

at last follow-up, functional outcome, or neurologic complications.

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IMPACT OF HOSPITAL-ACQUIRED COMPLICATIONS IN LONG-TERM CLINICAL OUTCOMES AFTER SUBARACHNOID HEMORRHAGE

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Objective Patients with subarachnoid hemorrhage (SAH) usually have prolonged hospitalizations due to the need to closely monitor their neurological status. Therefore, these patients have higher risk of experiencing hospital-acquired complications (HACs), which can complicate their clinical course and recovery. However, there is no evidence on the impact of HACs of long-term clinical outcomes. We aimed to identify if HACs are independent risk factors for poor clinical outcomes at 12 to 18 months of follow-up.

Methods Retrospective analysis of 323 patients with SAH diagnosis from 2013 until June 2018. We collected patient-related factors (age, sex, BMI, ethnicity), comorbidities (hypertension, smoke status, diabetes, coronary heart diseases, prothrombotic diseases and hypercholesterolemia), clinical variables (Hunt-Hess grade, modified Fisher grade, treatment, delayed cerebral ischemia), aneurysm characteristics (location, size) and HACs (pneumonia, DVT, ITU, EVD infections, sepsis, hyponatremia and acute respiratory distress syndrome). Poor outcomes were defined as mRS \geq 3.

Results 204 patients were included in the primary analysis. 82 (40.2%) experienced one or more HACs during their hospital course. Patients that developed HACs have significantly increased ICU (12.1 ± 6.6 vs 24.3 ± 23.6 , $p < 0.001$) and

hospital (18.7 ± 14.2 vs 35.3 ± 26.3 , $p < 0.001$) length of stays. Moreover, patients with HACs had significant higher rates of delayed cerebral ischemia, non-routine discharge and poor outcomes at 90 days. 177 patients had complete follow-ups at 12 to 18 months, HACs were independent risk factors for poor functional outcomes at 12 to 18 months after adjusting for demographic, comorbidities and clinical variables [OR=3.205, 95% CI 1.231–8.347, $p < 0.017$].

Conclusions HACs put patients at a higher risk of sustaining poor clinical outcomes 12 to 18 months after a SAH. Furthermore, HACs are significantly related with the occurrence of DCI, with non-routine discharge and 90-day poor functional outcomes.

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MID-TERM RESULTS OF ANEURYSM TREATMENT WITH THE NEW SURPASS EVOLVE FLOW DIVERTER: A MULTICENTER EXPERIENCE

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Purpose Flow diverters have become a safe and well-accepted treatment option for intracranial aneurysms of most sizes in the anterior and posterior circulation. Surpass Evolve (SE, Stryker Neurovascular, Kalamazoo, Michigan, USA) is a new flow diverter that is available in large diameters (2.5–5 mm) and long lengths (12–40 mm), with high radial force and a high in-vitro flow diverting effect irrespective of the parent vessel tortuosity. This is secondary to a consistency in mesh density (15–30 pores/mm²) and a high number of wires (48–64, depending on the device length). SE can be deployed through an 0.027" microcatheter, allowing easy navigation within tortuous anatomies. We describe device characteristics and mid-term results in the first patients treated with the SE for intracranial aneurysms.

Materials and Methods We included in this report all patients that underwent aneurysm embolization with the SE at two different institutions. Patients' data was prospectively collected in two databases and reviewed retrospectively. We included adult

patients harboring non-ruptured saccular or fusiform intracranial aneurysms with a wide neck (>4 mm) located in the anterior or posterior circulation. Standard dual anti-platelet therapy was started 5 days pre-procedure and continued for at least 6 months. Neurological complications were classified as intra-procedural, early or delayed if they arose within 1, 30 or more than 30 days from treatment, respectively. Neurological complications were considered minor and major if resulting in transient or permanent neurological morbidity, respectively. Clinical status at discharge and follow up was assessed by independent neurologists or neurosurgeons and imaging included MRI angiography (MRA), CT angiography (CTA) and DSA, depending on the institution.

