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Research article

Endovascular treatment of intracranial vertebrobasilar artery dissecting aneurysms: Parent artery occlusion versus flow diverter

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ABSTRACT

Purpose: To compare the safety and efficacy of endovascular parent artery occlusion (PAO) and flow diverter (FD) treatment in treating vertebrobasilar dissecting aneurysms (VBDAs).

Methods: A review of a prospective aneurysm database at our institution was performed to identify all consecutive patients with intracranial VBDAs managed with endovascular treatment, which were either PAO or FD. Clinical and imaging findings were compared between the two groups.

Results: A total of 25 consecutive patients with 27 VBDAs were included. Seventeen VBDAs were treated by PAO, and 11 VBDAs were treated with FDs. Immediate total occlusion rate after initial treatment was higher in the PAO group than in the FD group (62.5% v.s. 9.1%, p = .018). Complete occlusion on follow-up at 18 months was more frequently observed in the PAO group (81.8%) compared to the FD group (55.6%), although the difference was not statistically significant (p = .433). Procedure related complication rate and mortality for the whole case series was 28% and 24% respectively, and were comparable in the two groups. Excellent outcome at discharge was achieved in 77.8% and 40% of patients treated with FD and PAO respectively, which was not statistically significant (p = .169). Excellent outcome at followed-up was comparable as well.

Conclusions: PAO and FD treatment are both feasible options for treatment of VBDAs. PAO provide higher immediate complete occlusion rate compared to FD. Despite low initial complete occlusion rates, FD group presented a comparable long-term outcome and similar perioperative events rate compared to the PAO group.

1. Introduction

Vertebrobasilar dissecting aneurysm (VBDA) is a serious life-threatening neurovascular condition associated with significant morbidity and mortality [1]. Endovascular treatments have emerged as therapeutic options for VBDAs. There are two main strategies to treat VBDAs, reconstructive techniques and deconstructive techniques [2,3]. Deconstructive techniques, also called parent artery occlusion (PAO), are reliable in prevention of rebleeding, but may expose patients to increased risk of acute or chronic ischemia [4,5], and may increase the risk of de novo aneurysms formation in other arteries providing collateral flow because of increased hemodynamic stress [6]. Due to those concerns, reconstructive approaches are more frequently favoured when the basilar artery, dominant vertebral artery, or major branches are involved. However, this may increase hemorrhagic risk due to the need for platelet anti-aggregation therapy or persistence of the aneurysm. In general, these two strategies seem to demonstrate comparable long-term occlusion, recurrence, and perioperative mortality [2,7], however the optimal treatment is still unclear.

Flow diverters (FD) have been increasingly used in treating refractory aneurysms, including large/giant aneurysms, blister aneurysms, and dissecting aneurysms [8,9]. Different FD devices have been applied in treating VBDAs, and showed encouraging results [3,10,11]. However, their safety and efficacy in the posterior circulation, especially in treating acutely ruptured aneurysms, still need further evaluation [12–14,11].

We aim to report results of the endovascular management of VBDAs in our institution, and to compare the safety and efficacy of FDs and PAO.

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2. Materials and methods

This study is a retrospective analysis of our prospective collected aneurysm database. It was approved by the institutional review board of our hospital, and informed consent was waived.

2.1. Patients and aneurysms

A comprehensive review was performed to identify all consecutive patients with intracranial VBDAs, both ruptured and unruptured, treated at our institution from February 2003 to July 2016. Bilateral vertebral artery dissecting aneurysms (VADA) treated with FD and PAO separately were also included. Saccular aneurysms at the bifurcation of vertebrobasilar artery and branches were excluded. VBDAs treated by microsurgical procedure, conventional coiling, or stent assisted coilingwere excluded. Database records were verified and supplemented by a review of electronic charts. Clinical follow-up information was obtained from chart notes at our multidisciplinary clinic.

Intracranial aneurysms in our institution are managed by a multidisciplinary team consisting of interventional neuroradiologists and cerebrovascular neurosurgeons. In general, PAO was the treatment of choice for ruptured VBDAs or co-dominant/non-dominant VAs with sufficient collateral circulation demonstrated upon an occlusion angiographic test; whereas FDs are more frequently chosen for the unruptured lesions (Figs. 1 and 2).

2.2. Procedural details

All procedures were performed under general anesthesia. Heparin was intravenously infused after femoral sheath placement, with the goal of achieving an activated clotting time of 2–2.5 times that of baseline during the procedure. Heparinization was discontinued at the end of the procedure.

2.3. Parent artery occlusion

Internal trapping with platinum coils was preferred to occlude the vessel from the distal VA through the aneurysmal dilation to the proximal VA. When a perforator is involved or the distal VA is difficult or dangerous to access, proximal occlusion was used as an alternative with detachable balloon or platinum coils. Technical success is defined by occlusion of parent artery. Total occlusion is defined as absence of contrast medium filling in the aneurysmal dilation on bilateral VA injections.

