

# Variable Position of Greater Palatine Foramen in Human Skulls

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## SUMMARY

*Fifty dried human adult skulls were studied to detect the location of greater palatine foramen. It was found to be located against 2nd molar tooth in 6%, against 3rd molar tooth in 64% and between 2nd and 3rd molar in 30% skulls. Mean distance of greater palatine foramen from median (sagittal) plane was 13.29 mm on right side and 13.36 mm on the left side. Number of lesser palatine foramina was variable, ranging from 0-3. Multiple lesser palatine foramina were more on the right side. A bony projection was noted on the posterior margin of greater palatine foramen in 21% skulls, on medial margin in 6% skulls and in both these sites in 2% skulls. Direction of opening of greater palatine foramen was inferior in 47% skulls, inferomedial in 40 % skulls and inferolateral in 13 % skulls. We conclude that location of greater palatine foramen is quite variable in human Asian skulls and in majority of cases (64%) it is located against 3rd upper molar tooth. The difference of mean distance of greater palatine foramina from midline on either side was statistically not significant ( $P=0.392$ ) but the foramen was directed in majority of skulls (47%) inferiorly.*

## INTRODUCTION

Maxillary nerve block represents an excellent method of producing profound anaesthesia in the maxillary region. Local anaesthetic is injected in palatine branches of maxillary nerve through oral cavity via greater palatine foramen. This method is however not used very commonly because of lack of experience with the techniques involved and fear of iatrogenic injury<sup>1</sup>, due to inconsistent position of greater palatine foramen.

The position of this foramen has been described only in a general way in various textbooks of anatomy, moreover the location described is also not consistent, e.g. in the postero-lateral border of palate<sup>2</sup>, near the lateral palatal border<sup>3</sup>, medial to last molar tooth<sup>4</sup>, opposite the last molar tooth<sup>5</sup>, opposite the second molar tooth<sup>6</sup>, opposite the third molar tooth or between the second and third molar tooth<sup>7</sup>. There is no study available to describe the position of this foramen precisely in Pakistani skulls.

The purpose of this study was to determine the location, direction and presence of bony projection on the margins of greater palatine foramina more

precisely in human Asian skulls. Number of any lesser palatine foramina was also noted.

## MATERIAL AND METHODS

The present study was conducted on 50 dry adult human skulls available in the anatomy department of King Edward Medical College, Lahore. The sex and ages of the skulls taken for this study were unknown, but were adult as detected by the presence of third molar teeth. Following parameters were selected for evaluation.

1. Position of greater palatine foramen in relation to maxillary molar teeth.
2. Direction of opening of foramen.
3. Distance from medial margin of foramen to median plane with the help of vernier caliper in millimeter scale.
4. Presence of any bony projection on posterior or anterior margin of greater palatine foramen.
5. Number of lesser palatine foramina if any.

Levene test for equality of variances was

applied to determine the statistical significance of the results obtained.

## RESULTS

Results obtained regarding the position of greater palatine foramen in relation to maxillary molar teeth are presented in Table 1. In 64% of skulls this foramen was opposite the 3rd molar tooth, whereas in 30% skulls it was medial to the area between 2nd and 3rd molar tooth. Only in 6% skulls greater palatine foramen was situated opposite 2nd molar tooth. This finding showed a bilateral symmetry in all the skulls examined. Figure 1 for location of greater palatine foramen.



**Fig. 1:** Photograph showing position of greater palatine foramen.

Table 2 shows that mean distance from medial margin of greater palatine foramen to median plane was 13.29 mm on right side with a standard deviation of 1.01 mm. On left side it was 13.36 mm with a standard deviation of 0.92 mm from mean with F value of 0.739 and p value of 0.392 indicated an insignificant difference of distance on the two sides.

Greater palatine foramina in 47% skulls were opening directly inferiorly, whereas in 40% direction of opening was infero-medial. Only 13% foramina opened in an infero-lateral direction, i.e. directed towards the molar teeth. Table 3 shows the

frequency on each side.

A bony projection was found in the posterior margin of greater palatine foramen in 21% skulls. In 6% skulls projection on anterior margin of foramen was noted. In 2% skulls bony projections were present both on anterior and posterior margins of greater palatine foramen. See Table 4 for differences and frequency on each side. Figure 2 shows this bony projection.



**Fig. 2:** Photograph showing bony projection over greater palatine foramen.



**Fig. 3:** Photograph showing lesser palatine foramina.

Number of lesser palatine foramina was quite variable, ranging from 0-3 (Fig. 3). Mean number on right side was  $1.32 \pm 0.62$  and on left side was  $1.08 \pm 0.63$ . There was an insignificant difference in the number of lesser palatine foramen on two sides with a p value of 0.36. However presence of multiple lesser palatine foramina was more on right side (Table 2).

