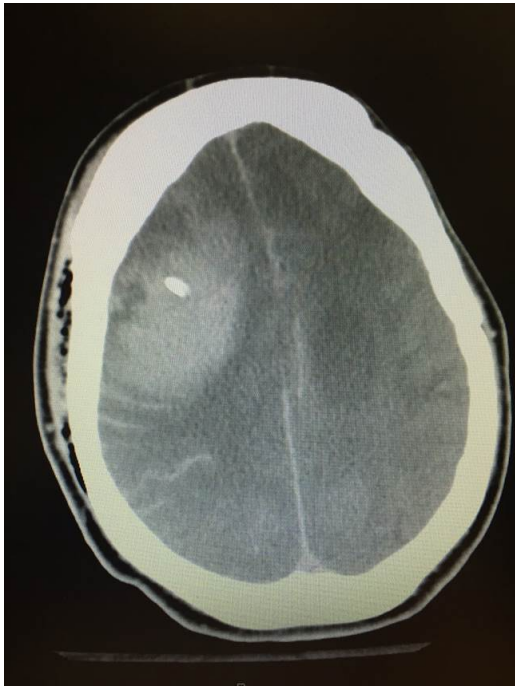


<div><div>Introduction</div><p>Concerns have arisen regarding the potential hemorrhagic risks of intraprocedural anticoagulation with unfractionated heparin for balloon and stent-assisted procedures and periprocedural dual antiplatelet therapy for stent-assisted cases for patients having undergone recent placement of external ventriculostomy.</p><div>Methods</div><p>This is a retrospective review of patients presenting to a single academic center. All patients underwent EVD placement via twist-drill burrhole within 24 hours of embolization. Individuals underwent CT scan of the head after drain placement and prior to catheterization as well as another within 48 hours of embolization. Post procedure CT scans were reviewed for new or worsened track hemorrhages. Charts were reviewed to identify use of balloon or stent-assisted techniques and those undergoing primary coiling. Additionally, chart reviews identified the presence of new neurologic morbidity attributed to track hemorrhages. Chi-squared tests were used to evaluate outcomes.</p></div>	<div><div>Results</div><p>One hundred seven patients from 7/2005-4/2014 underwent EVD placement prior to coiling of the associated aneurysm. Ninety-one of these individuals met inclusion criteria (N=91; 85%). Mean age was 55.2 yrs. 64 patients were female (70.3%) and 63 were Caucasian (69.25). 19 patients underwent balloon or stent-assisted procedures (21%; 3 = stent/16 = balloon). 1 patient in the balloon/stent group exhibited new/worse track hemorrhage vs 13 in the primary coil group (5.3% vs. 18.1%; p =0.169) No new/worse track hemorrhage exhibited attributable neurologic morbidity. Further analysis showed that 11 patients in the stent/balloon group received intraprocedural anticoagulation with unfractionated heparin vs. 24 in the primary coil group (60% vs. 33%; p=0.05) and 4 patients in the stent/balloon group received periprocedural antiplatelet medication vs. 8 in the primary coil group (21% vs 11%; p=0.25)</p><div>Conclusions</div><p>Balloon and stent-assisted techniques represent a reasonable treatment option for patients with ruptured aneurysms undergoing embolization following EVD placement for select patients in this limited study where zero patients exhibited new deficits from track hemorrhage. Additional randomized study is indicated.</p></div>	<div><div>Image 1</div><div>Example image showing right frontal intraparenchymal hemorrhage as complication of EVD placement</div></div> <div><div>Learning Objectives</div><p>By the conclusion of this session participants should be able to</p><ol style="list-style-type: none">1) describe the relative overall risk of hemorrhage with EVD placement,2) Compare the relative risk of hemorrhagic complications between primary coiling and adjunct treatments,3) Apply knowledge of complication risks to clinical practice.</div>	<div><div>References</div><p>Hong Y, Wang YJ, Deng Z, Wu Q, Zhang JM. Stent-assisted coiling versus coiling in treatment of intracranial aneurysm: a systematic review and meta-analysis. PLoS One 2014; 9(1):e82311. Doi:10.1271</p><p>Chalouhi N, Starke RM, Koltz MT, Jabour PM, Tjoumakaris SI, Dumont AS, et al. Stent-assisted coiling versus balloon remodeling of wide-neck aneurysms: comparison of angiographic outcomes. Am J Neuroradiol 2013. 34(10):1987-1992.</p><p>Shapiro M, Babb J, Becske T, Nelson PK. Safety and efficacy of adjunctive balloon remodeling during endovascular treatment of intracranial aneurysms: a literature review. Am J Neuroradiology 2008; 29(9):1777-1781.</p><p>Maniker AH, Vaynman AY, Karimi RJ, Sabit AO, Holland B. Hemorrhagic complications of external ventricular drainage. Neurosurgery 2006; 59(4 Suppl 2):ONS419-24.</p><p>Ross IB, Dhillon GS. Ventriculostomy-related cerebral hemorrhages after endovascular aneurysm treatment. AJNR Sept 2003;24:1528-1531.</p><p>Sussman ES, Kelner CP, Nelson E, McDowell MM, Bruce SS, Bruce RA, et al. Complications of ventriculostomy: incidence and predictors in patients with intracerebral hemorrhage. J Neurosurg. Jan 2014; [Epub ahead of print].</p><p>Binz DD, Toussaint LG, Friedman JA. Hemorrhagic complications of ventriculostomy placement: A meta-analysis. Neurocrit Care 2009; 10:253-256.</p><p>Hoh BL, Nogueira RG. Safety of heparinization for cerebral aneurysm coiling after external ventriculostomy placement. Neurosurgery 2005; 57: 845-848.</p></div>
--	--	---	---