Unruptured AVMs

Abstract O-020 Figure 2

the complication rate (especially regarding visual functions) remains non-negligible.

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O-021

SAFETY AND EFFICACY OF TRANSVENOUS EMBOLIZATION OF RUPTURED BRAIN ARTERIOVENOUS MALFORMATIONS AS A LAST RESORT: A PROSPECTIVE SINGLE ARM STUDY

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Purpose Due to limited data of 69 cases reported up to now, the transvenous embolization for brain AVMs is still considered an unproven salvage therapy. Our aim was to explore the safety and curability of transvenous embolization treatment.

Materials and methods Between November 2016 and November 2018, 21 consecutive patients with ruptured brain AVMs who underwent transvenous embolization were prospectively followed. The Spetzler-Martin grade was: grade I and II (33.3%, n = 7), grade III (52.4%, n = 11), and grade IV and V (14.3%, n = 3). Safety was evaluated by observing the procedure-related complications occurred within 1 month, and the primary outcome of efficacy was complete angiographic obliteration of the AVMs nidus on the 6-month follow-up angiography. Functional outcome was established using the mRS.

Results The procedure was technically feasible in 19 of 21 (90.5%) cases. Procedure-related complications were 6 (28.6%), including 5 hemorrhages and 1 infarction, which caused 1 (4.8%) disability and 1 (4.8%) death. Sixteen (84.2%) patients had immediate angiographic obliteration in

technically feasible patients. The median angiographic follow-up for 14 surviving patients was 5.5 (range, 3 – 15) months, and in 13 (92.9%) patients complete obliteration of the nidus conformed. Among them, 1 patient in whom immediate angiographic obliteration was not achieved showed spontaneous obliteration at the 13-month follow-up. There were no recurrences during the follow-up period. The good functional outcome (mRS≤2) ratios improved from 57.1% (12/21) at preoperation, to 66.7% (14/21) at 1-month follow-up and 100% (19/19) at 6-month follow-up respectively.

Conclusion This prospective study demonstrates that transvenous embolization for brain AVMs may have a high rate of complete angiographic obliteration but also a high rate of procedure-related morbidity and mortality.

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O-022

CFD SIMULATION FOR CEREBRAL ARTERY WITH PATIENT-SPECIFIC INFLOW CONDITIONS EXTRACTED FROM 4D-DSA

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Introduction Hemodynamics is believed to be related to the pathology of cerebral aneurysms such as rupture and growth, so those phenomena have been investigated using

Abstract O-022 Figure 1 Hemodynamic difference between general flow condition and patient specific condition

computational fluid dynamics (CFD). In previous studies, we have used the same inflow condition to simulate blood flow regardless of patients' differences, although the heartbeat cycle differed from patient to patient. In this study, we extracted the patient-specific heartbeat cycle and blood flow velocity from four-dimensional digital subtraction angiography (4D-DSA) data that contain spatial and temporal information of contrast media. Finally, we performed CFD simulations and evaluated the effect of patient-specific inflow conditions.

Materials and methods Data of a 73-year-old man with hypertension were analyzed. We extracted the patient-specific heartbeat cycle and blood flow velocity from 4D-DSA data. Then, we performed CFD simulations using ANSYS CFX 18.1 under both general inflow conditions (healthy adult) and patient-specific inflow conditions extracted from 4D-DSA to reproduce the angiographic images. We calculated the cardiac cycle duration and the amplitude of voxel intensity values at one point on the vessel centerline over two cardiac cycles, for both the CFD simulation and 4D-DSA data sets. To assess the accuracy of the patient-specific flow condition extraction method, we compared the calculation results of the cardiac cycle duration and the amplitude obtained from both data sets. Finally, we compared the wall shear stress (WSS) differences caused between general inflow condition and patient-specific condition.

Results The 4D-DSA analysis gave a heartbeat cycle duration of 1.11 s and an intensity amplitude of 0.856. The CFD simulation under general inflow condition gave a cycle duration of 0.825 s, and an intensity amplitude of 0.879. In contrast, the CFD simulation under patient-specific inflow condition gave a cycle duration of 1.03 s and an intensity amplitude of 0.854. The cycle duration error difference between 4D-DSA analysis and CFD simulation results under general inflow condition was 3.90%, and between intensities 25.3%. In contrast, the cycle duration error between 4D-DSA and CFD simulation under patient-specific condition was 0.945%, and the intensity amplitude error 7.24%. In addition, we found that the WSS value using general conditions was overestimated compared with that using patient-specific condition in this case (see figure 1).

Conclusions We performed CFD simulation using patient-specific heartbeat cycle and blood flow velocity extracted from 4D-DSA data. The result showed that the CFD simulation under patient-specific inflow condition could simulate the actual blood flow more accurately.

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O-023

STENT-ASSISTED COILING OF CEREBRAL ANEURYSMS: MULTI-CENTER ANALYSIS OF RADIOGRAPHIC AND CLINICAL OUTCOMES IN 659 PATIENTS

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Introduction Endovascular stent-assisted coiling approach for the treatment of cerebral aneurysms is evolving rapidly with the availability of new stent devices. It remains unknown how each type of stent affects the safety and efficacy of the stent-coiling procedure.

Methods This study compared the outcomes of endovascular coiling of cerebral aneurysms using Neuroform (NEU), Enterprise (EP), and Low-profile Visualized Intraluminal Support (LVIS) stents. Patient characteristics, angiographic results using the Raymond-Roy grade scale (RRGS), clinical outcomes and procedural complications were analyzed in our study.

Results 659 patients with 670 cerebral aneurysms treated with stent-assisted coiling (NEU, n=182; EP, n=158; LVIS, n=330) were retrospectively collected from six academic centers. Patient characteristics included mean age 56.3 ± 12.1 years old, female prevalence 73.9% and aneurysm rupture on initial presentation of 18.8%. We found differences in complete occlusion on baseline imaging, defined as RRGS I, among the three stents: LVIS 64.4%, 210/326; NEU 56.2%, 95/169; EP 47.6%, 68/143; $p=0.008$. The difference of complete occlusion on 10.5 months (mean) and 8 months (median) angiographic follow-up remained significant: LVIS 84%, 251/299; NEU 78%, 117/150; EP 67%, 83/123; $p=0.004$. There were 7% (47/670) intra-procedural complications and 11.5% (73/632) post-procedural related complications in our cohort.

Conclusions The type of stent used for stent-assisted coiling affects immediate and long-term angiographic outcomes. Randomized prospective trials comparing the different types of stents are warranted.