expense in lumbar spine fusions. While open and mini-open fusions such as transforaminal lumbar interbody fusion (TLIF) and minimally invasive TLIF (MIS-TLIF) are more challenging in obese patients, new MIS procedures like oblique lateral lumbar interbody fusion (OLLIF) may improve perioperative outcomes in obese patients relative to TLIF and MIS-TLIF.
Purpose The purpose of this study is to determine the effects of obesity on perioperative outcomes in OLLIF, MIS-TLIF, and TLIF.
Study Design This is a retrospective cohort study.
Patient sample We included patients who underwent OLLIF, MIS-TLIF, or TLIF on three or fewer spinal levels at a single Minnesota hospital after conservative therapy had failed. Indications included in this study were degenerative disc disease, spondylolisthesis, spondylosis, herniation, stenosis, and scoliosis.
Outcome Measures We measured demographic information, body mass index (BMI), surgery time, blood loss, and hospital stay.
Methods We performed summary statistics to compare perioperative outcomes in MIS-TLIF, OLLIF, and TLIF. We performed multivariate regression to determine the effects of BMI on perioperative outcomes controlling for demographics and number of levels on which were operated.
Results OLLIF significantly reduces surgery time, blood loss, and hospital stay compared to MIS-TLIF, and TLIF for all levels. MIS-TLIF and TLIF do not differ significantly except for a slight reduction in hospital stay for two-level procedures. On multivariate analysis, a one-point increase in BMI increased surgery time.
Conclusions Obesity is associated with increased surgery time and blood loss in TLIF and with increased surgery time in MIS-TLIF. Increased surgery time may be associated with increased perioperative complications and cost. In OLLIF, BMI does not affect perioperative outcomes. Therefore, OLLIF may reduce the disparity in outcomes and cost between obese and non-obese patients.
Disclosures H. Abbasi: None.

E-141 MINIMALLY INVASIVE DIRECT THORACIC INTERBODY FUSION (MIS-DTIF): TECHNICAL NOTES OF A SINGLE SURGEON STUDY

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10.1136/neurintsurg-2020-SNIS.173

Background Minimally invasive direct thoracic interbody fusion (MIS-DTIF) is a new single surgeon procedure for fusion of the thoracic vertebrae below the scapula (T6/7) to the thoracolumbar junction. In this proof of concept study, we describe the surgical technique for MIS-DTIF and report our experience and the perioperative outcomes of the first four patients who underwent this procedure.
Study Design/Setting In this study we attempt to establish the safety and efficacy of MIS-DTIF. We have performed MIS-DTIF on six spinal levels in four patients with degenerative disk disease or disk herniation. We recorded surgery time, blood loss, fluoroscopy time, complications, and patient-reported pain.
Methods Throughout the MIS-DTIF procedure, the surgeon is aided by biplanar fluoroscopic imaging and electrophysiological monitoring. The surgeon approaches the spine with a series of gentle tissue dilations and inserts a working tube that establishes a direct connection from the outside of the skin to the disk space. Through this working tube, the surgeon performs a discectomy and inserts an interbody graft or cage. The procedure is completed with minimally invasive (MI) posterior pedicle screw fixation.
Results For the single level patients the mean blood loss was 90 ml, surgery time 43 minutes, fluoroscopy time 293 seconds, and hospital stay two days. For the two-level surgeries, the mean blood loss was 27 ml, surgery time 61 minutes, fluoroscopy time 321 seconds, and hospital stay three days. We did not encounter any clinically significant complications. Thirty days post-surgery, the patients reported a statistically significant reduction of 5.3 points on a 10-point sliding pain scale.
Conclusions MIS-DTIF with pedicle screw fixation is a safe and clinically effective procedure for fusions of the thoracic spine. The procedure is technically straightforward and overcomes many of the limitations of the current minimally invasive (MI) approaches to the thoracic spine. MIS-DTIF has the potential to improve patient outcomes and reduce costs relative to the current standard of care. We are currently expanding this study to a larger cohort and recording long term outcomes and costs.
Disclosures H. Abbasi: None.