2.4. Flow diverter deployment and peri-procedural anti-aggregation therapy

FDs used in our case series include Pipeline embolization device (PED, Medtronic Neurovascular, Irvine, CA, USA) and SILK flow diverter stents (Balt Extrusion, Montmorency, France). Procedures were performed as described previously with microcatheters recommended by the FD manufacturers. Technical success is defined by correct placement of the FD, with total aneurysmal neck coverage and patent parent artery. Intensive dual platelet anti-aggregation therapy (81–162 mg/day aspirin plus 75–150 mg/day clopidogrel) was given for at least 10 days before the procedure. When FD was planned for acutely ruptured cases, intravenous abciximab was used together with a loading dose of 300–600 mg Plavix and 325 mg aspirin via gastric tube. After the procedure, clopidogrel was continued at a dose of 75 mg/day for 6 months, and then discontinued. Aspirin was administered at a dose of 81 mg/day indefinitely.

2.5. Clinical assessment, angiographic and clinical follow-up

Clinical outcome was assessed using the modified Rankin Scale (mRS) score at discharge and at the last clinical follow-up. Excellent outcome was defined as mRS score 0–2 and good clinical outcome from 0 to 3. Immediate post-procedural angiograms were obtained to evaluate aneurysm occlusion according to the Raymond classification. All lesions were followed with MRI and time-of-flight (TOF) magnetic

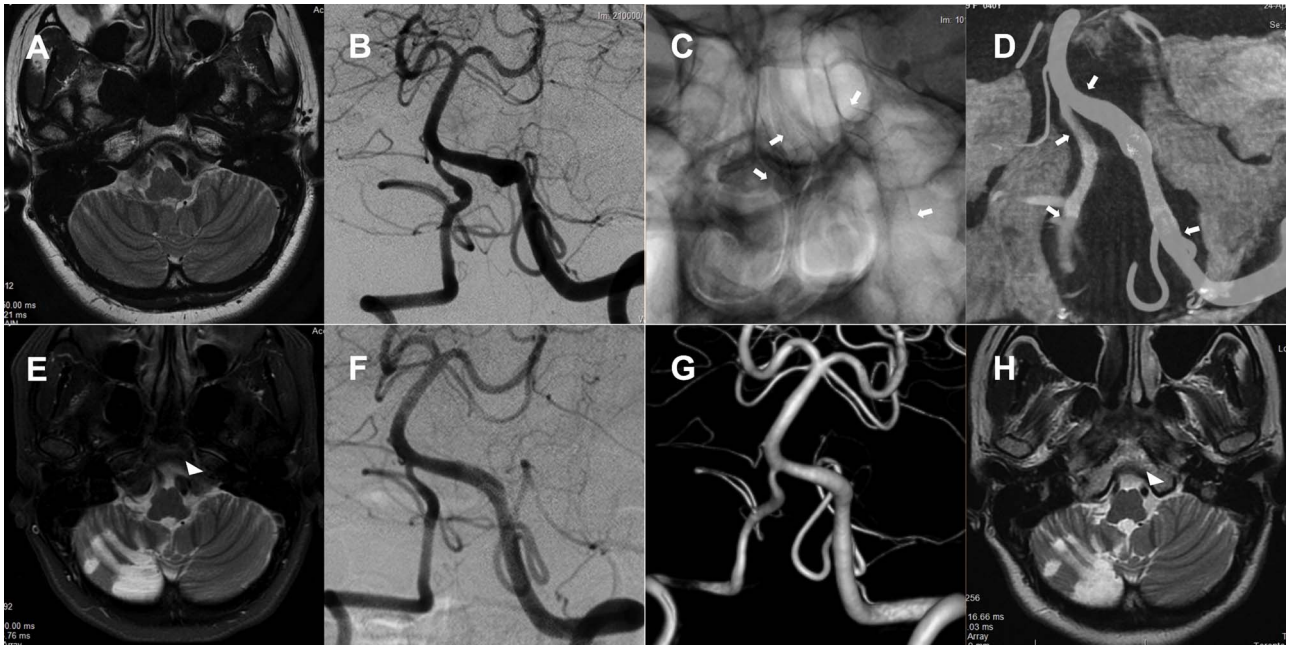

Fig. 1. Bilateral VBDAs treated by PED implantation without coils. A Pre-procedural T2WI showed flow void in the dilated left VA; B Angiogram of left VA with retrograde contrast filling into the right VA, showed bilateral VBDAs; C Image showed implanted PEDs (white arrows); D Dual volume reconstruction after bilateral PED implantation (white arrows); E T2WI at 6-week follow-up showed infarction in the right PICA territory, and the thrombosed portion of the left VBDA (white arrow head); F/G Angiogram and 3D reconstruction at 12-month follow-up showed total occlusion of bilateral VBDAs, and patency of bilateral PICAs; H T2WI obtained at the 29-month follow-up showed total regression of the aneurysm in the left VA (white arrow head). (Dilation of the right VA was not apparent on either pre-procedural or post-procedural MRI).