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Asterion as a surgical landmark for lateral cranial base approaches

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SUMMARY. Introduction: **When approaching the posterior fossa and posterolateral cranial base, surface landmarks are helpful in locating the junction of the transverse and the sigmoid sinus.** Material and methods: **On 100 skull halves a 2 mm drill bit was externally placed over the asterion and was drilled through the bone perpendicular to the skull surface. Various positions of the asterion and its distance from the root of the zygomatic process of the temporal bone, from the suprameatal crest and the mastoid tip were investigated.** Results: **The position of the asterion has been found to be located superficial to the transverse–sigmoid sinus junction in 87% of all samples, inferior to the transverse–sigmoid sinus junction in 11% and superior to the transverse–sigmoid sinus junction in 2%. The distance from the asterion to the root of the zygoma has been determined to be 54.6 ± 5.5 mm. The distance between asterion and Henle's spine was 45.2 ± 5.2, and from asterion to Frankfurt Horizontal Plane 15 ± 7.5 mm.** Conclusion: **Asterion varies regarding its cephalocaudal position. The findings of this study might have direct consequences for transmastoid and retrosigmoid approaches for microvascular trigeminal root decompression and combined petrosal approaches.**

Keywords: **asterion; sigmoid sinus; surgical approach; anatomy**

INTRODUCTION

In approaching the posterior fossa and posterolateral cranial base, surface landmarks are helpful to locate the transverse–sigmoid sinus junction (*Cantore* et al., 1994; *Ammirati* et al., 1995; *Aslan* et al., 1996; *Bozbuga* et al., 1998). The asterion, defined as the junction of the lambdoid, parietomastoid, and occipitomastoid sutures, has been advocated as a primary landmark in performing combined petrosal approaches to the cranial base (*Williams* et al., 1995; *Aslan* et al., 1997; *Day* and *Tschabitscher*, 1998; *Aziz* et al., 2000). But there has also been some doubt requiring its reliability as a landmark (*Yamashima* et al., 2004).

It is important for the surgeon to know the correct location of an initial burr hole for a retrosigmoid craniotomy (*Lang* and *Samii*, 1991; *Sekhar*, 1998). The sigmoid sinus is easy to lacerate during posterior fossa craniotomy because it lies in a groove in the bone, may be adherent to bone, and is further attached by an emissary vein. On the other hand, the transverse sinus is easy to separate from the bone and is unlikely to be injured even if the burr hole is right over it. The greater danger with the transverse sinus is that the surgeon may not realize where it is and opens the dura right over it. For this reason, it is better to open the dura of the posterior fossa in the inferolateral corner, which will also allow early drainage of the cerebellomedullary cistern to relax the cerebellum (*Sekhar*, 1998).

Various positions of the asterion and its distance from the root of the zygomatic process, suprameatal crest and mastoid tip can embarrass the surgical approach to the tympanic cavity, mastoid antrum and membranous labyrinth during internal acoustic meatus and cerebellopontine trigone surgery and transmastoid cisternoscopy (*Sripairojkul* and *Adultrakoon*, 2000; *Ozveren* et al., 2002; *Turgut* et al., 2003). The purpose of this research was to determine the reliability and usefulness of the asterion as a surgical landmark for lateral cranial base approaches to the posterior fossa. Therefore this study was devised to define the morphometry and topographic anatomy of the asterion in a large series using various parameters such as its relationship to the transverse–sigmoid sinus junction, the mastoid air cells, the distance from the root of zygomatic process, suprameatal crest, mastoid tip and Frankfurt Horizontal Plane.

MATERIAL AND METHODS

For this study, 16 skull bases, 24 half-skull bases, 17 fixed male cadaver heads and 10 fixed male half cadaver heads were obtained from the Department of Anatomy, Ege University. The morphometric relationships were determined on both sides of each specimen yielding 100 sides evaluated. Soft tissues were removed to expose the posterolateral cranium from the root of the zygomatic process up to the inion. A 2 mm drill bit was placed externally over the asterion and it was drilled through the bone perpendicular to the skull surface. The position of the drill hole was determined on the inner surface and then recorded. A 3×3 cm grid centred over the transverse sinus and upper curve of the sigmoid sinus

was used to record the position of the asterion. The position was determined to fall within 1 cm^2 segments.

The key surface structures identified for the purpose of this study and the distances measured between major surface landmarks have been depicted in Fig. 1.

(a) Distance between asterion and the superior curve of the transverse–sigmoid sinus junction
(b) Width of transverse–sigmoid sinus junction
(c) Width of transverse sinus
(d) Width of sigmoid sinus
(e) Distance between asterion and the root of the zygomatic process of the temporal bone
(f) Distance between asterion and suprameatal crest (Henle's spine)
(g) Distance between asterion and the mastoid tip
(h) Distance between asterion and Frankfurt Horizontal Plane (FHP)

The relationship of the upper curve of the surface bone was noted with regard to the crest that delineates the posterior aspect of the body of the mastoid and to the squamo-parietomastoid suture junction. The asterion has been described as over, above or below the sinus junction according to the relationship to the upper curve of the sigmoid sinus; the upper aspect of the sigmoid sinus was described as curved or angled (*Kayalioglu* et al., 1996). All measurements were made with a flexible ruler by one author (HU). Mean and standard deviation values were calculated for each parameter and the Student's *t*-test was used for statistical analysis in the assessment of right–left differences.