**Table 1: Location of greater palatine foramen (n=50)**

Location	Frequency	Percentage
Opposite 2nd molar tooth	3	6
Opposite 3rd molar tooth	32	64
Between 2nd & 3rd molar	15	30
Total	50	100

**Table 2: Statistical analysis (n=50)**

	Right side		Left side		p value
	Mean mm	S.D	Mean mm	S.D	
Gr. palatine foramen Distance from midline	13.29	1.07	13.36	0.92	0.392
No. of lesser palatine foramina	1.32	0.62	1.08	0.63	0.358

## DISCUSSION

Greater palatine foramen is an important landmark in oral cavity. It is present at an easily accessible place and transmits the greater palatine vessels and nerve. This foramen also marks the entry into palatine canal through which the palatine nerves pass. In maxillofacial surgery maxillary branches of maxillary division of trigeminal nerve can be injected for the purpose of obtaining local anaesthesia.

The description of location and relations of greater palatine foramen is given just in a general way in various textbooks of Anatomy. Moreover the location described is not consistent. Regarding the direction of opening of greater palatine foramen, it is

described to open inferiorly, inferolaterally or inferomedially.

**Table 3: Direction of opening of greater palatine foramen (n = 50)**

Location	Right side		Left side	
	Frequency	Percentage	Frequency	Percentage
Inferomedial	21	42	19	38
Inferolateral	8	16	5	10
Inferior	21	42	26	52
Total	50	100	50	100

**Table 4: Bony projection over greater palatine foramen (n = 50)**

Location	Right side		Left side	
	Frequency	Percentage	Frequency	Percentage
Posterior	11	22	10	20
Medial	3	6	1	2
Nil	35	70	38	76
Both	1	2	1	2
Total	50	100	50	100

Number of lesser palatine foramina is also a quite variable feature in normal skulls, ranging from 0-4. Number of foramina can be different on two sides. These foramina transmit small lesser palatine nerve and vessels. Although they are not directly involved in any surgical or anaesthetic injection procedures, but they are liable to injury during procedures in the vicinity specially when the greater palatine foramen is in an unexpected position. Presence of bony projection on margin of foramen or alteration in the direction of opening of foramen on palate can further enhance such problems. It was therefore decided that a study that describes these anatomical variations will be quite helpful and will determine the location of greater palatine foramen more precisely with particular reference to maxillary molar teeth. Presence of bony projection on margins of foramen, direction of opening of foramen and number of lesser palatine foramen was also noted for the same reason. Comparison of sexual and racial variations was not possible, as the source of available

skulls was unknown.

In the present study position of greater palatine foramen was quite variable in relation to molar teeth. Slavkin et al<sup>8</sup>, reported the position of greater palatine foramen, to be 1.3 mm distal to third molar tooth. Westmoreland and Blanton<sup>9</sup>, observed 6% foramina distal to third molar, 9.7% foramina medial to second molar. Ajmani<sup>10</sup> reported that 2.9% foramina were distal to third molar, 64% opposite third molar and none opposite second molar. Westmoreland & Blanton<sup>9</sup> reported most common position of this foramen to be medial to third molar (57%). Present study supports this finding in which 64% foramina were found to be located medial to third molar. This finding also supports the report of Ajmani<sup>10</sup> but he did not notice any foramen medial to second molar whereas we found 6% foramina to be located in this position. This finding is comparable to Westmoreland and Blanton<sup>9</sup> who reported 9.7% foramina in this position.

In present study no foramen was found to be distal to third molar whereas Westmoreland and Blanton<sup>9</sup> reported 6% and Ajmani<sup>10</sup> reported 2.9% foramina to be located distal to third molar tooth.

As regards the distance of greater palatine foramen from sagittal plane, Westmoreland and Blanton<sup>9</sup> reported this distance to be 1.48 cm on right side and 1.5 cm on left side in Indian skulls. Ajmani<sup>10</sup> measured this distance to be 1.47 cm on right and 1.46 cm on left side. Our results are quite consistent with the above observations. This distance being 13.28 mm on right side and 13.35 mm on left side. There was an insignificant difference in distance on two sides.

Findings in the studies available regarding direction of opening of greater palatine foramen are quite inconsistent. The opening of foramen was directed inferiorly in 47%, inferomedially in 40% and inferolaterally in 13% of skulls in our study. Ajmani<sup>10</sup> reported 91.4% foramina to be opening inferomedially. Westmoreland and Blanton<sup>9</sup> reported inferior direction of greater palatine foramen in 82% skulls.

A foramen opening inferolaterally can lead to difficulty in attempting to insert the point of needle into greater palatine foramen and pterygopalatine canal. A bony projection on margin of foramen can further increase the risk. In present research in 21% foramina, a bony projection was found on posterior margin of foramen, in 6% on anterior margin and in 2% on both sides of foramen. Ajmani<sup>10</sup> reported a

bony projection on posterior margin in 12% of foramina and Westmoreland and Blanton<sup>9</sup> observed a posterior projection in 16% skulls.

Variation in position of greater palatine foramen may be due to sutural growth occurring between maxilla and palatine bone. Anteroposterior dimensions of palate increase with the eruption of posterior teeth. In children the relative position of greater palatine foramen moves posteriorly as the next posterior tooth erupts<sup>8</sup>.

In conclusion, the location of greater palatine foramen is quite constant in Asian skulls, however the direction of opening of this foramen is quite variable with a bony projection on margins of foramen being a relatively common feature (29% of skulls). These facts should be kept in mind during surgical and anaesthetic procedures in oral cavity in Pakistanis.

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