A computed tomography study in the location of greater palatine artery in South Indian population for maxillary osteotomy

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ABSTRACT

Introduction: The greater palatine artery is one of the important feeding vessel to the maxilla. The surgeon should know the surgical anatomy of greater palatine artery to avoid trauma in maxilla which leads to ischemic problems. Aim: The CT evaluation of the distance between Pyriform aperture and the greater palatine foramen in various ages of both sexes. Result: The distance varies according to sex and age which are measured by CT and standardised. Discussion: The lateral nasal osteotomy can be done upto 25 mm depth, instead of 20 mm. Conclusion: By this study it shows that the lateral nasal wall osteotomy can be performed without injury to greater palatine artery.

KEY WORDS: Computed tomography study, greater palatine artery, maxillary osteotomy

Aim

The aims of this study are as follows:

• To find out the location of the greater palatine artery in the lateral wall of the nose in relation to Lefort 1 osteotomy in different age groups on both sexes
• To measure the distance from the pyriform aperture to the greater palatine foramen
• To compare the location of the artery in the right and left sides on the same patient.

Materials and Methods

This prospective study is to find out the location of the greater palatine artery in the lateral wall in relation to Lefort 1 osteotomy. The study included a total of 70 subjects, 35 males and 35 females in the age group of 15–30 years. They should not have any systemic problems.

This study explains the relationship of greater palatine artery to the maxillary osteotomy to avoid fatal complications.
An axial slice 3 mm above the nasal floor that corresponds to the osteotomy site where Lefort I osteotomy has to be done and reviewed.

**Anatomical landmarks**

- Anteriorly – pyriform aperture
- Posteriorly – greater palatine foramen.

**Discussion**

Blood supply to the floating maxilla following Lefort I osteotomy is derived from the palatal vascular pedicle via the greater palatine artery, as well as the branches of the ascending pharyngeal and facial arteries and from the buccal vascular pedicle via the posterior superior alveolar artery. Among these, the greater palatine artery which is the largest vessel with a mean diameter of 1.7 mm is one of the main causes of arterial bleeding during lateral nasal wall osteotomy and pterygomaxillary dysjunction in Lefort I osteotomy. The blood supply is derived from the palatal vascular pedicle via the greater palatine artery, as well as the branches of the ascending pharyngeal and facial arteries and from the buccal vascular pedicle via the posterior superior alveolar artery. Among these, the greater palatine artery which is the largest vessel with a mean diameter of 1.7 mm is one of the main causes of arterial bleeding during lateral nasal wall osteotomy and pterygomaxillary dysjunction in Lefort I osteotomy. Lanigan et al. identified the risk factors for aseptic necrosis after performing Lefort I osteotomy, segmentalization of the maxilla, clipping of the descending palatine artery, perforation of the palatal mucosa, midline palatal osteotomies, and significant stripping of the palatal mucosa.

New house also stated the cause of hemorrhage was due to a sharp bony fragment of the fractured pterygoid plate that may have been forced posteriorly during down fracture manipulation causing laceration of the internal maxillary artery or its terminal branch, the greater palatine artery. A good knowledge of the pterygomaxillary region is needed, particularly the anatomical relationship of the greater palatine artery during lateral and medial nasal wall cuts in the procedure of Lefort I osteotomy to avoid profuse bleeding and unfavorable fracture. Example of statistical analysis:

**Results**

Seventy individuals between the ages of 15–30 years were randomly selected. Males were more than 30% in 18–20 age group and females were more than 30% in 20–22 age group. Computed tomography (CT) scans were taken of these individuals and distance between the pyriform aperture and greater palatine foramen on both the right and left sides was measured.

From the data obtained, the maximum distance in male was 50.7 mm and 51.7 mm on the left and right sides, respectively, whereas the minimum distance in male was 31.70 mm and 30.90 mm for the left and right sides, respectively, and in females, it was 31.20 mm on both sides (Table 1).

Analysis of the variant using one-way “ANOVA” shows that the distance between the two reference points on both the left and right sides has significant ($P < 0.01$) variations among the different age groups. The shortest distance was for the 15 years age group and the longest distance was for the 18–20 years age group (Tables 2 and 3).