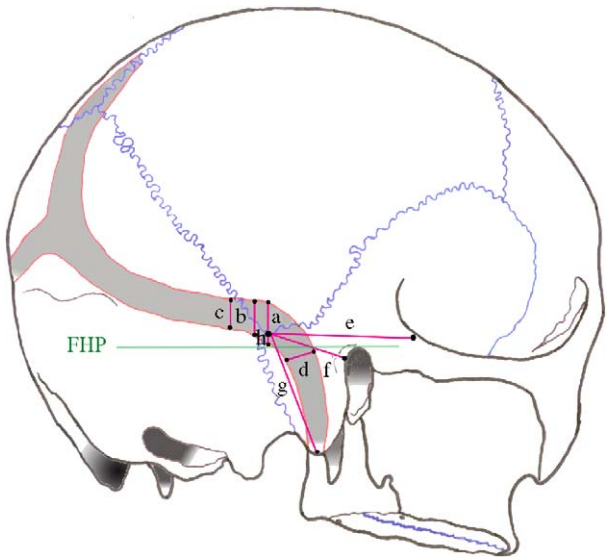
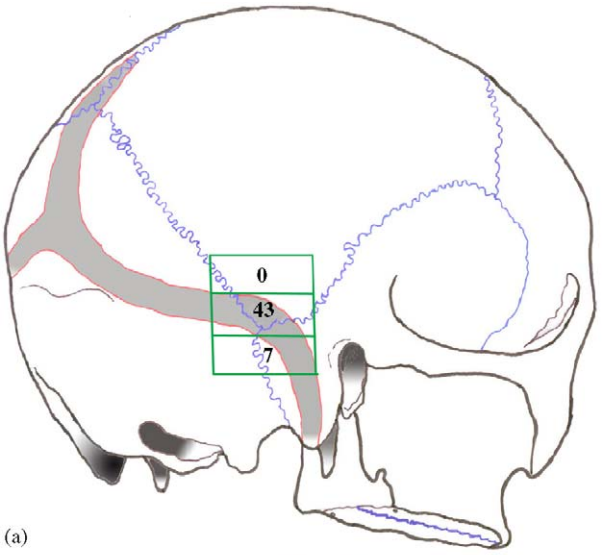


Fig. 1 – The distances measured between significant anatomical surface landmarks on the cranium (for explanation of letters see text).

RESULTS

It was noted that in 87 (87%) of all samples, the position of the asterion was found to be located superficial to the sigmoid sinus junction. The asterion was inferior to the transverse–sigmoid sinus junction in 11 (11%) and superior to the transverse–sigmoid sinus junction in 2 (2%).

The asterion was over the posterior cranial fossa dura mater and inferior to the transverse–sigmoid sinus junction in 14% (7 samples) on the right, and in 8% (4 samples) on the left (Fig. 2). The position of the asterion was right on the transverse sinus or sigmoid sinus junction in 86% (43 samples) on the right, and in 88% (44 samples) on the left (Fig. 2). This landmark was superior to the transverse–sigmoid sinus junction in 4% (2 samples) on the left,



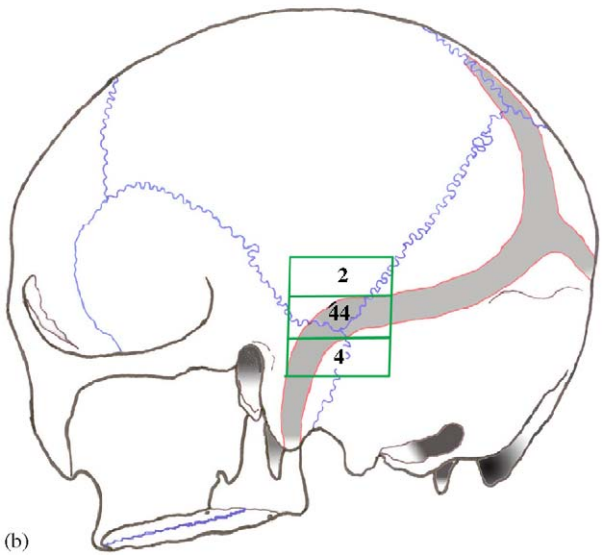


Fig. 2 – (a) Right side of the skull with frequencies of the position of the asterion in relation to to the junction of the sinus. (b) Left side of skull with the frequencies of the position of the asterion in relation to the junction of the sinus and the posterior fossa dura mater.