Supramastoid Crest, Safety Landmark for Craniotomy?

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Background: Bony landmarks are important in identifying and avoiding various structures, and thus, decreasing surgical morbidity. Knowledge of frontal bone was studied to help surgeons with safe craniotomy as temporooccipital region study was rare.

Objective: To identify usefulness of supramastoid crest and relationship to venous and Labbe’s vein.

Material and Method: Twenty fresh cadaveric heads, the vessels were injected with colorized silicone, were studied on both sides, yielded 40 sides. The relationship of the supramastoid crest to the transverse, sigmoid sinus, Labbe’s vein was also determined and measured. The following distances were measured utilizing the digital caliper for all measurements.

Results: Supramastoid crest was found in all cadavers (100%) and skull opened along supramastoid crest 100% safe from injury to venous sinus. Anterior border of supramastoid crest was close in relation to middle cranial fossa floor, 85% on right side and 90% on left side and the same level of middle cranial. The authors defined supramastoid point with turning of supramastoid crest and found distance from supramastoid point to nearest venous sinus (always transverse sinus) 1.0-22.41 mm in range and average 12.94 mm on right side and 11.87 mm on left side. The last distance, from supramastoid point to nearest Labbe’s vein, was measured and found to be 5.94-24.97 mm in range and average 17.23 mm on both sides.

Conclusion: Supramastoid crest is bony landmark and easy to identify in the adult cadaver and craniotomy along supramastoid crest and always safe from injuring the venous sinus and Labbe’s vein. 87.5% anterior border of supramastoid crest is the same level for middle cranial fossa floor.

Keywords: Supramastoid crest, Safety landmark

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Anatomical localization of internal cranial anatomy based on superficial landmarks is important in identifying and avoiding various structures, and thus, decreasing surgical morbidity. Knowledge of frontal bone was studied to help surgeons in safe craniotomy, as temporooccipital region study was rare. Supramastoid crest is bone ridge in the posterior part of temporal fossa than runs backward and upward across at the posterior part of temporal fossa; it serves for the attachment of the temporal fascia and limits the origin of the temporalis muscle. In the past, the supramastoid crest was not verifiable, recognized and studied relative to beneath the venous structure.

The purpose of this present study was to identify usefulness of the supramastoid crest and measure the distance from supramastoid crest to middle fossa floor, Labbe’s vein, the transverse and sigmoid sinus. Accurate information of supramastoid crest can guide a surgeon to a safe craniotomy in temporooccipital operation example, hemicraniectomy or temporal craniotomy for subtemporal approach. For practical information, we studied the supramastoid crest in fresh cadavers and dissected the cadavers with techniques similar to a real operation.

Material and Method

Twenty fresh cadaveric heads, the vessels injected with colored and silicone, were studied. Studies of both sides yielded 40 sides. The temporalis muscle and soft tissues were removed to expose the temporal fossa and posterior cranium-identified zygomatic root and followed to supramastoid crest. The following supramastoid crest were identified in each specimen and defined the anterior border of the supramastoid crest, supramastoid point (turning curve of the supramastoid crest) and the posterior border of the supramastoid crest in Fig. 1, 2. Posterior cranial bone was cut to expose the dural sinus.

Supramastoid point was identified, drilled with
to the nearest margin of the transverse or sigmoid sinus was measured. The relationship of the anterior border of supramastoid crest and middle cranial fossa floor was checked and measured. Dura was opened and distance from supramastoid point to nearest Labbe’s vein was measured. The following distances were measured utilizing the Marathon 8 inch/200 mm Electronic Digital Caliper for all measurements. Descriptive statistics was used to report the results. Design and study protocol was approved by Khon Kaen University Ethics Committee for Human research.

