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MANDIBLE — CLINICALLY REVISITED

Abstract: Based on the current literature authors revised anatomical and clinical datas considering the mandible.

Key words: mandible, anatomy, development, nerve supply.

INTRODUCTION

Composition of the mandible resembles somehow the structure of flat bones. It consists of central cancellous bony tissue and surrounding compact substance. Compact substance hinders penetration of the anesthetic. Body of the mandible is much thicker than the ramus — it is the thickest at a level of oblique and mylohyoid lines. Mentioned locations are reported to the greatest burden during upper jaw pressure. Composition of the compact substance is specially tight, and both external and internal laminae are thick at their connections on the mandibular base. Between factors predisposing such shape one can list the ligaments, which insertions are located on this bone [1–3]. Internal (lingual) walls of dental alveoli are significantly thicker than external ones (labial and buccal respectively), apart from the dental alveolus of the third molar tooth where the buccal wall seems to be thicker [1, 4].

Mandibular ramus is a quadrangular bony plate which originates bilaterally from the posterior end of the body. Anatomically it has two surfaces and two processes. Lateral surface of mandibular ramus is rough in its inferior part — possessing the masseteric tuberosity, where masseter muscle inserts. Medial aspect of mandibular ramus shows mandibular foramen. One can see accessory foramina here [5, 6]. Mandibular foramen is limited anteriorly by little bony spicule — lingual. This projection and its vicinity serve as an attachment for sphenomandibular ligament [7]. Lingula is palpable during inspection of the oral cavity through the oral mucosa. It indicates the direction of the needle position during performing anesthesia of the lower teeth [8].

Canal of the mandible (mandibular canal) starts with mandibular foramen. It arches anteriorly (when single) within cancellous bony tissue until it reaches the level of the medial incisor's dental alveolus. At the level of the mental foramen the canal is relatively wide, but next, medially it becomes narrower [9, 10]. Mylohyoid sulcus begins at the mandibular foramen or in its vicinity [11]. Posterior to the sulcus, medial surface of mandibular ramus is scabrous forming pterygoid tuberosity, resulted from an attachment of the medial pterygoid muscle [11].

Inferior border of mandibular ramus is thick, runs straight and becomes the inferior border of the body of mandible. Together they use to create mandibular angle, significantly irregular both on the lateral and medial surfaces, serving as attachment of the masseter and medial pterygoidmuscles respectively [12–14]. Mandibular angle itself serves as attachment of the stylomandibular ligament.

Anterior border of ramus of mandible is a continuation of an oblique line. Medially it neighbors to a little depression (localized in the vicinity of the buccal margin of the wisdom tooth) — extramolar sulcus. Medial to it one can find the retromolar triangle, which is localized posterior to the last molar. The retromolar triangle is limited medially by the buccinators crest (which provides and attachment for the buccinator muscle), and lateral by the lateral limb of the temporal crest [12].

Posterior border of ramus of the mandible is thick, curved, covered by parotid gland. The superior border bears two processes: an anterior — coronoid process, and posterior — condylar process, separated by the mandibular notch [12].

DEVELOPMENTAL REMARKS

Mandible is almost the first bone to ossify in the human body, apart from the clavicle. Majority of the mandible arises as a result of membranous ossification on the lateral surface of Meckel's cartilage. Very soon during the 6–7. week of gestation, there is arising single ossification center in each half of the mandible. It gives rise to main part of the body and ramus. Next some cartilaginous condensates appear in the mesenchyme, and slowly ossify undependently from the Meckel's cartilage. Such condensates appear within coronoid and condylar processes, angle of mandible, anterior ends of both mandibular halves and within alveolar arch [1]. Very soon these mentioned above foci of cartilage unify with the core bone. Still within intrauterine development mandible consists of two halves united by fibrous mental symphysis, which ossifies in humans and other primates during the first postnatal year [15].

