

## **Anatomy of the Persian Cat's Skull and its Clinical Value During Regional Anesthesia**

*Ali Louei Monfared*

Department of Anatomy, Faculty of Para-Veterinary Medicine, University of Ilam, Ilam, Iran

**Abstract:** The head of Persian cats is characterized by a short face and open orbits. Also, the phenotypic appearance of the cat head depends on the shape of the skull and is strongly related to breed specific skeletal properties. Since, there is a lack of information on anatomical measurements of the skulls of Persian cats and its clinical value during regional anesthesia; the present work was taken. The investigation was carried out on sixteen mandibles and upper jaws from cats older than one year without any apparent skeletal disorders. Then, a total of seventeen skull measurements and indices were recorded. The skull length, cranial length, nasal length and cranial width of the adult cats were 10.58 cm, 7.38 cm, 3.32 cm and 4.1 cm respectively. Also, the cranial index was 55.55. In addition, the distances from the root of premolar tooth to infra-orbital canal and from the latter to the root of the canine tooth were 0.94 cm and 2.3 cm, respectively. The length and height of the mandibles of the adult cats were 8.3 cm and 3.7 cm, respectively. Furthermore, the distances from the lateral alveolar root to mental foramen and from the mental foramen to caudal mandibular border were 1.4 cm and 6.9 cm, respectively. In the current work, the distances from mandibular foramen to the base of mandible as well as from caudal border of mandible to below of the mandibular foramen were 0.8 cm and 1.04 cm, respectively. Also, the distances from the base of mandible to condyloid fossa and from the latter to the maximum height of mandible were 3.07 cm and 0.76 cm, respectively. Finally, the distance from caudal border of mandible to mandibular foramen and from the latter to mandibular angle were 0.65 cm and 0.83 cm, respectively. These data as important landmarks are discussed with regard to their application to clinical maneuvers around the head of the Persian cats such as regional anesthesia during treating head injury and dental extraction.

**Key words:** Anatomy • Persian cat • Skull • Regional Anesthesia

### **INTRODUCTION**

The head of Persian cats is characterized by a short face and open orbits [1]. Also, the phenotypic appearance of the cat head depends on the shape of the skull and is strongly related to breed specific skeletal properties. Schlegel [2] summarized the cat's head features under the term of a "stocky round head". Furthermore, the head of Siamese cats is characterized by a completely different shape, whereas those of the European Shorthair are in between these extreme forms of Siamese and Persian cats [2]. Additionally, the functional impact of breed selection and functional interpretations of morphometric investigations of the cat's head was examined by previous study [1]. According to a previous

study [3] the formation of a round skull type in the Persian cats was thought to be exclusively attributed to the decrease in length of the face and simultaneous increase in convexity of the calvarias.

The skull's morphologic and morphometric investigations are not only reflect contributions of genetic and environmental components to individual development, but also are foundations of the clinical and surgical practices [4,5]. In addition, clinical anatomy is one of the principles of the clinical and surgical practice; because it enables the clinician to visualize details of structures relevant to the case at hand [6, 7]. Similarly, the directions of the cranial nerves and their passages from different foramina in the skull are of clinical importance in regional anesthesia around the head [7, 8].

**Corresponding Author:** Ali Louei Monfared, Department of Basic Sciences, division of anatomy and histology, Faculty of Para-Veterinary Medicine, University of Ilam, Ilam, Iran, Pajoohesh Street, Bangonjab, University of Ilam, Ilam, Iran. Tel: +98-8412222015+989183419098, Fax: +98-8412222015.

Since, there is a lack of information on anatomical measurements of the skulls of Persian cats and its clinical value during regional anesthesia; therefore, the present work was taken to provide anatomic reference for cat's skull and its applications for head regional anesthesia.

## MATERIALS AND METHODS

The investigation was carried out on sixteen mandibles and upper jaws from cats older than one year without any apparent skeletal disorders. The specimens were brought for dissection purposes in the gross anatomy laboratories of the University of Tehran (Tehran, Iran), University of Shahid Chamran (Ahwaz, Iran) and University of Ilam (Ilam, Iran). The heads were severed at the occipito-atlantal joint and processed in the veterinary anatomy laboratory using the boiling maceration techniques for skeleton preparation that have been reported by Simoens *et al.* [9]. The main steps in skull skeleton preparing briefly are following:

- On the working day, frozen cat head were allowed to thaw.
- Skin and most of the muscles were separated and eyes were enucleated.
- Heads were heated to over 80°C for at least 1 hour in solution of surfactant (detergent) and soap chips.
- Muscles of boiled heads were separated with the aid of forceps and scalpel in running water.
- Further separation of muscles and ligaments from the skulls was done after left in detergent water at least 20-30 minutes.
- Separation of remaining muscles and ligaments from the skull was done after left in 1% sodium hypochlorite solution for at least 24 hours.
- After that, the skulls were left in the above solution, for 48-72 hours with solution, being changed at least twice and clean in running tap water.
- The skulls were then left to dry.