This study data have provided a thorough preoperative assessment so that the depth of the lateral nasal wall osteotomy could be predetermined and this will help to prevent a major bleeding morbidity and an uneventful postoperative wound healing.

**Conclusion**

Seventy subjects of age group 15–30 years were selected for this study. Using CT, it was found that the distance between the pyriform aperture and greater palatine foramen in different age groups are statistically significant. The mean distance for the pyriform aperture and greater palatine foramen is different in different age groups.

| Group          | Mean ± SD Left distance (mm) | Mean ± SD Right distance (mm) |
|----------------|------------------------------|-------------------------------|
| Male           | 42.96 ± 3.74                 | 43.23 ± 3.76                  |
| Female         | 41.61 ± 3.73                 | 41.68 ± 3.76                  |
| Total population | 42.29 ± 3.77                | 42.46 ± 3.81                  |

**Table 2: Mean distance of greater palatine foramen from pyriform aperture in different age groups**

| Age group (years) | Mean ± SD Left distance (mm) | Mean ± SD Right distance (mm) |
|-------------------|-------------------------------|-------------------------------|
| 15-18             | 41.63 ± 3.48                  | 42.55 ± 3.32                  |
| 18-20             | 43.50 ± 2.83                  | 43.35 ± 2.61                  |
| 20-22             | 42.32 ± 3.77                  | 42.15 ± 2.69                  |
| 24-26             | 41.72 ± 2.26                  | 40.22 ± 3.39                  |
| ≥26.1             | 42.50 ± 4.01                  | 42.52 ± 4.17                  |

SD: Standard deviation

**Table 3: Percentage age distribution of patients belonging to different distance (mm) groups**

| Age group (years) | Left distance groups (mm) | Right distance groups (mm) |
|-------------------|---------------------------|----------------------------|
| 15-18             | 50.7 ± 3.60               | 41.7 ± 3.80                |
| 15.1-18           | 51.7 ± 3.78               | 42.2 ± 3.90                |
| 18.1-20           | 53.3 ± 4.00               | 43.5 ± 4.10                |
| 20.1-22           | 54.5 ± 4.20               | 44.8 ± 4.30                |
| 22.1-24           | 55.7 ± 4.40               | 46.1 ± 4.50                |
| 24.1-26           | 56.9 ± 4.60               | 47.4 ± 4.70                |
| ≥26.1             | 58.1 ± 4.80               | 48.6 ± 4.90                |

SD: Standard deviation

Example of statistical analysis:

- **Table 1: Mean distance of greater palatine foramen from pyriform aperture**

- **Table 2: Mean distance of greater palatine foramen from pyriform aperture in different age groups**

- **Table 3: Percentage age distribution of patients belonging to different distance (mm) groups**
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Table 4: Mean distance (mm) of greater palatine foramen from the pyriform aperture in different sexes

| Gender | Mean±SD | Left distance (mm) | Right distance (mm) |
|--------|---------|--------------------|---------------------|
| Male   | 42.96±3.74 | 43.23±3.75         |                     |
| Female | 41.61±3.73 | 41.69±3.76         |                     |
| t      | 1.507    | 1.721              |                     |
| P      | >0.05    | >0.05              |                     |

SD: Standard deviation

Table 5: Percentage sex distribution of patients belonging to different distance (mm) groups

| Sex   | Left distance groups (mm) | Right distance groups (mm) |
|-------|---------------------------|-----------------------------|
|       | ≤35 35.1-40 40.1-45 ≥45.1 | ≤35 35.1-40 40.1-45 ≥45.1 |
| Male  | 33.3 33.3 51.2 64.3 25.0 33.3 52.3 61.5 |
| Female| 66.7 66.7 48.8 35.7 75.0 66.7 47.7 38.5 |
| χ²   | 2.834 2.783              |                             |
| P    | >0.05 >0.05             |                             |

With the good knowledge of surgical anatomy and recent diagnostic tools in maxillofacial surgeries, we can get predictive predetermined results with good prognosis and avoidance of any ischemic complication.

On the basis of the four studies, it has been recommended that a maximum penetration of 40 mm for both sexes [Tables 4 and 5] during lateral nasal wall osteotomy is performed without any encroachment to the greater palatine artery so as to prevent ischemic complications.

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Conflicts of interest
There are no conflicts of interest.

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