Posterior end of the ventral cartilage of the first pharyngeal arch joins with the future ear area, whereas anterior ends of the right and left cartilages nearly join each other. Posterior end ossifies forming auditory ossicles — malleus (hammer) and incus (anvil). Fragment of the anterior end is incorporated into the mandible, while remaining part regresses. Mylohoid sulcus is a remnant of a groove which was the former bed of the above described cartilage. Sphenomandibular ligament arises from a 'vagina' of the fibrous coat localized in the periphery of the cartilage [16, 17].

POSTNATAL GROWTH

Shape of the mandible is permanently modified after delivery. Infantile mandible contains bilaterally dental alveoli for incisors, canine and two decidual molars, which are not completely separated yet [1]. Canal of mandible is proportionally wide, localized next to the inferior border of the mandible. It contains inferior alveolar nerve and the vessels. Separate innervation and blood supply of incisors, canines and molars is characteristic for prenatal period. It may exist in a persistent form immediately posterior to the foramen of mandible as so called Serres' canal (which contains the vein of Serres) [18]. Mental foramen is placed relatively low, next and inferior to the primordium of the first molar tooth. The angle between ramus and body of mandible is obtuse (varies between 150 and 160°, condylar process is significantly small). In contrast coronoid process of infant's mandible is large and stands above condylar process [1, 16].

Postnatally both halves of the mandible fuse. This process occurs within the syphysismenti and proceeds from below. Because of development of permanent teeth the body of mandible elongates posterior to the mental foramen [16]. The height of the body increases to fit the growing dental roots. Appearance of permanent teeth is accompanied by dislocation of the mandibular canal till right above the mylohyoid line, while the mental foramen moves anteriorly to reach the level of the second premolar [1]. The angle of mandible becomes less obtuse — at the age of 4 it reaches 140° [16]. In adults proportions seem to be different; the alveolar part and mandibular base are similarly high. The mental foramen is localized in the midheigth of the body [9, 10]. Mandibular canal almost parallels the mylohyoid line [19]. Ramus of mandible is almost vertical and the angle decreases till 120–130° [20].

Loss of teeth in elderly causes decrease of parameters of the mandible. Alveolar part is being reduced. Much of the body is localized below oblique line, and the mandibular canal together with mental foramen apparently rises upwards, neighboring to the alveolar arch. Ramus of the mandible bends posteriorly. The angle increases and reaches the value of 140°. The neck of the condylar process bends posteriorly [21].

ANTHROPOLOGICAL REMARKS

Anterior fragment of the mandible, represented by chin, undergoes numerous changes. Sparse prehistoric mandibles i.e. mandible from Mauer are characterized by a complete lack of the chin like in the anthropoid monkeys [22]. Strongly marked chin is a remarkably feature characteristic for humans [21].

Chin is a result of different intensity of the growth of alveolar part and the base of the body of mandible. Till the moment of delivery growth of the alveolar part is characterized by intense dynamic [3, 15]. The chin protrudes. Such development is a typical human featue, because in other mammals growth of the base of the mandible backs down comparing to the growth of the alveolar part. Development of the chin is then a symptom of general phylogenetic adaptation of the skull. Widening of the brain box, especially in its anterior part cause in a consequence change in the face width, i.e. upper jaws and palate, and the mandible had to follow these changes. Development of the mandible was influenced by achievement of communication skills, which resulted in widening of the tongue and growth of the mandible. "The bodies" of the mandible of the right and left sides fuse in the median sagittal plane. As a consequence strong transverse tension of the chin bony structure arises. Reduction of tensions is made by the so called mental ossicles — which are typical human formations. They use to exist in the compact tissue of symphysis menti, as various elements both according to shape and number. They use to fill the mental symphysis and gradually unite with each other and the halves of the mandibular body. This is how the mental protuberance arises, more evident in males than in females [4, 21].