Results The study included 28 patients (23 females, 82%; age range: 36–86, median age: 56) treated between April and November 2019, harboring 29 aneurysms. Twenty-eight aneurysms were saccular and in the anterior circulation. The majority of aneurysms were <12 mm in diameter (18/29, 62%), 8/29 (28%) were large (<25 mm), 2/29 (7%) were giant (>25 mm) and one was fusiform and partially thrombosed (3%). The SE was delivered in all cases via a tri-axial approach with an intermediate catheter and a 0.027" microcatheter for implant delivery. This low-profile catheter allowed delivery of the implant through the trans-radial route. Thirty-two implants were used (4 in the patient with the fusiform aneurysm) with an average of 1.1 stents/patient. There were no intra-procedural complications. Median clinical and imaging follow up time was 6 months (range: 2–6 months). There were no deaths. Three patients (3/28, 11%) had early minor neurological complications. There was one (4%) early major neurological complication in a patient with a hemispheric stroke on post-op day 4. Two patients had minor delayed neurological complications (2/28, 7%). Complete thrombosis was seen in 16/29 aneurysms (55%, most of those imaged at 6 months), while partial thrombosis was seen in 12/29 aneurysms (41%). Covered side branches were patent in all patient but the one who experienced the stroke.

Conclusion The SE shows excellent navigability while keeping a high flow-diverting effect. Mid-term clinico-radiological results show good efficacy and acceptable safety of the implant.

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RUPTURED INTRACRANIAL ANEURYSMS TREATED WITH THE PIPELINE EMBOLIZATION DEVICE: A SYSTEMATIC REVIEW AND POOLED ANALYSIS OF INDIVIDUAL PATIENT DATA

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Objectives The pipeline embolization device (PED) is a flow diverting stent used for the treatment of intracranial aneurysms. This technique necessitates dual antiplatelet therapy

(DAPT) and aneurysm occlusion is delayed. Despite these limitations, the PED is used for a subset of ruptured aneurysms not amenable to traditional treatment techniques. We seek to evaluate the safety and efficacy of this practice.

Methods A systematic review of the PubMed and MEDLINE databases from January of 2011 to October of 2019 was performed to identify studies of ruptured intracranial aneurysms treated with the PED. Inclusion required publication in English, a minimum of 5 cases and reporting of clinical outcome and complications. Duplicate patient reports from the same author(s) were excluded. Individual patient data was collected for pooled analysis.

Results Individual patient data was collected for 140 patients with 140 ruptured aneurysms treated with the PED from 11 studies. Seventy-four (73.3%) out of 101 patients were female and the mean age 50.9 years. Hunt and Hess score was 1–3 for 84.2% of patients. Mean aneurysm size was 6.0 mm and the majority were blister (51.0%) or dissecting (26.9%) in morphology. Aneurysms re-hemorrhaged following PED placement in 3 (2.1%) cases: 3 mm saccular ICA aneurysm, 21 mm saccular ICA aneurysm, and 34 mm fusiform ICA aneurysm. Larger aneurysm size (p=0.05) and saccular morphology (p=0.01) were associated with aneurysm re-hemorrhage. Of the 125 patients with radiographic follow up, 104 (83.2%) had complete aneurysm occlusion. Smaller aneurysm size was associated with complete aneurysm occlusion (p=0.03). Symptomatic neurologic complications occurred in 18 (12.4%) and symptomatic neurologic complications were associated with increasing Hunt and Hess score and Fisher grade.

Conclusion The majority of ruptured aneurysms treated with the PED and reported in the literature were blister or dissecting in morphology. Treatment of ruptured aneurysms was associated with a re-hemorrhage rate of 2.1% and complete occlusion rate of 83.2%. Flow diversion with the PED is a viable option for ruptured aneurysms not amenable to traditional surgical and endovascular treatment options.

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SINGLE-CENTRE STUDY OF ENDOVASCULAR TREATMENT OF MIDDLE CEREBRAL ARTERY (MCA) ANEURYSMS

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Purpose To evaluate safety and efficacy of endovascular treatment of MCA aneurysms. Current published data does not clearly demonstrate an advantage with either endovascular treatment or open neurosurgical clipping.

Methods and Materials Consecutive patients with ruptured and unruptured MCA aneurysms, treated with endovascular methods in our comprehensive multidisciplinary institution, from January 2008 to September 2019 were included. Database was prospectively acquired and retrospectively analysed. Baseline patient demographics, aneurysm location, size and previous treatments were collected. Imaging follow up was performed at 3 months, 6 months, 18 months, 2 years and 5 years. Data analyses focused on type of device used, procedure-related