

ORIGINAL RESEARCH

A Morphological Study of Retromolar Foramen and its Clinical Relevance in Human Dry Mandible

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ABSTRACT

Background: Multiple accessory canals may emerge from the mandibular canal running almost parallel to it. These canals transmit the branches of inferior alveolar neurovascular bundle supplying the mandibular area. Retromolar canal is formed when one of these accessory canals extends antero-superiorly within the mandible and finally emerges through a single or multiple foramina into the retromolar fossa. This foramen is called retromolar foramen. At times, this area is important for the clinicians during mandibular surgeries and anesthetic procedures so, it is important to determine the exact location of retromolar foramen.

Materials & Methods: 100 dried adult human mandible (58 male and 42 female) were included in the present study. All the mandibles were examined for the presence of retromolar foramen. In the mandible where foramina were noticed, we measured the distance of foramina from three landmarks namely, posterior border of socket of third molar tooth, anterior border of ramus of mandible and lingual. We also measured the boundaries of the retromolar trigone.

Results: Out of 100 mandibles, retromolar foramen was found in 21% (8% in male and 13% in female). Retromolar foramen was observed in 6% on right side, 5% on left side and 10% bilaterally. The minimum distance of retromolar foramen from various landmarks was found to be more on left side.

Conclusion: We concluded that the retromolar foramen is not a rare variation. This area should be regarded as an important landmark for various surgical and anesthetic procedures.

Keywords: Mandible, Inferior Alveolar Neurovascular Bundle, Retromolar Trigone, Retromolar Canal, Retromolar Foramen.

INTRODUCTION

Retromolar foramen is an anatomical variant of mandible which is found in the retromolar fossa, a depression behind the base of third molar [1]. Retromolar fossa is bounded by the base of third molar tooth anteriorly, temporal crest medially and anterior border of the ramus of mandible laterally [2]. This triangular area is called retromolar trigone. Rarely, the

mandibular canal may extend from its anterior part and reaches upto the retromolar foramen through the retromolar canal [3]. The retromolar canal and foramen transmits neurovascular bundle consisting of branches of inferior alveolar artery and nerve which may supply the buccal and molar area of mandible [4].

The knowledge of this anatomical variation is important in different clinical scenarios involving surgical and anesthetic intervention in the retromolar area. The different procedures like impacted third molar extraction, placement of implant, osteotomy surgeries, inferior alveolar nerve blockage, etc. if not properly done may damage the neurovascular bundle [5]. This may lead to complications like postoperative hemorrhage, failure of nerve block, spread of infection, etc. [6]. The carcinoma involving the retromolar area may sometimes require radical procedures posing risk of damage to the neurovascular structures [7].

As the understanding of this variation may be crucial both for the surgeons and patients, we have tried to explore the retromolar foramen. Though this variation posed challenging situations for the practicing surgeons, it has been quite neglected and the incidence of it is not well presented in the textbooks. Hence, the present study is an attempt to consolidate the clinical applications of the retromolar foramen.

MATERIALS & METHODS

The present study was carried out on 100 dry adult human mandibles, in the department of anatomy of Madhubani Medical College, Madhubani, Bihar and Lord Buddha Koshi Medical College, Saharsa, Bihar. Deformed and fractured mandibles were excluded from the study. The morphological gender of the mandible was determined as per Loth & Henneberg [8]. Accordingly, 58 males & 42 females mandible were identified.

All the mandible was observed carefully for the presence of retromolar foramen (either unilateral or bilateral). Mandibles in which retromolar foramina were present, the minimum distance of the retromolar foramina from the posterior border of socket for third molar, anterior border of the ramus of mandible and lingula were measured. The anterior, medial and lateral boundaries of the retromolar trigone were also recorded. All the measurements were taken in millimeter (mm) with the help of a digital vernier caliper. The mean value and standard deviation were analyzed statistically.

RESULTS

In the present study, the retromolar foramen were found in 21 out of 100 mandibles in which 8 were of male and 13 belonged to female. In 6 mandibles, retromolar foramen were observed on right side, 5 mandibles had retromolar foramen on left side, while the remaining 10 mandibles had bilateral retromolar foramen. [Table 1]

The minimum distance (in mm) of retromolar foramen from posterior border of socket of third molar tooth, anterior border of the ramus of mandible and lingula were measured. The mean and standard deviation of these distances were found to be 5.05 ± 1.97 , 7.44 ± 2.62 , 5.63 ± 2.32 on the right side and 6.67 ± 1.29 , 8.47 ± 2.36 , 6.12 ± 1.54 on the left side respectively. [Table 2]