E-142 DUAL LUMEN PICC LINE FOR TREATMENT OF REFRACTORY MULTILEVEL CSF LEAK BY FIBRIN GLUE

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10.1136/neurintsurg-2020-SNIS.174

Background and Purpose Epidural blood patch has been the standard of care for treating Cerebrospinal fluid (CSF) leaks that fail conservative management whether it is related to post-dural puncture or spontaneous. The use of fibrin glue and mixed blood/fibrin patches have been described to be effective in multiple reports. However, in many cases of CSF leak, identifying the level(s) of the leak to direct the treatment poses a challenge leading to refractory symptoms post treatment, especially in spontaneous CSF leak. We describe a novel approach for treating refractory CSF leakage using peripherally inserted central catheter (PICC) lines in the epidural space.
Materials and Methods Two patients presenting with recurrent attacks of progressive positional headache (one spontaneous and one post traumatic) were proven by myelograms to be secondary to CSF leak. After failure of conservative management, epidural blood patch was decided.
Results In the post-traumatic patient, epidural contrast extravasation was seen in the ventral epidural space extending between C6 and T4 levels, centered at the T1/T2 disc space with 2 sites of leak suspected at C7/T1 and the other between T3 and T6 level. After 5 unsuccessful attempts of epidural blood and fibrin patches and failed hemilaminectomy with transpedicular repair over a 2-month period, a 4 F sheath was placed at L2/3 level followed by navigation of a diagnostic catheter over a guide wire to the upper thoracic levels, the catheter was then exchanged for a 4F PICC line and 13 cc of fibrin glue was injected all the way from T4 level down to L2/3 level. Following treatment, the patients' symptoms significantly improved with no further treatment required. In the

other case of spontaneous CSF leak, 4 leakage sites were suspected; patient underwent 4 epidural blood and fibrin glue patches at various levels between T1 and L4, with none of which was successful in controlling the symptoms. Again, a PICC line inserted at L3/4 level was navigated to the craniocervical junction followed by fibrin glue injection in the epidural space from the craniocervical junction down to the upper lumbar level. The procedure was successful in achieving symptoms resolution. No post-procedure complications occurred in both patients.

Conclusions Epidural Fibrin glue injection using peripherally inserted central catheter (PICC) lines is a safe and effective approach for treatment of refractory CSF leaks with multiple or unconfirmed sites of leakage.

Disclosures R. Abdalla: None. **D. Cantrell:** None. **M. Hurley:** None. **S. Ansari:** None. **A. Shaibani:** None.

E-143 EMBOLIZATION OF SPINAL DURAL ARTERIOVENOUS FISTULA: NBCA IS SUPERIOR TO ONYX EMBOLIZATION

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10.1136/neurintsurg-2020-SNIS.175

Introduction/Purpose Historically, spinal dural arteriovenous fistulas (SDAVFs) have been treated with intradural ligation of the draining vein. While endovascular embolization can achieve durable occlusion in a subset of these patients, recent studies have demonstrated a superiority of microsurgical ligation. However, given that spinal angiography is essential in the workup of suspected SDAVFs, we and others have demonstrated the utility of an 'endovascular-first' approach to SDAVFs. One limiting factor to the success of endovascular therapies has been the reliability of casting and occluding the draining vein using Onyx. In contrast, we have observed that n-butyl-2-cyanoacrylate (nBCA) glue can readily penetrate and cast the fistula and vein. We therefore sought to compare the efficacy of nBCA and Onyx embolization in the treatment of SDAVFs.

Material and Methods We performed a retrospective analysis of our endovascular database from 4/2007 to 4/2019 to identify patients treated for SDAVFs. We extracted demographic, clinical, treatment, and radiographic information data. We considered a 'durable cure' of the SDAVF to include complete obliteration of the fistula following endovascular treatment, demonstrated clinical improvement, and follow-up radiographic studies demonstrating improvement of spinal cord edema and flow voids on MRI/MRA and/or persistent obliteration on follow-up angiograms. We compared our results using Onyx and nBCA embolysate.

