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Comparative Anatomy of the Neurocranium in Some Wild Carnivora

[1]Ömer Atalar, [1]Yasemin Üstündag, [2]Mine Yaman and [3]Dervis Özdemir
[1]Department of Anatomy, [2]Department of Histology and Embryology,
Faculty of Veterinary Medicine, Firat University, 23119, Elazig, Turkey
[3]Department of Anatomy, Faculty of Veterinary Medicine,
Ataturk University, 25100, Erzurum, Turkey

Abstract: This study was carried out to investigate the specific anatomical features of the neurocranium in the lynx, wolf, fox and marten. Three from each species were used without sexual distinction. The dorsal surface of the neurocranium consisted of a paired parietal and frontal bones. *Crista sagittalis* externa was more significant in the wolf than in others species. *Processus mastoideus* was developed in all species examined. There were two foramen laterally on the each side of the *Condylus occipitalis* in the wolf. These foramens were not seen in other species. *Processus paracondylaris* was projected caudally and slightly in the lynx. The frontal zygomatic process was slightly developed in the marten. The supraorbital foramen was absent in all species examined. *Protuberentia occipitalis* externa was seen as distinct structure in the fox and marten. The results of the present study may contribute to extension of data in this field of science.

Key words: Anatomy, neurocranium, lynx, wolf, fox, marten

INTRODUCTION

Neurocranium is an important part of the head that protects the brain. It consists of os occipitale, os sphenoidale, os pterygoideum, os ethmoidale, os vomer, os temporale, os parietale and os frontale (Getty, 1975; Nickel *et al*., 1987; Dursun, 1994; Atalar and Yilmaz, 2004; Atalar and Temizer, 2009). The lynx (*Lynx lynx*), the wolf (*Canis lupus*), the fox (*Vulpes vulpes*) and the marten (*Martes foine*) were found different as taxonomically (Demirsoy, 1992; Atalar and Cakir, 2004).

In general, animal remains are mostly as bone fragments and it is difficult to distinguish between the bones of wild carnivores. Therefore, it is important to obtain the basic data on the skeleton of the carnivores.

Despite anatomical studies on the osteology of wild carnivores such as the badger, raccoon dog, marten and otter (Hidaka *et al*., 1998; Yilmaz *et al*., 2000; Dinç, 2001; Atalar *et al*., 2004; Karan *et al*., 2006), the comparative anatomy of the neurocranium in the lynx, wolf, fox and marten has not been studied. So, this study was aimed to investigate the specific anatomical features of the neurocrainum of the lynx, wolf, fox and marten with comparative anatomical consideration.

MATERIALS AND METHODS

In this study, a total of 12 animals including 3 lynx, 3 wolves, 3 foxes and 3 martens were used without sexual distinction. The animal materials were obtained from the museum of biology department in Firat University, Turkey. The observation was carried out by the naked eye and photographs were taken as required. For terminology, Nomina Anatomica Veterinaria (The Committees, 1994) was used.

RESULTS AND DISCUSSION

The frontal zygomatic process was angular shape in all species examined and very well developed in the lynx; less developed in the wolf and fox and slightly developed in the marten (Fig. 1). Hidaka *et al*. (1998) reported that the frontal zygomatic process was angular shape in raccoon dog. Researchers indicated that this feature was absent in badger (Dinç, 2001) and otter (Yilmaz *et al*., 2000). Karan *et al*. (2006) determined that the frontal zygomatic process was less developed in otter, slightly developed in the badger and dog and well developed in the cat.

The supraorbital foramen was absent in the dog and cat (Dursun, 1994), in the marten (Atalar *et al*., 2004), in the badger (Dinç, 2001) and in the otter (Yilmaz *et al*., 2000). In present study, it was found that the foramen supraorbitale was also absent in the lynx, wolf, fox and marten (Fig 1).

Paired of parietal bone joined each other at the midline, forming the sutura sagittalis in the lynx, wolf, fox while it was separated by the linea temporalis in the marten. *Crista sagittalis* externa was very well developed

Corresponding Author: Ömer Atalar, Department of Anatomy, Faculty of Veterinary Medicine, Firat University, 23119, Elazig, Turkey

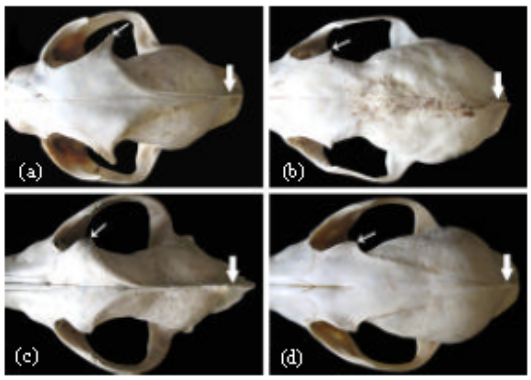

Fig. 1: Dorsal view of the cranium (a) lynx (b) marten (c) wolf (d) fox (big arrow) *Crista sagittalis* externa (small arrow) frontal zygomatic process

