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Macro-Anatomical Investigations on the Hedgehog Skeleton (*Erinaceus europaeus*) I- Ossa Membri Thoracici

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Abstract: Three adult male hedgehogs (*Erinaceus europaeus*) were used to investigate the bones of the thoracic limb. It was observed that the area of the fossa supraspinata (48%) was slightly larger than that of the fossa infraspinata (46%). Foramen supracondylare and foramen supratrochleare were absent but in one hedgehog while there was a foramen supratrochleare in the right humerus, there was no such foramen in the left humerus. The tuberositas deltoidea was not developed well but the tuberculum majus and tuberculum minus, crista tuberculi minoris, crista supracondylaris lateralis, epicondylus lateralis and epicondylus medialis were prominent. A spatium interosseum antebrachii was present. The olecranon was large and there was a deep fossa on the medial surface of the olecranon. Three proximal and 4 distal carpal and 5 metacarpal bones were determined.

Key Words: *Erinaceus europaeus*, hedgehog, bones of the thoracic limb

Kirpi (*Erinaceus europaeus*) İskelet Sistemi Üzerinde Makro-Anatomik Araştırmalar I. Ossa Membri Thoracici

Özet: Bu çalışmada ön bacak kemiklerini incelemek için 3 yetişkin erkek kirpi (*Erinaceus europaeus*) kullanıldı. Fossa supraspinata'nın alanının (% 48) fossa infraspinata'dan (% 46) biraz daha büyük olduğu gözlendi. Foramen supracondylare ve foramen supratrochleare'nin bulunmadığı fakat bir kirpide sağ humerus'ta foramen supratrochleare bulunurken sol humerus'ta böyle bir foramen'in yer almadığı saptandı. Tuberositas deltoidea'nın iyi gelişmediği ancak tuberculum majus ve tuberculum minus, crista tuberculi minoris, crista supracondylaris lateralis, epicondylus lateralis ve epicondylus medialis'in belirgin olduğu gözlendi. Spatium interosseum antebrachii bulunmaktaydı. Olecranon büyük olup medial yüzü üzerinde derin bir fossa yer almaktaydı. 3 proximal ve 4 distal carpal ve 5 metacarpal kemik belirlendi.

Anahtar Sözcükler: *Erinaceus europaeus*, kirpi, ossa membri thoracici

Introduction

Hedgehogs belong to the family Erinaceidae, order Insectivora (1,2). The literature on the macro-anatomical features of the skeletal system in hedgehogs is meager.

Despite some macro-anatomical investigations on the skeletal systems of wild carnivores such as the wolf and fox (3), the hyena (4), the mink (5),the otter (6) and badger (7) wild ruminants like the wild goat (8) and animals from the order Rodentia such as the guinea pig, rat (9) and porcupine (10), the skeletal systems of hedgehogs from the order Insectivora have not been investigated in detail.

There are some general statements on the forelimb skeleton. Particularly among mammals, the shaft of the ulna may fuse with the radius (11). In the order Insectivora, the ridges and tuberosities are better developed in burrowing forms than in others (12).

The aim of the present work is to investigate the ossa membri thoracici part of the skeletal systems in hedgehogs and to contribute to the knowledge of this subject.

Materials and Methods

The bones examined were obtained from 3 adult male hedgehogs from the Elazığ area. Maceration of bones was carried out by a previously described method (13,14).

For the measurement of the surface areas of the fossa supraspinata and fossa infraspinata, a digital planimeter

(KOUZUMI KP, 90 PLACOM) was used. For the terminology, Nomina Anatomica Veterinaria (15) was used.

Results

Scapula: The corpus scapula was triangular and the collum scapula was a tapered neck. The spina scapula was a prominent longitudinal ridge and the acromion process had a caudoventral extension possessing proc. hamatus and proc. suprahamatus (Figure 1). These processes exceeded the level of the cavitas glenoidalis. The medial surface of the scapula (facies medialis) had a shallow fossa and the cavitas glenoidalis was piriform. The tuberculum supraglenoidale and proc. coracoideus were prominent. The surface areas of the fossa supraspinata and fossa infraspinata were 2.1 and 2.0 cm^2 respectively, and the total surface area except the collum scapula and its distal portion was found as 4.3 cm^2. According to these results, the area of the fossa supraspinata (48%) was slightly larger than that of the fossa infraspinata (46%).

Skeleton brachii

Humerus: There was no entepicondylar, supracondylar or supratrochlear foramen but in one hedgehog while a supratrochlear foramen was present in the right humerus, there was no such foramen in the left humerus and there was no communication between the fossa radialis and the fossa olecrani (Figure 1). The tuberculum majus exceeded the level of the caput humeri. The tuberositas deltoidea was not developed well but the tuberculum majus, tuberculum minus, crista tuberculi minori, crista supracondylaris lateralis, epicondylus lateralis and epicondylus medialis were prominent. The clavicle was well developed; it was convex cranially and concave caudally with blunted acromial and sternal ends.