The anterior, medial and lateral boundary of retromolar trigone were measured in mm. The mean and standard deviation of anterior boundary was 11.88 ± 2.54 on right side and 10.8 ± 1.78 on left side, while mean and standard deviation of medial and lateral boundary was found to be 37 ± 4.32 , 36.81 ± 5.91 on the right side and 39.67 ± 5.04 , 35.12 ± 6.2 on the left side respectively. [Table 3]

Table 1: Distribution of retromolar foramen

	Male	Female	Total
Right Side	2	4	6
Left Side	2	3	5
Bilateral	4	6	10
Total	8	13	21

Table 2: Minimum distance of retromolar foramen from various landmarks

Parameters	Right Side	Left Side
	(Mean±SD)	(Mean±SD)
Socket Of Third Molar Tooth	5.05±1.97	6.67±1.29
Anterior Border Of Ramus	7.44±2.62	8.47±2.36
Lingula	5.63±2.32	6.12±1.54

Table 3: Dimensions of the boundaries of retromolar trigone

Boundary Of Retromolar Trigone	Right Side	Left Side
	(Mean±SD)	(Mean±SD)
Anterior (Base Of Third Molar Tooth)	11.88±2.54	10.8±1.78
Medial (Temporal Crest)	37±4.32	39.67±5.04
Lateral (Anterior Border Of Ramus Of Mandible)	36.81±5.91	35.12±6.2

**Fig 1: Unilateral retromolar foramen on right side**



Fig 2: Unilateral retromolar foramen on left side



Fig 3: Bilateral retromolar foramen

DISCUSSION

Retromolar foramen was first discussed by Lofgren [9]. The retromolar foramen situated in the retromolar trigone may transmit the accessory branches of inferior alveolar neurovascular bundle. This area has gained importance clinically as during various surgical procedures involving this area like third molar extraction, repair of mandibular fractures, bone graft and osteotomy surgeries these neurovascular bundles may get damaged leading to complications [10]. Hence, surgeries in this area should be performed cautiously [11]. As this area is a widely innervated area, patients may feel pain even after anesthetizing the inferior alveolar nerve in the mandibular canal [12]. Hence, retromolar foramen should also be considered while giving anesthesia in this region [13]. The available modalities to ascertain the retromolar foramen include computed tomography, cone beam computed tomography and panoramic radiography [14]. Previous research about the prevalence of retromolar foramen suggested wide variation ranging from 3.2% to 72% in human dry mandible, 5.4% to 75.4% by cone beam computed tomography and 3.06% to 8.8% by panoramic X-ray [14]. Such wide variation may be linked to different factors like genetic, ethnicity, environmental etc.

In the present study, the prevalence of retromolar foramen was found to be 21% which coincides with the study by Kondera H and Hashimoto I [15]. According to Sawyer DR and Kiely ML the retromolar foramen was present in 7.7% out of 234 adult human mandibles studied (1), while a study by Kawai et al., revealed the prevalence of retromolar foramen to be 52% out of 46 mandibles studied [16]. According to Potu BK et al., the retromolar foramen was found bilaterally in 3.2%, on the left side in 3.2% and on the right side in 5.3% out of 93 human mandibles studied [17]. In the present study, retromolar foramen were observed bilaterally in 10%, on right side in 6% and on left side in 5% out of 100 human mandibles studied. With respect to sex differences, a study by Sawyer DR & Kiely ML did not find any difference in the incidence of RMF [1], whereas in the present study, the retromolar foramen was more common in female.

The study by S Athavale et al., showed that the minimum distance of retromolar foramen from posterior border of third molar tooth is within the range of 3.12 to 13.07 mm on the right side and 3.31 to 14.92 mm on left side. However, in the present study it was 3.08 to 7.02 mm on the right side and 5.38 to 7.96 mm on the left side [18]. Due to the short distance between retromolar foramen with third molar tooth the structures passing through it are liable to get damaged during extraction.

According to Saravana Kumar S, the average measurement of base of third molar tooth, temporal crest and anterior border of the ramus of mandible on right side was 12.9 mm, 38.8 mm and 35.5 mm whereas on the left side it was found to be 13 mm, 40.1 mm and 35.7 mm respectively [19]. However, in the present study it was 11.88 mm, 37 mm and 36.81 mm on the right side whereas, 10.81 mm, 39.67 mm and 35.12 mm on the left side respectively.

Previous study by Jacob M et al., concluded that the retromolar foramen is normal anatomical variation of mandible hence, this variation may be considered among other variations of skull [20].

CONCLUSION

The present study reported that the occurrence and variations of retromolar foramen is not uncommon in human dry mandibles. It is useful to locate this area before undertaking any surgical or anesthetic procedures. For better understanding of this area further studies involving radiological interventions in alive subjects can be undertaken.

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