

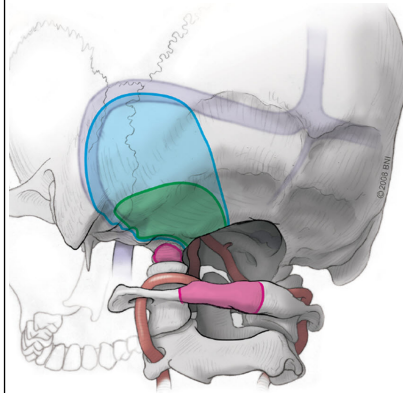
Introduction

The far-lateral approach (FLA) is often used to access pathologies near the vertebral and posterior inferior cerebellar arteries (VA-PICA). The extent of craniotomy of this approach has not yet been quantified. We quantitatively analyzed six sequential steps of the FLA to help plan the extent of craniotomy and additional bone work that might be required to gain the necessary exposure.

Methods

Anatomic measurements were performed on 5 cadaveric heads (10 sides). The FLA was performed in 6 sequential steps and was classified as a modified small FLA (msFLA) and classic large FLA (clFLA) groups based on its size. The msFLA group involved a 2.5 cm x 2.5 cm craniotomy and its variations. The clFLA involved a 2.5 cm x 5 cm craniotomy and its variations. The variations included the removal of the C1 arch and the removal of the posterior third of occipital condyle. After each approach, the area of surgical exposure and the horizontal and vertical angles of attack were measured.

Figure 1. Illustration showing the modified small far-lateral approach

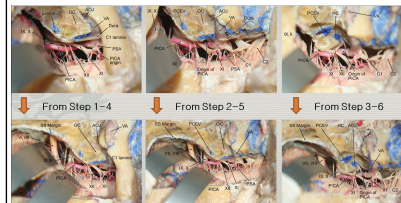


(msFLA, Step 1, green), the classic large far-lateral approach (clFLA, Step 2, blue), and the extent of a C1 hemilaminectomy (Steps 2 and 5) and posterior condyle drilling (Steps 3 and 6, red)

Results

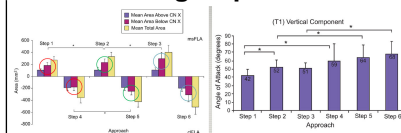
The total area of exposure above CN X increased significantly ($p < 0.05$) from the msFLA to clFLA. However, the surgical exposure area below CN X, which was the practical working area for the VA-PICA region, did not change ($p > 0.05$). C1 hemilaminectomy increased ($p < 0.05$) the vertical angle of attack, and drilling the posteromedial third of the occipital condyle increased ($p < 0.05$) the horizontal angle of attack, to the origin of PICA.

Figure 2. MSFLA Group vs CLFLA group



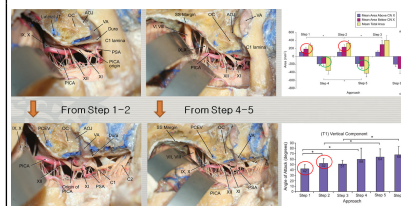
After the craniotomy was extended, the total surgical area and vertical angle of attack increased as expected.

Figure 3. Practical working space and angle of attack of msFLA Group and clFLA group



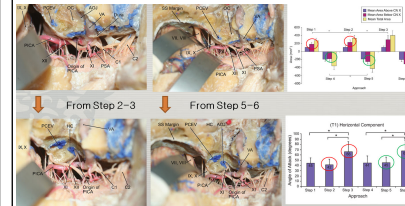
In terms of practical working space and angle of attack, larger craniotomy offers no advantage over small craniotomy if target point is the VA-PICA.

Figure 4. Practical working area and angle of attack after C1 arch Removal



The areas below CN X and vertical component of the angle of attack increased in the caudal direction.

Figure 5. Practical working area and angle of attack after Condyle removal



The areas below CN X and horizontal component of angle of attack increased in the lateral directions.

Discussion

The total surgical area increased as expected between the msFLA and clFLA, reflecting the increase in the size of the craniotomy. This increase in area mainly involved the increase in the area above CN X; the area below CN X remained the same in both craniotomies. The practical surgical working space (area below CN X) and the angles of approach to the VA-PICA region were not affected by the size of craniotomy. The removal of the lateral portion of the jugular tubercle with the occipital condyle and the C1 hemilaminectomy increased the horizontal and vertical angles of attack, respectively.

Conclusions

According to the location, extent, and pathology of lesions in the VA-PICA region, the type of the FLA, including the craniotomy and lateral and inferior extensions, should be individually tailored to obtain the exposure needed without unnecessary surgical steps.

References

1. Babu RP, Sekhar LN, Wright DC. Extreme lateral transcondylar approach: technical improvements and lessons learned. *J Neurosurg.* 1994; 81(1):49-59.
2. D'Ambrosio AL, Kreiter KT, Bush CA et al. Far lateral suboccipital approach for the treatment of proximal posterior inferior cerebellar artery aneurysms: surgical results and long-term outcome. *Neurosurgery.* 2004; 55(1):39-50.
3. Heros RC. Lateral suboccipital approach for vertebral and vertebrobasilar artery lesions. *J Neurosurg.* 1986; 64(4):559-562.