First Report of a Bifid Mandibular Canal Containing a Large Vein Draining into the Anterior Jugular Vein

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Summary: The bifid mandibular canal (BMC) is an anatomical variant of the mandible that is often observed on cone-beam computed tomographic images. We identified a BMC during routine cadaveric dissection. The upper mandibular canal contained the inferior alveolar nerve and artery, and the lower mandibular canal contained a large inferior alveolar vein. This latter vein left the mandible through a lateral lingual foramen and joined the anterior jugular vein. Additionally, this vein gave rise to small tributaries to the mental foramen and anterior surface of the mandible from the second mandibular canal. To our knowledge, this is the first report illustrating the contents of a BMC and drainage of a vein into the large anterior jugular vein.

Key words Anatomy, cadaver, anatomic variation, mandible, inferior alveolar nerve, vein

INTRODUCTION

The bifid mandibular canal (BMC), which has also been called a double mandibular canal [1], is an anatomical variation of the mandible and has attracted increased attention with the development of cone-beam computed tomography (CBCT) [2-4]. However, even with the high resolution of CBCT [5], this imaging modality cannot visualize the contents of the mandibular canal, such as nerve, artery and vein, due to their size. Only Kawai et al. [6], and Motamedi et al. [7] demonstrated the gross anatomy and histology of the retromolar canal (RMC), which is a subtype of the BMC, and revealed that the RMC contains mainly nerves. The BMC found on CBCT images have been reported as containing both nerves and arteries, although without any strong evidence. In this case report, we describe an extremely rare case of a lower BMC

containing a large vein. This could potentially change our understanding of the BMC and impact its radiological diagnosis.

CASE REPORT

A BMC was found during routine dissection of a Caucasian male cadaveric head whose age at death was 81 years. Before dissection, red and blue colored latex was injected into the arteries and veins, respectively. Dissection of the BMC was performed using a surgical microscope (OPMI CS NC31, Carl Zeiss, Oberkochen, Germany). The right and left mandibular ramus was cut horizontally above the mandibular foramen. The anterior border of the right mandibular ramus and lateral surface of the mandibular body were fractured and a large vein was exposed (Fig. 1). This vein was traveling through the mandibular body in the lower

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Abbreviations: BMC, bifid mandibular canal; CBCT, cone-beam computed tomography; LLF, lateral lingual foramen; RMC, retromolar canal.

part of a BMC. Also, the abnormal vein drained from the lingual side of the mandible into the anterior jugular vein (Fig. 2). The right submental vein was not observed in this case. In order to reveal the course of

Fig. 1. Large vein (arrowhead) observed in the right body of the mandible.

these canals and this vein, the mandible was removed from the head (the inferior alveolar vein had been cut and the proximal origin of this vein was unclear). In a lingual view, a lateral lingual foramen (LLF) (1.28 mm in diameter) was identified below the second premolar tooth (Fig. 3). The lingual cortical bone surface of the canal was removed with a surgical drill (Medtronic, Dublin, Ireland). This canal contained only the vein and curved medially to exit the mandible from the LLF. The canal was completely separated from the mandibular canal and was visualized using flexible metal

Fig. 3. Lingual view of the right body of the mandible. A lateral lingual foramen identified below the second premolar tooth (arrow and pin).

Fig. 2. The abnormal vein (arrows) identified on the lingual side of the mandible and draining into the large anterior jugular vein (arrowheads).

A: lateral view
B: inferior view

Fig. 4. The abnormal canal completely separated from the mandibular canal and continuing to the lateral lingual foramen (arrows).

A: after removing the cortical bone surface to the abnormal canal and placing a flexible metal wire into the canal.

B: lateral view fluoroscopy with flexible metal wire

Fig. 5. Bony septum (arrows) between the first and second mandibular canals.

Fig. 6. Anterior tributary of the inferior alveolar vein exiting the mandible from its anterior surface (arrow).

wire and lateral view fluoroscopy (Fig. 4). The inferior alveolar nerve and artery were found running through the normal mandibular canal (the upper mandibular canal) which was located superolaterally and almost parallel to this abnormal canal (the lower mandibular canal). Between these two canals, a bony septum (approximately 1 mm in thickness) was observed (Fig. 5). This vein also received a small tributary anteriorly that connects to a small vein from the mental foramen. The anterior tributary of this vein drained into the mandible from its anterior surface (Fig. 6). The diameter of the upper and lower mandibular canals (at the position of the first molar tooth) and mental foramen were 2.89 mm, 4.01 mm and 3.83 mm, respectively.

DISCUSSION

The incidence of BMC using panoramic radiography is relatively rare and was reported in 0.08 to 0.09% of the population, whereas CBCT can detect BMC in 15.6 to 64.8% of individuals [4]. Yeong-Hoon and Hun Mu described the BMC as containing separate neurovascular bundles (i.e., both canals contained nerves, arteries, and veins) and that impingement of these accessory neurovascular bundles might lead to various complications such as paresthesia or bleeding during surgery [4]. Such descriptions of both canals in cases of BMC have permeated the literature. However, in the present case, the inferior alveolar nerve and artery traveled through the upper mandibular canal and the inferior alveolar vein traveled through the lower mandibular canal. These two canals were completely separated by a bony septum. This second canal had continu-

ity with the LLF, mental foramen, and another accessory foramen on the anterior surface of the mandible. In normal anatomy, the mean diameter of the mandibular canal and inferior alveolar vein is approximately 2.52 mm and 0.58 mm, respectively [8]. In our case, the diameter of the first canal was 2.89 mm and the second mandibular canal was 4.01 mm. This second canal contained a vein that was much larger than the normal inferior alveolar vein.

Embryologically, the inferior alveolar nerve first branches off into the mental and incisor branches. The mental foramen is incomplete until the twelfth week of gestation when the mental nerve separates into several fasciculi [9]. The large inferior alveolar vein in the lower mandibular canal might have developed around or before the twelfth week of gestation when the mandible was not yet ossified. Interestingly, the vein arose from the LLF and drained into the anterior jugular vein which was also large. The mental vein usually drains into the submental vein, facial and common facial veins and finally joins the internal jugular vein. In some drawings, the submental vein also has a small communicating tributary with the anterior jugular vein [10]. In this case, the submental vein was not clearly observed although a small tributary coursed toward the mental foramen from the second mandibular canal (which means this small tributary must have become the mental vein after leaving the mental foramen and draining into the submental vein). These bifid mandibular canals have to be detected before surgical procedures such as intraoral vertical osteotomy and sagittal split osteotomy in order to not only avoid nerve injury but also prevent hemorrhage.

CONCLUSION: To our knowledge, this is the first report revealing the exact anatomical contents of a BMC and to also demonstrate a large vein in the lower canal that drained into a large anterior jugular vein. Such an anatomical variation should be kept in mind by dentists and oral surgeons alike.

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