Results

Of our 20 cadavers, there were 9 female cadavers and 11 male. All cadavers were older than 18 years; the supramastoid crest was found in all cadavers (100%) and easy to view all cadavers. When the skull was opened along supramastoid crest, the authors found that the venous sinus to be far from the supramastoid crest in all specimens and were (100% safe from injury to venous sinus). The authors defined anterior border of the supramastoid crest and found it close relation to middle cranial fossa floor, 85% on right side and 90% on left side as with level of the middle cranial fossa and above the middle cranial fossa 15% on right side with average distance 5.88 mm and 10% on left side with an average distance 5.33 mm. The authors defined the supramastoid point with turning of the supramastoid crest and found distance from the supramastoid point to the nearest venous sinuse (always transverse sinus) 1.0-22.41 mm in range and average 12.94 mm on right side and 11.87 mm on left side. The last distance from the supramastoid point to the nearest Labbe’s vein was measured and found to be 5.94-24.97 mm, in range, and the average 17.23 mm on both sides (Table 1).

Discussion

Middle fossa surgery for brain tumor, trauma and vascular operation always needs adequate temporal craniotomy for excellent exposure to lesions with minimal brain retraction; however, study about the landmark to guide temporal craniotomy was rare. On the other hand, the squamaous part and mastoid part of temporal bone lay on transverse and sigmoid sinus and the temporal craniotomy may injure the venous sinus and lead to intra-operative complications as well as significant postoperative neurologic morbidity or mortality. In the past, many studies about bony the landmark and venous sinus example asterion superior nuchal line but not usefull for temporal

Fig. 1 Supramastoid crest was identified after scalp and temporalis muscle was dissected.

Fig. 2 Identified supramastoid point (circle), anterior border of supramastoid crest (dark arrow) and posterior border of supramastoid crest (thin arrow).

Fig. 3 Skull was opened along supramastoid crest and dura was opened and relationship between supramastoid crest with middle cranial fossa, venous sinus, Labbe’s vein was studied.
Table 1. Relationship of supramastoid crest and others structure

<table>
<thead>
<tr>
<th>Distance</th>
<th>Mean (mm) ± SD</th>
<th>Right</th>
<th>Left</th>
<th>Mean (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supramastoid point-transverse sinus (1.0-22.41 mm)</td>
<td>12.94 ± 11.87</td>
<td>12.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supramastoid point-labbe's vein (5.94-24.97 mm)</td>
<td>17.23 ± 17.06</td>
<td>17.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supramastoid crest save to injury sinus</td>
<td>20 (100%)</td>
<td>20 (100%)</td>
<td>40 (100%)</td>
<td></td>
</tr>
<tr>
<td>Anterior border supramastoid crest = middle cranial fossa (Y/N)</td>
<td>17 (85%)</td>
<td>18 (90%)</td>
<td>35 (87.50%)</td>
<td></td>
</tr>
<tr>
<td>Anterior border supramastoid crest higher than middle cranial fossa</td>
<td>5.88 mm ± 5.33 mm</td>
<td>5.60 mm</td>
<td>5 (12.50%)</td>
<td></td>
</tr>
</tbody>
</table>

craniotomy because previous the landmark was not exposed in middle fossa surgery.

The supramastoid crest is the bone ridge that runs backward and upward across its posterior part; it serves for the attachment of the temporal fascia, and limits the origin of the temporalis muscle and is the boundary between the squama and the mastoid portion of the bone. This structure was designated by Broca (1875) as supramastoid crest, and also called retrotomarstrum by Rossa (1896) and temporal ridge by Leidy (1883). Turgut HB et al reported suprameatal crests were observed commonly as a trace type on the male dry skulls (51.2%), though no such crest was seen on most of the female skulls (54.4%). In the present study, 20 adult cadavers at Khon Kaen University it was found that it could identify the supramastoid crest easily in 100% of the cadavers and height at least 2 mm; no gender difference was observed. The authors defined the anterior part of the supramastoid crest and found 85% on right, 90% on left side the same level in of the middle cranial fossa and 15% in right and 10% on the left superior to middle cranial fossa 5 mm in average. When the craniotomy along the supramastoid crest had not exposed the venous sinus, the distance from the supramastoid point to the nearest venous sinus was (always transverse sinus) 1.0-22.41 mm in range and 12.4 mm in average.