Skeleton antebrachii

Radius: The surface area of the caput radii was rectangular. The corpus radii was convex cranially. The tuberositas radii on the medial surface just distal to the neck and crista transversa were prominent. The distal end of the radius had a medial styloid process and a concave carpal surface.

Ulna: The corpus ulnae was concave cranially and the distal end had a lateral styloid process. The radius and ulna were not fused and there was a spatium between the articulatio radioulnaris proximalis and distalis extending along the longitudinal axis. The olecranon was large and there was a deep fossa on the medial surface of the olecranon (Figure1).

Skeleton Manus

Ossa Carpi: There were 3 and 4 carpal bones in the proximal and distal rows, respectively (Figure 2). In the proximal row, the os carpi radiale and os carpi intermedium were fused and the os carpi intermedioradiale, os carpi ulnare and os carpi accessorium were observed. The os carpi intermedioradiale was larger than the os carpi ulnare and

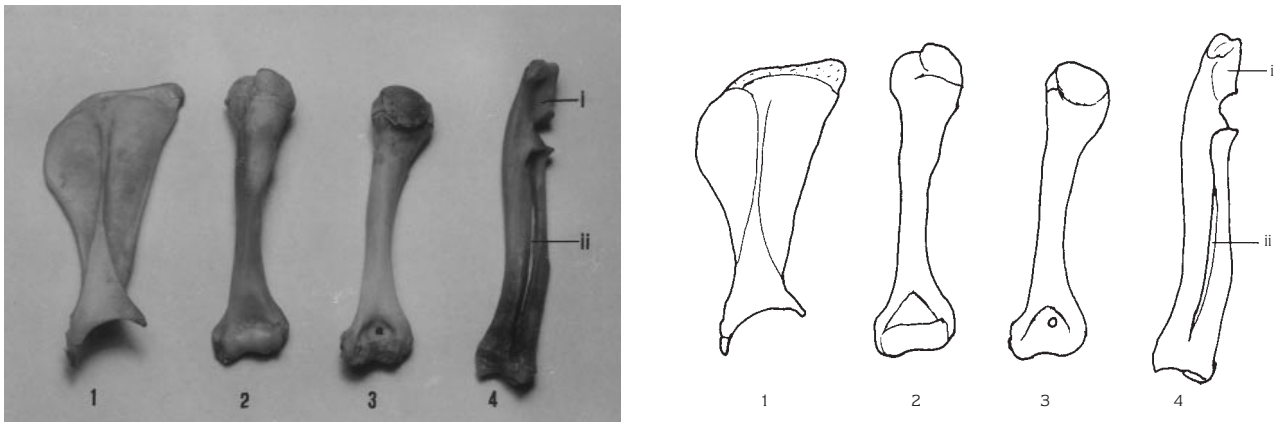

Figure 1. (1) Scapula (2) Left humerus possessing no supratrochlear foramen (3) Right humerus with the supratrochlear foramen (4) Antebrachium
(i) A deep fossa on the medial surface of the olecranon
(ii) Spatium interosseum antebrachii.

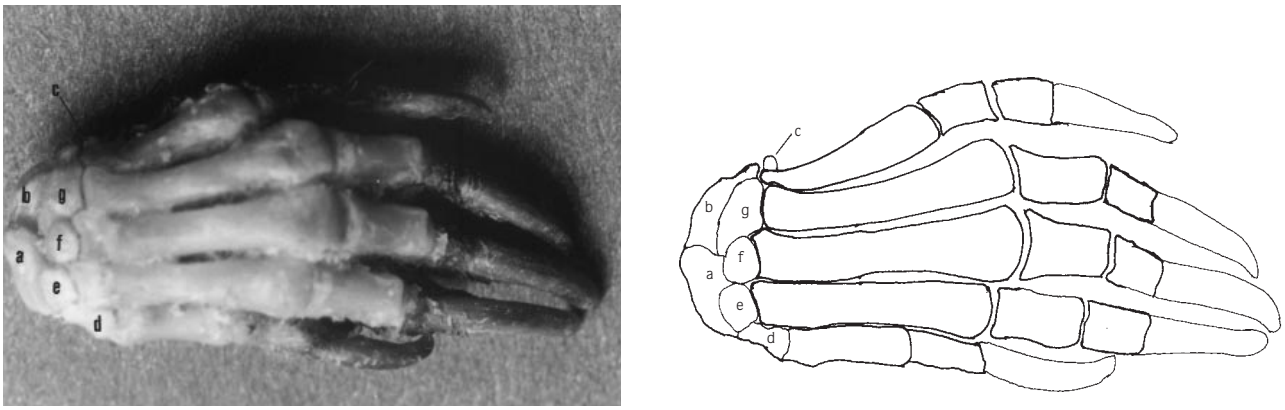

Figure 2. The manus with 5 digits, carpal and metacarpal bones
I) Proxımal row, (a) os carpi intermedioradiale (b) os carpi ulnare, (c) os carpi accessorium
II) Distal row, (d) os carpale I, e) os carpale II, f) os carpale III, (g) os carpale IV.

accessorium. In the distal row, the os carpale I (os trapezium), os carpale II (os trapezoideum), os carpale III (os capitatum) and os carpale IV (os hamatum) were observed. The os carpale IV was larger than the other distal row bones.

