

Presence of antilingula and its relationship to mandibular foramen—An anatomical study

ABSTRACT

Aim: Aim of this study was to evaluate the presence of antilingula and its relationship with mandibular foramen.

Materials and Methods: In this study, a total of 50 specimens of dry human hemi-mandibles were studied to analyze the presence and relationship of antilingula to mandibular foramen. A 1-mm fissure bur was used to drill a hole perpendicular to bone from the deepest aspect of the concavity at the center of the mandibular foramen from the medial to lateral side, the drill perforated both the medial and lateral cortex of the mandible. The distance from the antilingula to hole was measured and recorded in both antero-posterior and supero-inferior planes. The data were collected and put to statistical analysis.

Results: From this study, it was concluded that the antilingula was present in 90% (n = 45) of mandibles and was absent in 10% (n = 5) of mandibles. Antero-posteriorly, the antilingula was present anterior to mandibular foramen in 22.2% (n = 10) of mandibles, posteriorly in 57.7% (n = 26) of mandibles, and there was complete concordance in 20% (n = 9) of mandibles. The supero-inferior relation shows that antilingula was present superior to mandibular foramen in 97.8% (n = 44) of mandibles, and it was present inferiorly in 2.20 (n = 1) of mandibles.

Conclusion: Although vertical ramus osteotomy is not a commonly used procedure in these days. From our study, it was concluded that antilingula was present as an elevation in 90% of cases on the lateral ramus border and the mandibular foramen is present inferior and anterior to the antilingula.

Keywords: Antilingula, mandibular foramen, nerve injury, osteotomy, ramus

INTRODUCTION

In vertical ramus osteotomy procedures, where the ascending ramus of the mandible is approached from the external surface, it is of utmost importance to know exactly where the bone cuts should be made, to avoid transaction of inferior alveolar neurovascular bundle, which is lying on the medial side of ascending ramus. Any carelessness on the part of surgeon, during osteotomy, can lead to severe hemorrhage and permanent sensory loss; however, this procedure is not used routinely in these days; BSSO is a commonly used procedure for the correction of both retrognathia and prognathism of mandible due to its wide contact, intraoral procedure and rigid fixation and early jaw functions, etc.^[1,2] There are various surgical landmarks that are described in surgical textbooks for the safe surgical procedures to protect vital structures to damage.


“Antilingula” a bony prominence is considered as an important landmark located on the lateral surface of the

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ramus of mandible and is thought to be guide for the position of mandibular foramen on the medial surface of mandibular ramus during surgery on mandibular ramus.^[3-6] This study was conducted to determine the presence of antilingula and its relationship with mandibular foramen on the medial side of ramus on 50 dry human hemi-mandibles.

PURPOSE OF STUDY

The purpose of study was to determine the incidence of antilingula and its relationship to the mandibular foramen.

MATERIAL AND METHODS

Fifty dry human hemi-mandibles were collected from “The Department of Anatomy and maxillofacial surgery.” Each mandible was assigned a serial number starting from 1 to 50. Each mandible was inspected and palpated. By inspection and palpation, the most prominent point of the antilingula on the lateral surface of the ramus was assessed [Figure 1], and it was marked on the lateral surface of mandible with a marker as a point. In addition, the mandibular foramen [Figures 2 and 3] in the medial aspect of ascending ramus of mandible was visualized.

A 1-mm fissure bur was used to drill a hole perpendicular to bone from the deepest aspect of the concavity at the center of the mandibular foramen from medial to the lateral side, and the drill perforated both the medial and lateral cortex of the mandible. This hole was considered as a reference point for mandibular foramen on the lateral side. The distance from the antilingula to the hole was measured and was recorded in both antero-posterior and supero-inferior planes. The data were collected and put to statistical analysis. The positive values were assigned to anterior and superior coordinates, whereas negative values were assigned to posterior and inferior coordinates. The ethical clearance was obtained from BFUHS Faridkot with wide letter no BFUHS 2k8/TH/8607.

