A mandibular bone defect of uncertain significance: report of a paleopathological case

Gastone Sabbadini[1] · Paola Saccheri[2] · Luciana Travan[2]

Received: 4 September 2018 / Accepted: 21 January 2019 / Published online: 30 January 2019

Abstract
Anatomical variations of the mandibular canal as well as the presence of accessory canals and foramina are common findings in the human mandible. Here, we present a previously unreported type of anatomical variation, consisting of a large full-thickness bone defect of the right mandibular ramus, observed in a young male unearthed from a mediaeval cemetery located in North-Eastern Italy. The defect was located very close to, yet not directly connected with, the mandibular canal. Awareness of the existence of deviations from the anatomical norm such as that we describe here is strategic to avoid diagnostic misinterpretations, minimise technical hitches, and prevent clinical complications during invasive procedures in the region of the mandible.

Keywords Mandibular ramus · Mandibular canal · Anatomical variation · Paleopathology

Introduction

The human mandible consists of one horseshoe-shaped body and a pair of rami that join body at the mandibular angles. A prominent feature of this bone is the mandibular canal (MC), which extends bilaterally from the mandibular foramen (located on the medial aspect of the mandibular ramus) to the mental foramen (opening on the anterolateral surface of the mandibular body). The MC conveys the inferior alveolar nerve—that is, a terminal branch of the mandibular nerve—and homonymous blood vessels. Because of the close anatomical relationships with these important neurovascular structures, the MC and its entrance and exit foramina represent strategic anatomical landmarks for planning local anaesthetic blocks and oral/maxillofacial surgery [10].

Yet, anatomical variations of MC as well as the presence of supernumerary canals and foramina are common findings in the mandible [5, 9, 11]. Furthermore, these bony variations are often accompanied by changes in the branching pattern of local neurovascular structures, which may account for anaesthesia failures or clinical complications during invasive procedures in the region around the mandible [3, 5, 9, 10].

To date, a variety of supernumerary mandibular canals and foramina—collectively termed "accessory" [11]—have been reported in the literature, and various classification systems have been proposed based on their topographical and anatomical characteristics [5, 9]. Here, we describe in detail a previously unreported finding consisting of a large full-thickness bone defect of the mandibular ramus situated very close to, but having no direct relationship with, the MC.

Case presentation

In 2005, skeletal remains of more than 40 people were unearthed from the cemetery of a rural church located in North-Eastern Italy, along the ancient road directed route leading to Cividale del Friuli, one of the main urban settlements in the Roman Empire and first capital of the Lombard Kingdom. One skeleton, belonging to a young man (20–25 years at death), was named T1.

Radiocarbon (14C) dating of his bones, performed by CEDAD laboratories—University of Salento, revealed a date between 1410 and 1530 AD.

✉ Luciana Travan
luciana.travan@uniud.it

[1] Department of Medical Surgical and Health Sciences, University of Trieste, Trieste, Italy

[2] Department of Medicine, Section of Human Anatomy, University of Udine, Piazzale Kolbe 3, 33100 Udine, Italy

T1 was buried at some distance from the other individuals with his hands tied behind his back and a stone in the mouth (Fig. 1a, b). There were no macroscopic signs of bone pathologies, or any evidence of cut marks or other traumatic injuries. The cause of death remained undetermined.

Fig. 1 The skeleton of T1. He was buried with his hands tied behind his back (**a**) and a stone in the mouth (**b**)

On the medial surface of the right ramus of the mandible, it was well-visible round-shaped full-thickness defect (4 mm diameter) emerging laterally, after a short, tubular intra-bony course (4 mm width, 5 mm length), just above the mandibular foramen (1 mm distance). The walls of the intra-bony course of the defect were smooth, covered by a layer of compact bone (Fig. 2a, b). Probing of the intra-bony route of the defect documented a completely patent lumen.

Computed tomography examination of the mandibular ramus revealed the presence of normal compact and cancellous bone surrounding the intra-bony course of the defect and its entrance and exit foramina. No relationship was found between the bone defect and the MC (Fig. 2c, d).

Discussion

Apart from the mandibular, mental, and lingual foramina and sockets of teeth, all the other openings in the human mandible are referred to as "accessory" [11].