Results We performed 40 endovascular treatments for SDAVFs in 38 patients. The embolysates utilized were Onyx without any other embolysate (22), NBCA without any other liquid embolysate (16), and a combination of nBCA and Onyx (2). For the 22 treatments in which Onyx was the only embolysate used, endovascular treatment resulted in a durable cure in 11 cases (50%) (mean follow-up 20.8 months). For 10 of these 22 (45.5%), a complete obliteration of the fistula with casting of the vein was not achieved and these patients were referred for microsurgical ligation. For 1 of these 22 treatments, a complete obliteration of the fistula was noted on immediate post-procedure angiography. However, 4.2 months after treatment, he was found to have a recurrence. For the 16 treatments in which nBCA was the only liquid embolysate used, endovascular treatment resulted in a complete obliteration of the fistula following treatment in all 16 (100%) patients. None of these patients underwent subsequent microsurgical treatment. Follow-up data were available for 13 of these patients (81.3%). Of these 13, all (100%) achieved a durable cure (mean follow-up 19.6 months) without clinical or radiographic recurrence. A durable cure was achieved more frequently in patients treated with nBCA (100%) relative to those treated with Onyx only (50%) ($p<0.01$). We evaluated the fluoroscopy time used in cases where obliteration of the fistula was achieved using a single radicular artery and resulted in a durable cure. When Onyx was used, the mean fluoroscopy time was 50.8. In contrast, the mean fluoroscopy time was significantly shorter ($P<0.02$) when nBCA was used for these cases (mean 31.8 minutes).

Conclusion NBCA embolization of SDAVFs is superior to Onyx embolization. NBCA embolization is safe and effective for a subset of SDAVFs with results in this population comparable to microsurgical ligation.

Disclosures J. Baranoski: None. **J. Catapano:** None. **T. Cole:** None. **N. Majmundar:** None. **B. Hendricks:** None. **D. Wilkinson:** None. **A. See:** None. **D. Cavalcanti:** None. **B. Flores:** None. **A. Ducruet:** None. **F. Albuquerque:** None.

E-144 MINIMALLY INVASIVE SCOLIOSIS SURGERY WITH TRANS KAMBIN POSTERIOR OBLIQUE LATERAL LUMBAR INTERBODY FUSION: SINGLE SURGEON FEASIBILITY STUDY

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10.1136/neurintsurg-2020-SNIS.176

Background Degenerative deformities of the spine have traditionally been treated with extensive open surgeries. However, these open procedures are associated with a high degree of surgical morbidity. In this study, we explore whether clinical improvement in patients with spinal deformities can be achieved using a new minimally invasive surgery (MIS) called oblique lateral lumbar interbody fusion (OLLIF). OLLIF is a MIS single surgeon procedure in which the disc is approached through Kambin's triangle. OLLIF can achieve correction of spinal deformities through careful cage placement.

Purpose The purpose of this study is to establish the safety and efficacy of using OLLIF to correct spinal deformities and to collect early outcome data. Collected data includes perioperative outcomes, patient reported outcomes, and radiographic outcomes.

Study Design/Setting This study is a retrospective review of 37 OLLIF surgeries in 36 patients with symptomatic degenerative spinal deformity. Collected perioperative data included surgery time, blood loss, and hospital stay. Follow-up was conducted at least 150 days post surgery. We recorded complications and patient reported outcomes such as Oswestry Disability Index (ODI) and pain scale. Imaging was conducted pre- and post-surgery. Fusion rates and changes in Cobb angle were also measured.

Results A total of 37 surgeries that treated 100 vertebral levels were performed. For two and three level procedures, respectively, the mean blood loss was 83 and 178 ml, the average surgery time was 74 and 158 minutes and the