RESULTS

In this study, a total 50 specimens of dry human hemi-mandibles were studied to analyze the presence and relationship of antilingula to mandibular foramen. From this study, it was concluded that the antilingula was present in 90% (n = 45) of mandibles and was absent in 10% (n = 5) of mandibles. Antero-posteriorly, the antilingula was present anterior to mandibular foramen in 22.2% (n = 10) of mandibles, posteriorly in 57.7% (n = 26) of mandibles, and there was complete concordance in 20% (n = 9) of mandibles [Graph 1]. The supero-inferior relation shows that antilingula was

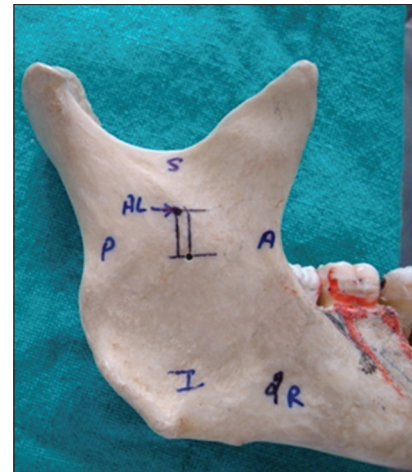


Figure 1: Antilingula on lateral border, S superior I inferior A anterior P posterior AL antilingula



Figure 2: Drilled hole MF mandible foramen S superior I inferior A anterior P posterior

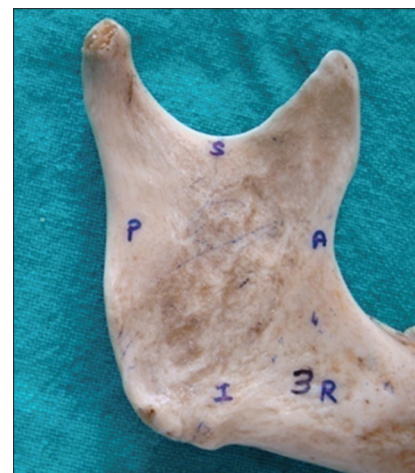
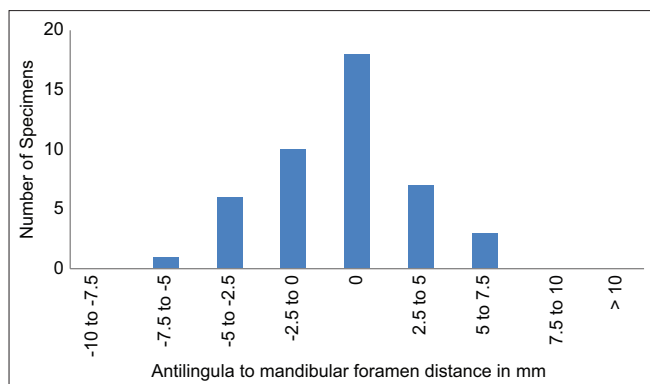
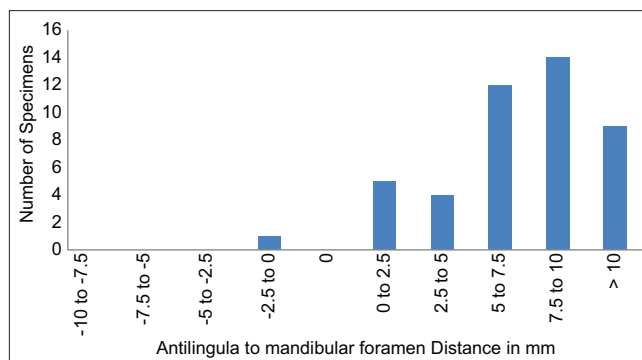


Figure 3: Flat lateral border of mandible without any antilingula or elevation

present superior to mandibular foramen in 97.8% (n = 44) of mandibles, and it was present inferiorly in 2.20% (n = 1) of



Graph 1: Location of antilingula to mandibular foramen in antero-posteriorly from statistical analysis. Standard deviation= 2.862. Mean = -1.644. Number of specimens= 50



Graph 2: Location of antilingula to mandibular foramen in supero-inferiorly from statistical analysis. Standard deviation= 3.375. Mean = 7.289. Number of specimens= 50

mandibles [Graph 2]. No concordance supero-inferiorly was found in this study.

The maximum distance of antilingula from mandibular foramen was anteriorly 3 mm, posteriorly 9 mm, superiorly 13 mm, and inferiorly 3 mm. And the minimum distance of antilingula to mandibular foramen was 1 mm anteriorly, 1 mm posteriorly, 2 mm superiorly, and 3 mm inferiorly [Table 1]. Statistical analysis of data was done, and confidence limits (99%) were computed for the raw score means, which are appropriate for the estimation of a single score ($n = 1$) and are wider than those computed for a sample mean ($n > 1$). For the anterior-posterior dimension, where mean was -1.644, the limit was -7.5 to +7.5 and superior-inferior mean 7.289, the limit was -2.5 to +10 [Table 2].