One or more accessory foramina on the inner surface of the mandibular body can be considered a nearly constant finding, whereas supranumerary foramina are less frequently observed at the level of the mandibular ramus [6, 9]. Accessory foramina may communicate through accessory bony canals with an otherwise normally structured MC or, in contrast, may occur as part of more complex anatomical variations involving also the MC, such as bifid, retromolar, and temporal crest canals [2, 5, 6]. The clinical relevance of these morphological variations is that they often transmit additional branches of the mandibular neurovascular bundle and/or its ramifications [1, 7]. It has been repeatedly reported that variations in the branching pattern of these neurovascular structures may account for a range of complications, including failure to obtain adequate anaesthesia, paraesthesia, traumatic neuroma, and excessive bleeding during oral and maxillofacial surgery [3, 5, 6, 9, 10]. In some

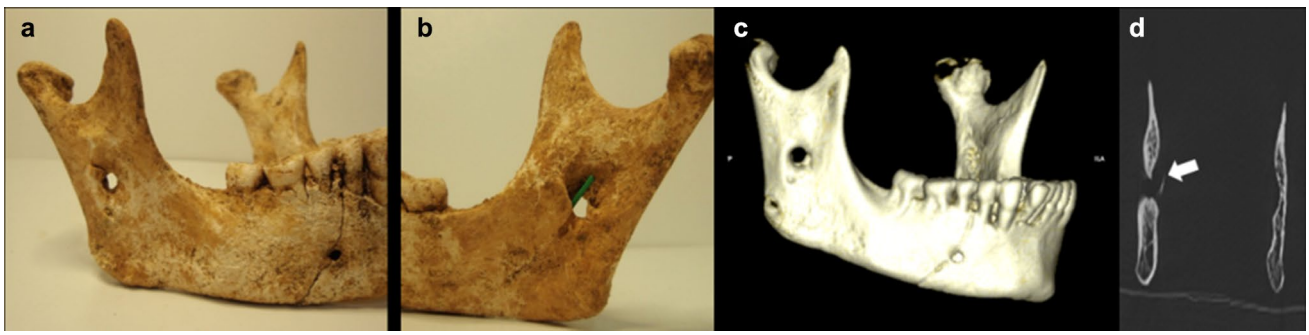

Fig. 2 **a** The right mandibular ramus, external surface with the opening of the defect. **b** The right mandibular ramus, internal surface: the full-thickness defect lies just above the mandibular foramen (green explorer). **c** CT scan, volume rendering reconstruction, oblique view of the right mandibular ramus. **d** CT scan, coronal view of the mandibular rami. On the right ramus, the bone defect is well visible (white arrow). Perilesional bone density and architecture are normal. (Color figure online)

circumstances, accessory foramina and canals have been shown to represent direct routes for the spread of tumour cells to the mandible [4].

The presence on the medial surface of the mandibular ramus of accessory foramina leading to accessory canals has previously been reported [2, 5, 6]. Our finding is unique in that, to our knowledge, this is the first description of a bone defect located very close to the mandibular foramen, yet with no direct connexion with the MC, extending from the medial to the lateral aspect of the right mandibular ramus.

The normal bone structure—that is, spongy bone covered by a layer of compact bone—surrounding the defect allows us to rule out a post-mortem artefact. Lack of other skeletal lesions aims to exclude loss of bone substance due to systemic disorders, whereas morphological and radiological features of the defect (uniform diameter and regular surface of its intra-bony course, and normal architecture of the surrounding bone) are difficult to reconcile with those typically resulting from focal diseases such as infections, tumours, or traumatic injuries. The absence of signs of bony reaction argues against the hypothesis of a recent lesion. Although it is not possible to bring conclusive evidence, these observations would suggest that the bone defect described here was congenital in nature.

Anatomical bony variations are increasingly described in the literature and many are still being reported, but defining their potential clinical implications is often challenging. Unfortunately, we know nothing about the soft structures, if any, that, during life, could have passed through the defect, and therefore, the clinical implications of our finding can only be speculative at this point. However, because the bone defect was positioned just above the mandibular foramen, one cannot exclude that it could have represented a route for an aberrant branch of the mandibular neurovascular bundle before it enters the MC. Indeed, it has been shown that the course and branching pattern of the inferior alveolar nerve at the level of the mandibular ramus is highly variable [12]. In any cases, regardless of whether or not critical neurovascular structures could have passed through our defect, knowledge of the existence of such an anatomical variation is always clinically relevant as it may be a source of diagnostic uncertainty.

