



Abstract E-077 Figure 1

**Conclusion** The CREST-2 eligibility criteria were specified to recruit individuals with a high degree of stenosis. However, even within this group of patients with a (likely) high degree of stenosis, there was a surprising heterogeneity between patients in the pattern of flows that qualified for the study, introducing the opportunity to assess differential treatment effects between those with different patterns.

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**E-078 STANDARD UMBILICAL ARTERY CATHETERS USED AS DIAGNOSTIC AND NEUROINTERVENTIONAL GUIDE CATHETERS IN THE TREATMENT OF NEONATAL CEREBROVASCULAR MALFORMATIONS**

A Kappel, D Orbach. *Neurosurgery/Neurointerventional Radiology, Boston children's Hospital, Boston, MA*

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**Background** High-flow intracranial arteriovenous malformations in neonates, including vein of Galen malformations (VOGMs), pial arteriovenous fistulas (AVFs) and dural sinus malformations (DSMs), often present with high-output cardiac failure requiring urgent or emergent intervention.

**Objective** Vascular access in neonates is limited by the small size of the femoral artery and the risk of complications, including thrombosis and limb ischemia. Although umbilical artery access has been described in neonates, previous reports detail exchange of the umbilical artery catheter for a conventional arterial sheath, which can be difficult and cumbersome.

Here we aim to describe direct use of the umbilical artery catheter as the sheath and guide catheter in neonatal patients requiring endovascular treatment for life-threatening intracranial arteriovenous shunts.

**Methods** We describe a direct approach to cerebral angiography and neurointerventions in newborns using umbilical artery catheters that does not require catheter exchange, and that allows for repeated, relatively straightforward endovascular access in neonates across multiple interventions.

**Results** Seven consecutive neonates underwent endovascular neurointerventional procedures for the treatment of life threatening, high-flow arteriovenous shunts using a direct umbilical artery catheter access technique without procedural morbidity. Five of seven patients underwent more than one procedure in the neonatal period, between day 1 and day 10 of life.

**Conclusions** Use of the umbilical artery catheter itself as a diagnostic catheter for cerebral angiography or as a guide catheter for neurointerventions greatly facilitates endovascular interventions in newborns and is ideal for patients requiring multiple interventions in the neonatal period. This technique helps to mitigate the risk of neonatal femoral artery access and its complications, including thrombosis, dissection, spasm, stenosis and limb ischemia.

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**E-079 MIDDLE MENINGEAL ARTERY EMBOLIZATION ASSOCIATED WITH REDUCTION IN CHRONIC SUBDURAL HEMATOMA VOLUME AND MIDLINE SHIFT REDUCTION IN THE ACUTE POST-OPERATIVE PERIOD**

J Catapano, S Hanalioglu,, D Farhadi, O Tunc, A Naik, E Winkler, V Srinivasan, S Koester, M Lawton, A Jadhav, A Ducruet, F Albuquerque. *Neurosurgery, BNI, Phoenix, AZ*

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**Background** Chronic subdural hematomas (cSDH) are associated with significant morbidity and high rates of recurrence, and effective management is essential to reducing the disease burden. Middle meningeal artery (MMA) embolization is a minimally invasive treatment strategy which is growing in popularity. We sought to evaluate whether hematoma volume and midline shift were reduced in the immediate post-operative window (<24h) following embolization.

**Methods** We performed a retrospective analysis of 81 unique patients with 98 chronic subdural hematomas managed via MMA embolization. SDH volumes and midline shift were quantified through image segmentation pre- and post-operatively (24-hour post-procedure) through computed tomography (CT) scans. Other demographic, clinical and operative parameters were abstracted from the medical record in a subset of patients for multivariate analysis. Paired t-tests were used to

Abstract E-079 Table 1 Impact of embolization of subdural hematoma and midline shift

Measure	Pre-Embolization	Post-Embolization	Mean Difference Reduction (95% CI)	p-value
Subdural Hematoma Volume (mL)	66.54 (34.67)	54.75 (33.0)	12.1 (9.32 - 14.27)	<0.001
Midline Shift (mm)	3.79 (2.85)	2.99 (2.47)	0.80 (0.24 - 1.36)	0.006

determine significant reduction in midline shift and SDH volume. Multivariate analysis was performed using logistic and linear regression for percent improvement from baseline volume.

**Results** Across 81 patients and 98 cSDHs, the mean initial SDH volume was 66.54 mL (SD: 34.67 mL), with the mean midline shift as 3.79 mm (SD: 2.85 mm). There was a significant mean reduction in SDH volume post-operatively (12.1 mL (95% CI: 9.32 - 14.27 mL),  $p < 0.001$ ). There was also a significant mean reduction in midline shift (0.8 mm (95% CI: 0.24 - 1.36 mm),  $p = 0.006$ ). 22% of patients had a reduction of over 30% in the immediate post-operative period. A multivariate analysis of 36 patients was performed. There were no significant parameters observed influencing degree of reduction.