DISCUSSION

Accurate identification of the location of mandibular foramen is essential in vertical ramus osteotomy. During such a surgical procedure which involves the ramus of mandible, a conflict arises as to how to design the vertical cuts to avoid the damage of inferior alveolar neurovascular bundle to avoid sensory loss of the lower lip which is the common complication of ramus osteotomy.^[7] The vertical cuts must be made enough posterior to mandibular foramen and anterior to posterior border of mandible to avoid the injury to nerve and vessel and the fracture of the posterior border which is undesirable. There are certain anatomical landmarks which are used in surgical field to avoid the injuries to vital structures and to the nerves and vessels. Previous studies have been shown that the chances of neurovascular damage were less when antilingula was used as a landmark for vertical ramus osteotomy in the literature.^[1-3,5,6]

Caldwell and Letterman first made reference to the lateral surface of mandibular ramus in 1954 in their article about

extra oral vertical osteotomies of the ramus. They mentioned a “very slight rounded prominence” as a reference on the lateral surface of the ramus that can be used to identify the mandibular foramen on the medial side for vertical ramus osteotomy.^[7] Alling described a “bulge overlying the inferior alveolar foramen” when discussing the technique of the oblique ramus osteotomy.^[5] Thoma mentioned a “small elevation of the surface of the bone” indicating “the location of the mandibular foramen.^[8]” In 1960s and 1970s, many other references to this area on the lateral surface of the ramus were made in the clinical literature.^[6] Alling called it an “elevation”; Berenyi described a “small eminence^[9]”; Behrma stated that his residents called it “Behrman’s bump^[10]”; Hall *et al.* discussed it as “tubercle signifying the location of the mandibular foramen on medial side of ramus,” and Caldwell *et al.* made a point of identifying the “prominence overlying the mandibular foramen.^[7,11]” The above surgeons were all used the topography of the lateral surface of the ramus to aid in osteotomy placement, which seems quite logical. Yates *et al.*^[12] were able to identify the antilingula in 44% of specimens of all the specimens; they studied and also found 41% of them demonstrated indefinite identification, and in 15% of specimens, they were devoid of antilingula. They noted that the mandibular foramen would lie in a posterior-inferior position compared with the antilingula in 81% of the specimens, and in 37% of cases, the foramen was within 5 mm of the antilingula position. Langston *et al.* “lateral ramus prominence” (LRP), as they referred to it, reported in all 50 mandible they examined.^[13] However, it was located anterior to the mandibular foramen in 66% of the time and posterior to it in 34% cases. In addition, the group found a 95% confidence rate that the LRP would lie between 4.2 mm anterior and 5.5 mm posterior and 0.5 mm inferior and 16.2 mm superior to the mandibular foramen. Martone *et al.* were able to identify the antilingula in only 42% (27 of 63) of the mandibles. They found that the mean distance between the antilingula and the mandibular foramen was 4.8 mm,

Table 1: Master chart showing relation of antilingula (anterior, posterior, superior, and inferior) to mandibular foramen

Side	Anterior (mm)	Posterior (mm)	Superior (mm)	Inferior (mm)
R	----	----	11	----
L	2	----	8	----
R	1	----	9	----
L	NO AL	NO AL	NO AL	NO AL
R	----	1	11	----
L	----	4	10	----
R	NO AL	NO AL	NO AL	NO AL
L	----	4	----	3
R	----	9	4	----
L	----	4	2	----
R	NO AL	NO AL	NO AL	NO AL
L	----	5	6	----
L	----	----	8	----
L	1	----	6	----
L	----	7	10	----
R	----	6	11	----
L	----	6	2	----
R	----	3	10	----
R	----	2	9	----
L	----	2	10	----
R	----	3	7	----
L	----	2	7	----
L	3	----	2	----
R	----	----	2	----
L	----	----	6	----

MASTER CHART

R	----	----	11	----
L	1	----	8	----
R	----	2	8	----
L	----	7	12	----
R	NO AL	NO AL	NO AL	NO AL
L	----	3	6	----
R	----	----	6	----
L	2	----	6	----
R	3	----	5	----
L	----	----	7	----
R	----	----	11	----
L	----	3	8	----
R	----	1	2	----
L	NO AL	NO AL	NO AL	NO AL
L	----	1	6	----
R	----	3	13	----
R	----	3	11	----
L	1	----	12	----
L	2	----	9	----
R	----	----	10	----
L	----	3	5	----
L	----	5	8	----
L	3	----	6	----
R	----	2	4	----
R	----	2	6	----