In conclusion, we believe that our case report, describing an as-yet unreported finding, can add valuable information about the anatomical variability of the mandible. The practical implication of this report is to remind clinicians that mandibular bony variations of uncertain significance, incidentally detected in the course of the conventional preoperative evaluation, should prompt further investigation by more appropriate imaging modalities. In this regard, cone-beam TC and high-resolution MR have been shown to provide a better viewing of the bony variations and can also be useful in identifying associated changes in neurovascular architecture, if any [5, 8, 9]. Since injuries to unrecognised nerves and/or vessels may cause unexpected complications during oral and maxillofacial surgery, the precise knowledge of both normal anatomy and anatomical variations of the mandible should be viewed as a crucial step in planning successful and harmless procedures in this area.

Acknowledgements The authors are grateful to the Soprintendenza Archeologica, Belle Arti e Paesaggio del Friuli Venezia Giulia for providing access to skeletal material and to Dr. Francesco Toso for providing the CT images.

Author contributions All authors have contributed to preparing the manuscript. Contribution: PS; LT: data analysis and manuscript editing; GS: literature review, manuscript editing, and critical approval of the final manuscript.

Funding The authors received no specific funding for this work.

Compliance with ethical standards

Conflict of interest The authors have no conflict of interest to declare.

References

1. Bilecenoglu B, Tuncer N (2006) Clinical and anatomical study of retromolar foramen and canal. J Oral Maxillofac Surg 64:1493–1497
2. Choi YY, Han SS (2014) Double mandibular foramen leading to the accessory canal on the mandibular ramus. Surg Radiol Anat 36:9:851–855
3. DeSantis JL, Liebow C (1996) Four common mandibular nerve anomalies that lead to local anesthesia failures. J Am Dent Assoc 127:1081–1086
4. Fanibunda K, Matthews JNS (1999) Relationship between accessory foramina and tumour spread in the lateral mandibular surface. J Anat 195:185–190
5. Haas LF, Dutra K, Porporatti AL, Mezzomo LA, De Luca Canto G, Flores-Mir C, Corrêa M (2016) Anatomical variations of mandibular canal detected by panoramic radiography and CT: a systematic review and meta-analysis. Dentomaxillofacial Radiol 45:20150310. https://doi.org/10.1259/dmfr.20150310
6. Han S-S, Hwang J-J, Park C-S (2014) The anomalous canal between two accessory foramina on the mandibular ramus: the temporal crest canal. Dentomaxillofacial Radiol 43:20140115. https://doi.org/10.1259/dmfr.20140115
7. Jablonski NG, Cheng CM, Cheng LC, Cheung HM (1985) Unusual origins of the buccal and mylohyoid nerves. Oral Surg Oral Med Oral Pathol 60:487–488
8. Krasny A, Krasny N, Prescher A (2012) Anatomic variations of neural canal structures of the mandible observed by 3-T magnetic resonance imaging. J Comput Assist Tomogr 36:150–153. https://doi.org/10.1097/RCT.0b013e3182436c6d
9. Przystańska A, Bruska M (2012) Anatomical classification of accessory foramina in human mandibles of adults, infants, and fetuses. Anat Sci Int 87:141–149. https://doi.org/10.1007/s12565-012-0136-z

10. Rodella LF, Buffoli B, Labanca M, Rezzani R (2012) A review of the mandibular and maxillary nerve supplies and their clinical relevance. Arch Oral Biol 57:323–334. https://doi.org/10.1016/j.archoralbio.2011.09.007
11. Sutton RN (1974) The practical significance of mandibular accessory foramina. Aust Dent J 19:167–173
12. Yeh AYE, Finn BP, Jones RHB et al (2018) The variable position of the inferior alveolar nerve (IAN) in the mandibular ramus: a computed tomography (CT) study. Surg Radiol Anat 40:6:653–665