Modified Far Lateral Approach for Posterior Circulation Aneurysms: An Institutional Experience

Anil Nanda, Subhas Konar, Shyamal C. Bir, Tanmoy Kumar Maiti, Sudheer Ambekar

■ OBJECTIVE: **The modified far lateral approach is a modified version of the far lateral approach without drilling of the condyle. This approach can be used for accessing aneurysms anterior and anterolateral to the brainstem and craniovertebral junction. We describe the surgical outcome and complications of the modified far lateral approach for vertebrobasilar, proximal posterior inferior cerebellar artery, and vertebral artery aneurysms.**

■ METHODS: **The records of 26 patients with vertebrobasilar aneurysms who underwent surgery using the modified far lateral approach from 1994 to 2015 were retrospectively reviewed to analyze the clinical outcomes.**

■ RESULTS: **Mean age of patients was 61 years (range, 38–84 years), and 18 patients were women. The most common presenting symptoms were sudden-onset headache (77%) and dizziness (35%). Of patients, 21 (81%) had saccular aneurysms, and 5 (19%) had fusiform aneurysms. The modified far lateral approach was used in 16 patients with posterior inferior cerebellar artery aneurysms, 6 patients with vertebral artery aneurysms, 2 patients with basilar aneurysms, 1 patient with a vertebrobasilar junction aneurysm, and 1 patient with an anterior inferior cerebellar artery aneurysm. All aneurysms were clipped successfully. Follow-up data were available for 25 patients (median duration 67 months). At last follow-up, 22 patients had a good recovery (modified Rankin Scale score 1–3), and 3 patients had a poor outcome (modified Rankin Scale score 4–6). Four patients developed lower cranial nerve palsy, and 7 patients developed new-onset hydrocephalus.**

■ CONCLUSIONS: **The modified far-lateral approach without condyle resection and vertebral artery mobilization is associated with low procedure-related morbidity and comparable outcomes to the more extensive traditional approach.**

INTRODUCTION

Aneurysms of the vertebrobasilar junction and the vertebral artery (VA) and posterior inferior cerebellar artery (PICA) are rare, accounting for <1% of all intracranial aneurysms.[1,2] The management recommendations for this aneurysm are confusing because of an unpredictable natural history and the low incidence among all intracranial aneurysms. With evolving endovascular treatment options, the microsurgical management option for this group of aneurysms is used less frequently because of associated risk. The reasons are deep location of the aneurysm, brainstem perforators, obstructing bone prominence, and surrounding lower cranial nerves. However, literature review revealed >85% success rate in microsurgical groups.[3-5] Various skull base approaches have been described for lower basilar artery (BA) and VA-PICA aneurysms. Since the inception of the far lateral approach by Heros[6], skull base surgeons have been divided regarding how much bone should be removed to avoid morbidity and mortality. Spetzler and Graham[7] suggested removal of the posterior condyle and lateral mass of C1, and

Key words
- Aneurysm
- Modified far lateral
- Posterior circulation
- Surgical outcome

Abbreviations and Acronyms
BA: Basilar artery
CSF: Cerebrospinal fluid
H&H: Hunt and Hess
JT: Jugular tubercle
mRS: Modified Rankin Scale
PICA: Posterior inferior cerebellar artery
SAH: Subarachnoid hemorrhage
VA: vertebral artery
WFNS: World Federation of Neurosurgical Societies

Department of Neurosurgery, Louisiana State University Health Sciences Center Shreveport, Shreveport, Louisiana, USA

To whom correspondence should be addressed: Anil Nanda, M.D., M.P.H. [E-mail: ananda@lsuhsc.edu]

Citation: World Neurosurg. (2016) 94:398-407.
http://dx.doi.org/10.1016/j.wneu.2016.07.029

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

1878-8750/$ - see front matter Published by Elsevier Inc.

Bertalanffy and Seeger[8] reported removal of the jugular tubercle (JT). Kawase et al.[9] contrasted the outcomes of the transcondyle and lateral suboccipital approaches for these types of aneurysms. We report our experience using the modified far lateral approach for lower BA and VA-PICA aneurysms at our institution.