AL—antilingula. NO AL—no antilingula. R—right side. L—left side

with the furthest distances found to be 8 mm anterior and 12 mm superior to it.^[14] Pogrel *et al.*^[15] conducted a study on 20 cadaver mandibles using three independent observers to palpate the lateral aspect of the mandibular ramus in an attempt to identify the antilingula and identified it in all the specimens. The lingula and antilingula corresponded in 17.5% of cases, within 5 mm in 25.8% of cases and within 10 mm in 50% of cases. In 6.7% of cases, there was a discrepancy of greater than 10 mm with the greatest being 14 mm. Aktan and Ucerle carried a study on 124 dry human mandible of two side total 248. The antilingula was present in 40 mandibles bilaterally and in 8 mandibles unilaterally. The total number of antilingula was on 88 sides out of 248 (35.48%).^[4] Hogan *et al.*^[10] searched literature for references to this bony lump on the lateral surface of the mandible to find its origin and intent and discussed with anatomists about the “antilingula.” However, research studies that have been performed reveal no evidence that the “antilingula” has any relationship to the entrance of the inferior alveolar nerve. They described that use of “antilingula” as a surgical guide during ramus osteotomies is therefore unreasonable. (Aziz *et al.*^[3]) In a study of 18 cadaver mandibles, “antilingula” was observed in all cases, in 11.1% cases, there was complete concordance of its position with lingula, in 33% antilingula was found posterior to lingula, in 45.6% cases antilingula was anterior, in 2.8% cases complete concordance of antilingula and lingula in superior-inferior plane, in 47.2% cases antilingula was inferior, and in 50% cases it was superior to lingual was observed. The study showed the antilingula to be an acceptable landmark in deciding the safe placement of cut in a mandibular vertical ramus osteotomy. They found at a distance of 5 mm posterior to the antilingula, there was minimal risk of damaging the neurovascular bundle. By calculated confidence intervals from their data, an osteotomy greater than 9 mm posterior to the antilingula would prevent damage to the neurovascular bundle in all. Apinhasmit *et al.*^[16] found antilingula in 80.4% cases, and it was present mostly anterior and superior to lingula with in maximum range anteriorly 5.9 mm and superiorly 8.2 mm. Cut made posterior and superior to it would be save the nerve from injury in 79% of the cases. Monnazzi *et al.*^[17] in their study concluded that lingula is a reliable and use full land mark to determine the position of mandibular foramen in lateral ramus osteotomies rather than antilingula and did not recommended to use it as a landmark in lateral ramus osteotomies by them. Hosapatna *et al.*^[18] found antilingula in 56% of cases, and it was present anterior inferior to mandibular foramen.

Park *et al.*^[19] reported antilingula anteriorly in 44% of cases and superiorly 31% in of ramus. Regarding the positional relationship with the antilingula, the lingula was located 0.54 mm superior and 4.19 mm posterior, and the mandibular

Table 2: Statistical evaluation of comparison of antero-posterior and supero-inferior positions of antilingula W.R.T. that of mandibular foramen

	Mean	SD	MIN	MAX	Coefficient of variation CV%	SE Mean	CI 95%	CI99%
ANT/POST	-1.644	2.862	-9.000	3.000	-174.018	0.427	-2.481 -0.808	-2.743 -0.546
SUP/INF	7.289	3.375	-3.000	13.000	46.306	0.503	6.303 8.275	5.993 8.585

ANT=anterior. POST=posterior. SUP=superior. INF=inferior. SD=standard deviation. MIN=minimum. MAX=maximum. SE=standard error

foramen was located 6.95 mm inferior and 4.98 mm posterior. The results suggested that to prevent damage to the IANB, osteotomy should be performed in the posterior region of ramus at least 29% of the total horizontal length of the ramus. Our study too coincides with the other studies reported in the literature for the presence of antilingula and its use as a reference for vertical ramus osteotomy, as the vertical ramus osteotomy is not a frequent procedure these days. The radiological and virtual planning with cutting guides is commonly used nowadays, but we can rely on anatomical landmarks too in certain scenarios.

CONCLUSION

From our study, it was concluded that antilingula was present as an elevation in 90% of cases on the lateral ramus border and the mandibular foramen is present inferior and anterior to the antilingula. If the cuts are made posterior and superior to it, there are very less chances of damage to the inferior alveolar neurovascular bundles.

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Conflicts of interest

There are no conflicts of interest.

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