon has similar elastic modulus as collagen and compression of the hybrid Teflon-PVA-C construct revealed good biomechanical mimicry with elastic modulus of 20-25MPa at 20% deformation, similar to human data. Bonding between PVA-C and porous titanium endplate is excellent. *Conclusions:* A fiber-reinforced PVA-C impregnated composite adequately mimics the annulus fibrosus. Our prototype of a tissue mimicking artificial intervertebral disc utilizes a woven Teflon fiber with 20% PVA-C (+Hydroxyapatite) annulus and 5% pure PVA-C nucleus bonded to porous titanium foam endplates.

## P.098

### Evaluation and surgical management of pelvic peripheral nerve sheath tumors: the University of Toronto experience and review of literature

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*Background:* Pelvic peripheral nerve sheath tumors (PNST), which includes neurofibroma, schwannoma, and MPNST, are rare tumors located in the retroperitoneum. *Methods:* The case records of a prospectively maintained database at Sunnybrook Health Sciences Center (SHSC) were reviewed to identify patients with pelvic PNST, managed between 2006 - 2016. Medical records were retrospectively reviewed for patient demographics, presentation, tumor location, symptoms, imaging characteristics, management, and outcome. The surgical technical caveats were described. An English language literature review was performed to describe previously published experiences. *Results:* The series consisted of 7 patients, ranging from 22 - 74 years of age at presentation. These lesions tend to be large at the time of diagnosis, and presenting symptoms include abdominal, flank, or back pain, as well as leg edema or hydronephrosis from local compression. Most patients in this cohort were managed surgically with midline abdominal transperitoneal exposures. Lastly, 5 tumors were benign schwannomas managed with gross total resection or debulking, while 2 patients had MPNSTs managed with biopsy followed by adjuvant chemoradiation therapy. *Conclusions:* In this case series, we describe the characteristics, evaluation, and management of 7 patients with pelvic PNST at a major healthcare institution in Toronto, Canada, highlighting the technical aspects of managing this rare and challenging entity.