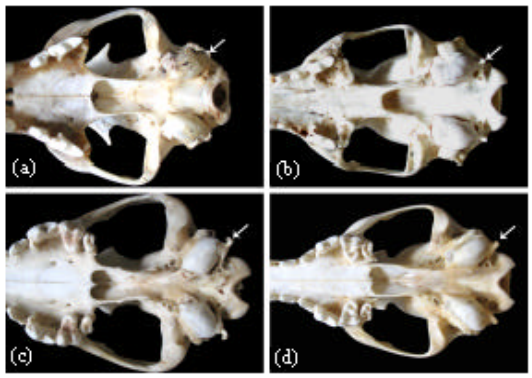

Fig. 2: Ventral view of the cranium (a) lynx (b) marten (c) wolf (d) fox (arrow) *Processus paracondylaris*

in the wolf less developed in the lynx while it was insignificant in the fox and marten (Fig. 1). As a general feature of wild and big carnivores the *Crista sagittalis* externa was well developed (Getty, 1975; Nickel *et al*., 1987). Similar findings were observed in this study.

The frontal bone was; narrow and flat in the marten, short in the fox and quite wide in the lynx. It was centrally depressed and more or less concave in profile in the wolf (Fig. 1). Researchers reported that the os frontale was; small in the otter, narrow and long in the marten and quite wide in the cat and dog (Atalar *et al*., 2004; Karan *et al*., 2006).

The dorsal surface of the neurocranium consists of a paired parietal and frontal bones. The caudal aspect of the neurocranial portion of the skull is formed by the occipital bone. The temporal bone is the most prominent bone, which forms the lateral part of the neurocranium (Hidaka *et al*., 1998; Yilmaz *et al*., 2000; Dinç, 2001; Atalar *et al*., 2004; Karan *et al*., 2006). The findings obtained from lynx, wolf, fox and marten in the present study showed a similarity with the findings of the researchers given above (Fig. 1-3).

The researchers have determined that the os interparietale fused with squama occipitalis and os parietale, the mastoid process was marked in domestic carnivore species (Getty, 1975; Nickel *et al*., 1987). The results of this investigation support these data in wild carnivores. However, the mastoid process was more developed in the lynx than in the wolf, fox and marten (Fig. 2 and 3).

In this study, the *Processus paracondylaris* was projected ventrally in the wolf, fox and marten; caudally in the lynx and it was shorter in the lynx than in the marten, wolf and fox (Fig. 2). The *Protuberentia occipitalis*

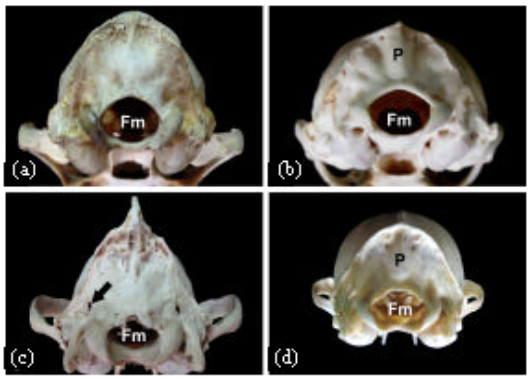

Fig. 3: Caudal view of the cranium (a) lynx (b) marten (c) wolf (d) fox (Fm) foramen magnum (p) protuberentia occipitalis externa (arrow) the foramen in the wolf

externa was very distinct in lynx and wolf, while was indistinct in the marten and fox. In only wolf, there was two foramen laterally on the each side of the *Condylus occipitalis* of squama occipitalis (Fig 3). Karan *et al*. (2006) indicated that *Processus paracondylaris* was projected ventrally in the cat, dog and badger, caudally in the otter. Yilmaz *et al*. (2000) noticed that in the otter, there were two foramina on the protuberentia occipitalis externa. Dinç (2001) has determined that in the badger, there was only one foramen on the protuberentia occipitalis externa.

According to Hidaka *et al*. (1998) the shape of foramen magnum was almost oval in the raccoon dog and badger. Getty (1975) and Nickel *et al*. (1987) have supported these findings in the dog and cat. In our study, this feature was also oval in all species examined (Fig. 3).

CONCLUSION

Distinguishable differences in bones forming the neurocraium were observed among the wild carnivores. In this study, we tried to document the similarities and differences of these bones in carnivores.

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