A total of 17 gross anatomical measurements were done in the upper jaw and mandibles using scale, thread and digital calipers and the results were presented as means±SD in Table 1. These anatomical parameters of the upper and lower jawbones of the adult cat's skulls are defined below and shown in Figs. 1-5.

**Skull Length:** From the dorsal lateral nasal cartilages to the external occipital protuberance; sub-divided into cranial length and nasal length.

**Cranial Length**

**Nasal Length**

**Cranial Width**

**Cranial Index:** Cranial width × 100/cranial length.

**The Root of Premolar Tooth to Infra-Orbital Canal:**

From the root of the first premolar tooth to the mid level of the infra-orbital canal.

**Infra-Orbital Canal to Root of Canine Tooth:**

Measurement is taken vertically from the mid-level of the infra-orbital canal to the root of the canine tooth.

**Mandibular Length:** From the level of the cranial extremity of the alveolar root of the incisor to the level of the caudal border of the mandible.

**Lateral Alveolar Root to Mental Foramen:** Shortest distance from the mental foramen to the lateral extent of the alveolar root of lower incisor.

**Mental Foramen to Caudal Mandibular Border:** From the level of the mental foramen to the extreme caudal border of the mandible.

**Mandibular Foramen to Base of Mandible:** Vertical line from the ventral limit of the mandibular foramen to the base of the mandible.

**Caudal Border of Mandible to below of the Mandibular Foramen:** Length from the caudal most border of the mandible to the vertical line produced by description of measurement of mandibular foramen to base of the mandible.

**Condylod Fossa to Height of Mandible:** From the maximum height of mandible to the condylod fossa.

**Condylod Fossa to the Base of the Mandible**

**Maximum Mandibular Height:** From the basal level of the mandible to the highest level of the coronoid process.

**Caudal Border of Mandible to the Level of Mandibular Foramen**

**Mandibular Foramen to Mandibular Angle:** Shortest distance from the mandibular foramen to the extreme caudal border of the angle of the mandible.

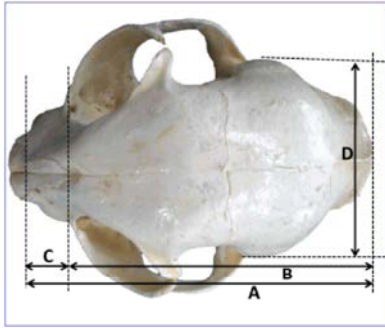


Fig. 1: Skull of the Persian cat; dorsal view. A: Skull length, B: Cranial length, C: Nasal length, D: Cranial width.



Fig. 2: Skull of the Persian cat; lateral view. F: The root of premolar tooth to infra-orbital canal, G: Infra-orbital canal to root of canine tooth.

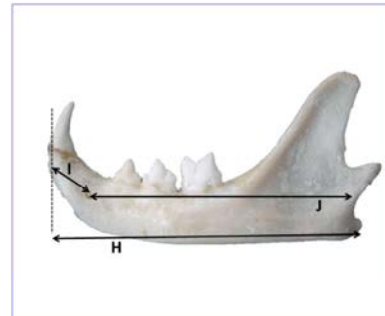


Fig. 3: Mandible of the Persian cat; lateral view. H: Mandibular length, I: Lateral alveolar root to mental foramen, J: Mental foramen to caudal mandibular border.

## RESULTS

In the present work, the skull length, cranial length, nasal length and cranial width of the adult cats were 10.58 cm, 7.38 cm, 3.32 cm and 4.1 cm respectively. Also, the cranial index was 55.55 (Figure 1, Table 1). In addition, the distances from the root of premolar tooth to infra-orbital canal and

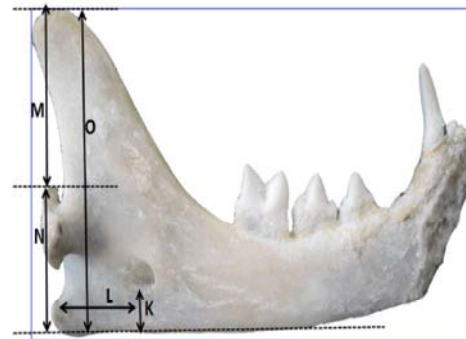


Fig. 4: Mandible of the Persian cat; medial view. K: Mandibular foramen to base of mandible, L: Caudal border of mandible to below of the mandibular foramen, M: Condyloid fossa to height of mandible, N: Condyloid fossa to the base of the mandible, O: Maximum mandibular height.



