Background Vertebral artery dissecting aneurysms (VADAs) are a rare cause of subarachnoid hemorrhage associated with high rates of morbidity and mortality. Ruptured non-dominant VADAs are traditionally treated via endovascular coil-occlusion. However, controversy exists for the appropriate management of unruptured VADAs and ruptured dominant VADAs. To the authors' knowledge, this is the largest single-center study comparing modern neuroendovascular neurosurgical treatment strategies, including flow diversion (FD), to treat VADAs.

Methods All patients with a VADA treated endovascularly at a single center from January 1st, 1999 to December 31st, 2019 were retrospectively analyzed from a prospectively collected database. VADAs were categorized as either dominant or non-dominant vertebral artery. Furthermore, location of the VADA was classified as either the proximal V4 segment of the vertebral artery (proximal to PICA), incorporating PICA origin, or (distal V4) distal to PICA. Primary neurological outcomes were measured via mRS, with a mRS >2 categorized as a poor neurological outcome and a decline in mRS from the preoperative neurological exam as a worse neurological outcome. Secondary outcomes included retreatment rate and complications.

Results 91 patients underwent endovascular treatment for a VADA over this 20-year period (44 patients underwent open microsurgical intervention). 77 (85%) VADAs were on the proximal V4 segment, 8 (9%) included the PICA origin, and 6 (7%) arose distal to PICA. Coil-occlusion was performed in 47 (51%), FD in 29 (32%), and stent/coil in 15 (17%) cases. 54 patients (59%) presented with SAH (treated via coil-occlusion in 39, FD in 7, and stent/coil in 8 cases; p<0.001) and 44 VADAs (48%) involved a dominant vertebral artery (all dominant vertebral arteries were treated by either a FD or stent/coil; p<0.001). Rates of complications and retreatment were both significantly higher in patients treated with stent/coil (complication: N=4, 27%, retreatment: N=6, 40%) vs either coil-occlusion (complication: N=1, 2%, retreatment: N=2, 4%) or FD (complication: N=2, 7%, retreatment: N=4, 14%) (p=0.008 and p=0.002, respectively). Preoperative mRS was significantly higher in patients treated with coil-occlusion (3.2±1.4) than FDD (1.9±1.5) or stent/coil (1.8±1.3) (p<0.001). Likewise, coil-occlusion (22, 46%) was associated with a higher percentage of patients with a mRS >2 on follow-up than FDD (4, 14%) or stent/coil (3, 20%) (p=0.006).

For dominant vertebral arteries, stent/coil (6, 40%) required greater percentage of retreatments than FD (4, 14%) (p=0.049). Of the unruptured VADAs (N=37), 1 patient suffered a complication (3%), 4 patients (11%) required retreatment, 2 patients (5%) had mRS >2, and 8 patients (22%) exhibited a decline in mRS on follow-up, with no significant difference between the treatments.

Conclusion The majority of ruptured VADAs at our center were treated by coil-occlusion of non-dominant vertebral artery. For dominant vertebral arteries, FD required less retreatment than stent/coil cases. Furthermore, endovascular treatment of unruptured VADAs is safe and associated with favorable angiographic and neurological outcomes.