Labbe’s vein travels on the brain surface and is susceptible to injury during maneuver. In our study after durotomy, the nearest Labbe’s vein (inferior anastomosis vein) was identified and was always far from the supramastoid crest and from the supramastoid point, 5.94-24.97 mm in range and 17.14 mm on average.

Conclusion

The supramastoid crest is the bony landmark that is easy to identify in adult Thai cadaver which makes the craniotomy along the supramastoid crest always safe from injury to the venous sinus and Labbe’s vein, and 87.5% of the anterior border of the supramastoid crest is the same at the level of the middle cranial fossa floor. The supramastoid point can provide guidance to the position of venous sinus and Labbe’s vein.

Acknowledgement

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Potential conflicts of interest

None.

References

การศึกษาความสัมพันธ์ของรอยหนังใกล้ที่ supramastoid crest และตำแหน่งของโพรงหลอดเลือดฉนวน posterior cranial fossa, Labbe’s vein ในผู้บริจาคความตายที่โรงพยาบาลศรีนครินทร์ มหาวิทยาลัยขอนแก่น

พิชญทร ดวงทองพล, ไชยวิทย์ อันไพศาล, อานาจ ศิริการีย์, โอวิท โชติวงศ์, วิไลวรรณ หนอดทอง

อุปกรณ์: เมื่อจากการผ่าตัดใหญ่ศีรษะ decompressive craniectomy เพื่อทำให้ท่านสมาชิค ไปทางประสาทศีรษะ เขน การผ่าตัด supramastoid crest และ posterior cranial fossa ทำให้ผู้ป่วยบรรลุสิ่งที่ต้องการ และมีความสัมพันธ์กับโพรงเส้นเลือดค้นบริเวณ Posterior fossa และ Labbe’s vein อย่างไร

วัสดุและวิธีการ: การศึกษาพรรณนา descriptive study โดยนำผู้ป่วยที่มีที่เสียชีวิตในเวลา 18 ปี อิ่มขึ้น 24 ชั่วโมง ซึ่งถูกทำการบริจาคมาที่แก้ไขจากศิลปะศิลป์ศีรษะ จากนั้นทำการผ่าตัดและมีผลจากซ้อมกิจโดย ภาพพรมสั้นเส้นด้ายด้านที่เป็นโพรงเส้นเลือดและรังข่ายเป็นที่ศึกษาทางด้านกล้ามเนื้อมีการ digital caliper ใช้มาเป็นมีสิ่งที่หลักผลผลิตของทางเรื่อง

ผลการศึกษา: พบว่า supramastoid crest สามารถสัมพันธ์ได้ 100% ของอาจารย์ใหญ่ที่ทำการศึกษาและมีเป็นโพรงหลอดเส้นเลือดค้นบริเวณ Posterior fossa และ Labbe’s vein ณ บริเวณ supramastoid crest ปกครองโดยโพรงเส้นเลือดและเส้นเลือด Labbe’s vein ณ บริเวณ supramastoid point ณ บริเวณ transverse sinus ได้ระยะ 1.0-22.4 มิลลิเมตร และween 12.94 มิลลิเมตร ในข้างยาว และ 11.87 มิลลิเมตร ในข้างยาวส่วนระยะจาก supramastoid point ณ Labbe’s vein เป็น 5.94-24.97 มิลลิเมตร และween 17.23 มิลลิเมตร

สรุป: supramastoid crest เป็นรอยหน้าใกล้ที่ของกล้ามเนื้อที่แยกได้ อยู่ และสามารถใช้เป็นจุดตัดในการเปิดโลกซึ่ง เป็นเนื้อเยื่อเดิมจากโพรงเส้นเลือดและเส้นเลือด Labbe’s vein และมีแนวขอบหน้าของ supramastoid crest ระยะละ 87.5 อยู่ระดับเดียวกับ middle cranial fossa floor