Fig. 5: Mandible of the Persian cat; medial view. P: Caudal border of mandible to the level of mandibular foramen, Q: Mandibular foramen to mandibular angle.

from the latter to the root of the canine tooth were 0.94 cm and 2.3 cm, respectively (Figure 2, Table 1).

The length and height of the mandibles of the adult cats were 8.3 cm and 3.7 cm, respectively. Furthermore, the distances from the lateral alveolar root to mental foramen and from the mental foramen to caudal mandibular border were 1.4 cm and 6.9 cm, respectively (Figure 3, Table 1). In the current work, the distances from mandibular foramen to the base of mandible as well as from caudal border of mandible to below of the mandibular foramen were 0.8 cm and 1.04 cm, respectively. Also, the distances from the base of mandible to condyloid fossa and from the latter to the maximum height of mandible were 3.07 cm and 0.76 cm, respectively (Figure 4, Table 1). Finally, the distance from caudal border of mandible to mandibular foramen and from the latter to mandibular angle were 0.65 cm and 0.83 cm, respectively (Figure 5, Table 1).

Table 1: Mean±SD of the anatomical measurements of the mandibles and upper jaws of Persian cat (cm)

Morphometric parameter	Mean±SD
A	10.58±1.62
B	7.38±0.91
C	3.23±0.55
D	4.1±1.18
E	55.55±3.45
F	0.94±0.08
G	2.3±0.49
H	8.3±1.03
I	1.4±0.37
J	6.9±1.48
K	0.8±0.66
L	1.04± 0.05
M	0.76±0.55
N	3.07±0.11
O	3.7±0.59
P	0.65±0.36
Q	0.83±0.01

## DISCUSSION

Comparatively, the values of skull length, cranial length, nasal length and cranial width of the Persian cats were similar to the results from previous investigation on the cats with round-shaped skulls [1], but were relatively different from the findings on the cats with triangular or cuneiform skulls [1]. It may be due to the existence of significant differences in the skull's shape and size between various breeds and individuals [10].

In the Persian cats, the distances from the root of premolar tooth to infra-orbital canal and from the latter to the root of the canine tooth were 0.94 cm and 2.3 cm, respectively. It had been demonstrated that the infra-orbital foramen in the skull of cat is over the alveolus for the second premolar tooth and infra-orbital nerve emerges through this foramen [6]. Therefore, these data can be useful for tracking the infra-orbital nerve and necessary for the desensitization of the skin of the upper lip, nostril and face on that side of the level of the foramen [6]. The injection of local anesthetic agents within the canal via the infra-orbital foramen will also lead to analgesia of the incisor, canine and first three premolars.

In the present study, the distance from the lateral alveolar root to mental foramen was 1.4 cm. This parameter is a vital guide that will detect the location of the mental nerve for this regional nerve block in the Persian cats; especially for lower lip anesthesia. The injection of the local anesthetic agents can be made in the rostral aspect of the mandibular canal through the mental foramen to mandibular nerve block in the mental zone. This will

ensure the loss of sensation of the lower incisors, premolar and lower lip on the same side [8] during lower lip trauma, dental extraction and treatment of the tooth injuries.

The mandibular length and height in the Persian cats were similar to the data obtained for the cats with round-shaped skulls [1]. Similar results had been reported in the values of the distances between the mandibular foramen to base of mandible, the condyloid fossa to height of mandible and condyloid fossa to the base of the mandible [1].

The caudal border of the mandible to bellow of the mandibular foramen was 1.04 cm in the Persian cats. In addition, the distance from the caudal border of mandible to the level of mandibular foramen and from the latter to the border of mandibular angle was 0.65 cm and 0.83 cm, respectively. The anesthetic agents must to be injecting on the medial side of the mandible, thereby; a successful nerve block produces anesthesia of the lower jaw with its teeth and the lower lip. These data are necessary for achieving the regional anesthesia of the mandibular nerve and also have clinical importance for desensitization of all the teeth in lower jaw [8].

In conclusion, the morphometric values of the skull and clinical anatomy of the head region of the Persian cats provide an important baseline for further research in this field. Furthermore, these results can also be useful tool that will aid the regional anesthesia of the cranial nerves around the head especially during treating head injury and dental extraction.

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