**Discussion** MMA embolization is a safe, and effective approach for the management of cSDH patients. We show a significant reduction of hematoma volume and reduction of midline shift even in the acute post-operative period. Larger studies, randomized trials, and longer-term studies are needed to confirm these findings.

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E-080

#### LESSONS FROM THE OTHER SIDE: THE ORIGINS AND EVOLUTION OF TRANSVENOUS TECHNIQUES IN NEUROINTERVENTIONAL SURGERY

<sup>1,2</sup>C Reynolds, <sup>3</sup>T Caton, <sup>3</sup>K Narsinh, <sup>3</sup>S Hettis, <sup>3</sup>D Cooke, <sup>3</sup>M Amans, <sup>3</sup>R Higashida, <sup>3</sup>C Dowd. <sup>1</sup>Transitional Year Residency Program, JPS Health Network, Fort Worth, TX; <sup>2</sup>Department of Medical Imaging, University of Arizona Tucson, Tucson, AZ; <sup>3</sup>Department of Radiology and Biomedical Imaging, University of California San Francisco, San Francisco, CA

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**Introduction/Purpose** Neurointerventional surgery emerged in the early 1960's, when Lusenhop and Spence described the first intravascular embolization of a cerebral arteriovenous malformation. Since then, neuroendovascular techniques have grown exponentially, becoming the standard of care for many pathologies. To date, this growth has been attributed largely to transarterial techniques; however, there has been a resurgent interest in transvenous (TV) neurointerventional methods, driven by a groundswell in technical innovation and advances in knowledge of the role of the cerebral venous system in health and disease. The purpose of this historical review is to chronicle the origins and evolution of TV neurointervention by highlighting seminal achievements, technical breakthroughs, and controversies, all of which shape the phylogeny of TV techniques in the modern era.

**Methods** A systematic review of seminal papers in TV neurointervention was performed using GoogleScholar and Medline indices, following PRISMA guidelines. The search strategy sought to identify landmark manuscripts describing TV neurointerventional techniques in three pathophysiologic states: 1) arteriovenous shunts 2) cerebral venous thrombotic disease 3) disorders of intracranial pressure homeostasis. Reference lists of selected articles were also reviewed for additional potential citations.

**Results** Foundational manuscripts in each of the three disease categories were identified: The genesis of therapeutic TV

neurointerventional surgery can be traced to 1981, when Debrun et al. described TV occlusion of direct carotid-cavernous fistulas via detachable balloons. In 1986, Mickle and Quisling performed the first TV embolization of Vein of Galen malformation, representing the first TV therapy in a child. In 1989, Halbach et al. demonstrated efficacy of TV embolization for dural arteriovenous fistulas. In 1995, King et al. identified cerebral venous stenosis as the culprit for idiopathic intracranial hypertension (IIH), with innovative use of TV manometry. The first application of rheolytic venous sinus thrombectomy was reported by Dowd et al. in 1999. In 2002, Higgins et al demonstrated efficacy of TV stenting in IIH. These, and other landmark innovations are the direct antecedents of ongoing revolutions in TV therapy including AVM embolization, CSF-diversion, and embolization of CSF-venous shunts.

**Conclusions** Pioneering work in the 1980s and 1990s paved the way for modern transvenous neurointervention. Despite the relative paucity of literature investigating transvenous approaches, their role in disease management has been clearly established and is expected to grow considerably. Therefore, the importance of transvenous skills for contemporary neurointerventionalist cannot be understated.

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E-081

#### COMBINED TRANSRADIAL AND TRANSVENOUS ACCESSES IN THE TREATMENT OF CAROTID CAVERNOUS FISTULAE

<sup>1</sup>D Babici, <sup>1</sup>P Johansen, <sup>2</sup>B Snelling. <sup>1</sup>Neurology, Florida Atlantic University, Boca Raton, FL; <sup>2</sup>Neurological Surgery, Boca Raton Regional Hospital, Boca Raton, FL

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**Introduction** The expansion of indications for neurointerventional procedures, combined with the need to treat a diverse patient population, has driven a need for broader access options. Concurrent arterial and venous access is often necessary for diagnosis and treatment of various neurovascular diseases. Although complication rates are low, life-threatening severe complications have been reported with these access methods. Moreover, venous access through traditional routes can be challenging in patients with large body habitus. There is a growing trend of utilizing radial artery access for neuroendovascular procedures due to the increased ease of access and similar efficacy. Nevertheless, the use of upper limb veins in neurointerventional procedures is still rare. Upper extremity transvenous access (UETV) has recently emerged as an alternative strategy for the neurointerventionalists, but data is limited.

**Methods** Case study

**Case Description** **Case #1** An 82-year-old male underwent successful mechanical thrombectomy for large vessel occlusion of the right middle cerebral artery (MCA) M1 segment. During the procedure, he sustained perforation of the cavernous internal carotid artery (ICA) at the posterior genu due to severe tortuosity and underlying atherosclerosis, resulting in a direct CCF. The next day, the patient was noted to have worsened visual acuity of the right eye along with chemosis and proptosis. The senior author was consulted, and the decision was made to perform embolization of the CCF using combined