The manus was complete with 5 digits. There were 5 metacarpal bones between the carpal bones and the phalanges and the shortest was os metacarpale I. The longest was os metacarpale III. There were 2 palmar located sesamoid bones in pairs at each of the metacarpophalangeal joints (Figure 3). The bases of the proximal phalanges were wider than the caput portions. The longest proximal phalanx was that after os metacarpale III. The corpus of the phalanx media was narrower than the phalanx proximalis. The distal phalanges were arched and pointed to accommodate the curved nails.

Discussion

In the order Insectivora, the ridges and tuberosities are better developed in burrowing forms than in others (12). In this study, in hedgehogs, tuberositas deltoidea in the humerus was not well developed but minor tubercular and supracondylar ridges were prominent.

Yılmaz et al. (10) mentioned that in the scapula the fossa supraspinata is larger than the fossa infraspinata in porcupines. In our study, the surface area of the fossa supraspinata was slightly larger than that of the fossa infraspinata in hedgehogs. In the order Insectivora, a supracondylar foramen in the humerus has been reported (12). In our study, this foramen was not observed in the humerus of hedgehogs. In porcupines, a supratrochlear foramen in the humerus has been reported (10). In the present study, this foramen was not observed in the humerus of hedgehogs, but in one hedgehog while a supratrochlear foramen was present in the right humerus, there was no such foramen in the left humerus.

The radius and ulna are reported to be distinct in the order Insectivora (2) and particularly among mammals the shaft of the ulna may fuse with the radius (11). In our study, these bones were observed to be separated and the spatium interosseum antebrachii was prominent.

It has been revealed that in the order Insectivora the hand usually has 5 digits (1,2,12) but in the squirrel from the order Rodentia the pollex is reduced and is absent in the guinea pig (12). In this study, in hedgehogs, the manus was observed to be complete with 5 digits also.

Yılmaz et al. (10) reported 4 proximal row and 4 distal row carpal bones and a distinct os carpi intermedium in the proximal row in porcupines, and Saunders and Manton (12) observed a central bone in *Talpa europaea* from the order Insectivora. In our study, 3 proximal and 4 distal row carpal bones were observed in hedgehogs and the os carpi radiale was fused with the os carpi intermedium (os carpi intermedioradiale) and there was no central bone.

The present results reveal that there are some prominent features in the thoracic limb bones in hedgehogs, order Insectivora.

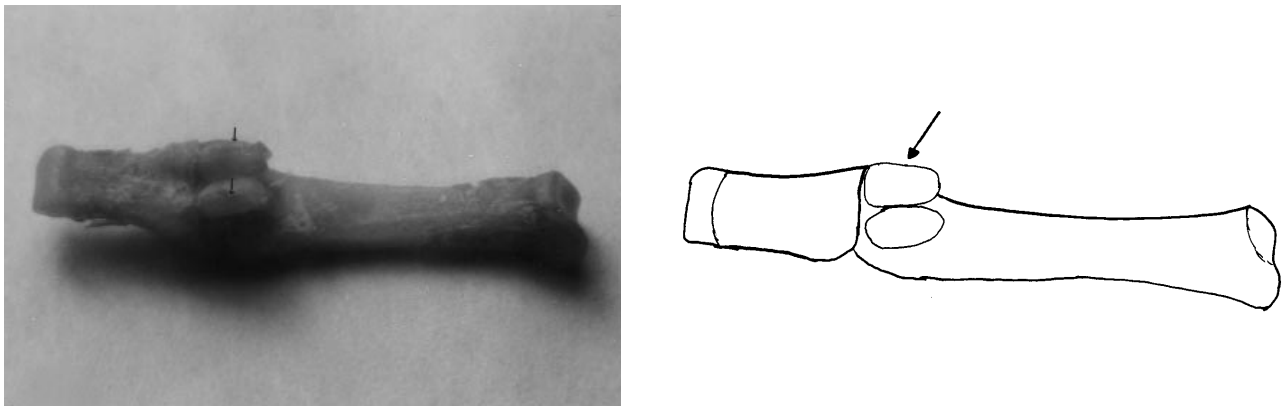

Figure 3. Two palmar located sesamoid bones at the metacarpophalangeal joint (arrow).

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