Much of the attention should be paid to mental spine, which serves as origin for genioglossus and geniohyoid muscles [15]. It varies according to a shape and presents as typical human feature, too. It may be absent sometimes or it can be replaced by genioglossal fossa. This depression can be still visible in a one year old child [22]. Coronoid process undergoes numerous transformations. It is shaped among others by the temporal muscle. Wide and relatively low coronoid process indicates potent development of temporal muscle, while long and pointed is significant for weak muscle [23, 24].

NERVE SUPPLY OF THE MANDIBLE

Both mandibular prominences are supplied by the third division of trigeminal nerve — mandibular nerve, which is a nerve of the first branchial arch. Nasofrontal and maxillary processes are accompanied by the first and second division of the trigeminal nerve. As a consequence of this fact, derivatives of these primoridia are supplied by mentioned above nerves respectively [4]. The mandible entirely receives sensory innervation from the mandibular nerve [1].

This nerve is the strongest and mixed branch of the trigeminal nerve. It carries the dendrites of trigeminal ganglion and axons of the masticatory nucleus of the pontinetegmentum. Pseudounipolar cells which contain components of the mandibular nerve are located in the postero-lateral portion of the ganglion. It concerns mainly to dendrites which carry the sensation from paradentium. During intracranial course, two main components of the mandibular nerve practically never exchange. The exchange of the fibers is possible probably as they traverse foramen ovale as well as they exit it [25]. Mandibular nerve supplies mandibular region, temporomandibular joint, muscles, skin and mucosa, giving off some branches to periosteum and all mandibular teeth. It leaves the skull through the oval foramen and posterior to the lateral pterygoid muscle it enters the infratemporal fossa [12, 13].

Mandibular nerve gives rise to the following:

- anterior division — branches which are mainly motor
- posterior division — with nerves which are mostly sensory.

Posterior division is consisted of three branches:

- lingual nerve
- inferior alveolar nerve
- auriculotemporal nerve.

The only sensory branch of the anterior division is a buccal nerve. This nerve traverses the superior portion of the infratemporal fossa. It crosses anterior border of ramus of mandible on the level of upper molar teeth (while the mouth is widely opened) [26].

Inferior alveolar nerve is the only nerve of the posterior group traversing the bony canal of the mandible. It arises from the posterior division together with the lingual nerve , running between the medial and lateral pterygoid muscles. Next it proceeds forward and downward, between the sphenomandibular ligament and the ramus of mandible, entering the mandibular canal. Within the foramen it is localized anterior and medial to the artery which accompanies the nerve. Such arrangement is present in about 60% of cases. In 20% nerve is lateral to the artery, in 10% it is posterior. In remaining 10% nerve's course is independent on the course of the artery [27]. Within the canal nerve is localized immediately below the inferior alveolar vein. Artery is placed more lingual. Inferior alveolar nerve contains both sensory and motor components. Before entering the canal it gives off the mylohyoid nerve which accommodates within the mylohyoid sulcus. If the mylohyoid nerve originates within the canal it runs within the separate bony canal. After reaching the posterior border of the mylohyoid muscle it gives off the branches to anterior belly of the digastric muscle. Terminal sensory branches reach the skin of the chin and submental region. Sometimes the nerve fuses with lingual nerve through a little branch piercing the mylohyoid muscle. It may contribute innervation of last molar teeth. It may innervate incisors, too — then it can fuse ipsilateral or even contralateral incisive nerve. Separation of the mylohyoid nerve may vary — this is the main causative problem in anaesthesia of the incisor teeth [9, 10, 12].

Buccal nerve runs in the vicinity of the mandible — usually it goes between between heads of the lateral pterygoid muscle or between both pterygoid muscles. Next it accompanies the buccal artery on the lateral aspect of buccinators muscle till angle of mouth. Its branches pierce the muscle, but they do not innervate it, supply mucosa of the cheek and partially gums. On their way the branches use to supply the skin of the chick and fuse with branches of the facial nerve. Buccal nerve can be replaced by branch of the infraorbital nerve or even originate directly from the inferior alveolar nerve.

CONFLICT OF INTEREST

None declared.

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