MATERIALS AND METHODS

This study was approved by the institutional review board at Louisiana State University Health Science Center Shreveport in compliance with Health Insurance Portability and Accountability Act. The senior author (A.N.) started using the modified far lateral approach in 1994. A prospectively maintained hospital inpatient database was used for patients who underwent the modified far lateral approach for aneurysm clipping during a 21-year period from 1994 to 2015. Medical records, operative reports, imaging studies, and clinical follow-up evaluations were retrospectively reviewed for all patients. Patients with ruptured aneurysms were evaluated using the Hunt and Hess (H&H) grading scale, and the unruptured group was scored as grade 0. H&H grade 0, 1, 2, or 3 was considered good, and H&H grade 4 or 5 was considered poor. Outcomes were assessed at the time of discharge and at 3 months, 1 months, and 1 year postoperatively with annual follow-up thereafter using the modified Rankin Scale (mRS). An mRS score of ≤3 was considered a good outcome, and an mRS score of 4 or 5 was considered a poor outcome. The feasibility of clipping versus coiling was assessed by the senior author (A.N.) and the endovascular team beginning in 2006, when the endovascular unit began functioning. The clinical grade at presentation, medical comorbidities, aneurysm-related factors (e.g., size [giant], neck size, direction of the aneurysm), possible treatment risks, and patient or family preference were considered in the final decision regarding mode of treatment.

Microsurgical Technique

After induction of general anesthesia, the patient was placed in a lateral position, and the head was fixed on a Mayfield 3-point fixation device (Ohio Medical Instrument Company, Inc., Cincinnati, Ohio, USA). A curvilinear S-shaped incision was performed behind the ear extending from the mastoid process to the level of C2 inferiorly. Our preference for an S-shaped incision over a C-shaped or straight incision is based on our experience that an S-shaped incision provides improved exposure and visualization of the suboccipital and paracondylar regions and decreases operative time (Figure 1). After reflecting the muscle layers, the suboccipital triangle and occipital artery were exposed. The dorsal ramus of the C1 nerve root, the VA, and the suboccipital venous plexus were identified deep within the suboccipital triangle. The VA was located coursing anterior to the anterior ramus of the C2 ganglion as it emerged from the foramen transversarium of C2 and entered the foramen transversarium of C1. The rectus capitis posterior major, superior oblique, and inferior oblique were divided, and the VA was traced up to its entry into the intradural compartment. The atlantooccipital membrane was cut, and the dura mater was exposed (Figure 2).

A suboccipital craniotomy was performed extending to the foramen magnum. The posterior arch of C1 was drilled. In all

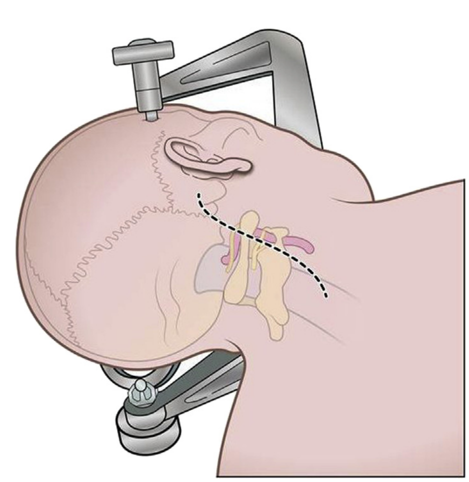

Figure 1. Positioning of the patient. The patient's head is laterally rotated and flexed to open up the atlantooccipital space. Lazy "S" incision is shown.

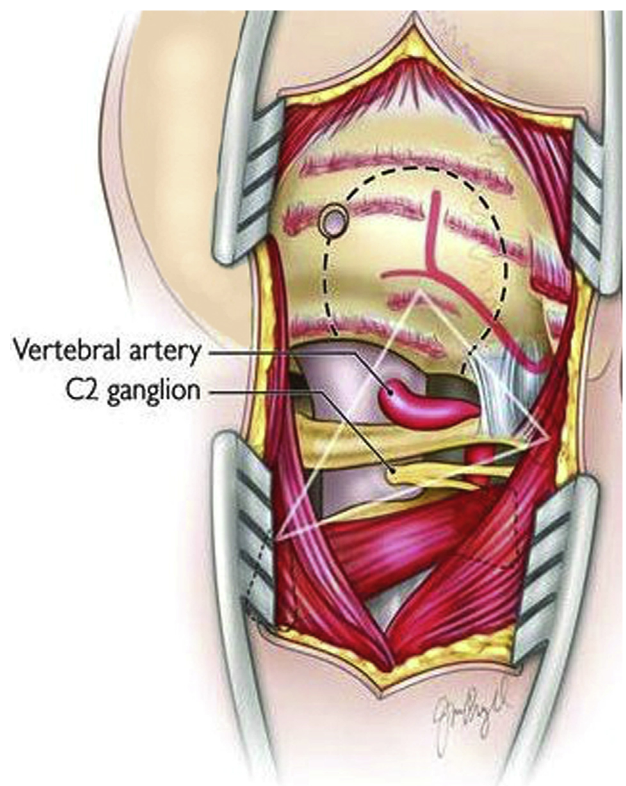

Figure 2. Exposure of suboccipital bone and foramen magnum after muscle dissection. The *black dotted line* denotes the extent of the craniotomy. The suboccipital triangle is outlined with *white lines*.