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Short Communication

GROSS ANATOMY AND BIOMETRY ON TIBIOTARSUS, FIBULA AND TARSOMETATARSUS OF INDIAN EAGLE OWL (*BUBO BENGALENSIS*)

Kamal Sarma[1], Jasvinder Singh Sasan[2*], Shalini Suri[3]

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ABSTRACT: The present study was conducted on the tibiotarsus, fibula and tarsometatarsus of Indian eagle owl. Tibiotarsus was formed by the fusion of the distal end of the tibia with the proximal row of the tarsal bones. Proximal extremity presented large medial and a smaller lateral condyle. The lateral border of lateral condyle presented a facet for articulation with the head of the fibula. The proximal end of tibiotarsus possessed a sharp cranial cnemial crest and a lateral crest separated by inter-cnemial sulcus. Distal extremity presented large lateral and small medial condyles anteriorly which were separated by the inter-condyloid fossa. Extensor canal was seen immediately proximal to the condyles. Just below the lateral condyle, shaft presented a distinct fibular crest for the attachment of the shaft of the fibula. About the middle of the lateral surface there was presence of nutrient foramen. Fibula was much reduced bone. Body of the fibula had a rough area for attachment with fibular crest of tibiotarsus. Tarsometatarsus was formed by metatarsal bones II, III and IV which were fused with each other and with distal tarsal bones. Proximal extremity presented two concave articular facets for the condyles of tibiotarsus. On planter surface of proximal extremity hypotarsus was present hypotarsus. Shaft presented longitudinal lateral and medial crests on both dorsal and planter surfaces which were more prominent on planter surface. The distal extremity had three trochlea separated by two inter-trochlear clefts. Medial articular trochlear was at a higher level than middle and lateral. Medial inter-trochlear cleft was wider than the lateral cleft.

Key words: Indian eagle owl, Cranial cnemial crest, Fibula, Hypotarsus, Tibiotarsus, Tarsometatarsus**.**

The Indian eagle-owl, also called the rock eagle-owl or Bengal eagle-owl (*Bubo bengalensis*), is a species of large horned owl inhabited in the Indian subcontinent. They are typically large owls, and have "tufts" on their heads. They are generally nocturnal and flies with slow, deliberate wing beats interspersed with long bouts of gliding on outstretched wings. They usually fly close to the ground. They primarily hunt rats and mice, but also take birds up to the size of peafowl. The literature is available on the gross anatomy of tibiotarsus and fibula of peahen (Sreeranjini *et al*. 2013), tibiotarsus and tarsometatarsus of emu (Kumar and Singh 2014), cattle erget (Rezk 2015) but information was scant about Indian eagle owl. Keeping in view the paucity of literature, this study was conducted to generate the useful baseline data on gross morphological aspects on these bones for clinicians in treating surgical and other clinical disorders in this species.

The study

The present study was conducted on the tibiotarsus, fibula and tarsometatarsus of an adult Indian eagle owl. The bones were processed as per standard technique (Raghavan 1964) and subsequently studied to record its gross morphological features. Thread, scale and Vernier caliper was used to record biometrical parameters.

Findings of the study

Tibiotarsus

Tibiotarsus was a long bone formed by the fusion of the distal end of the tibia with the proximal row of the tarsal bones as also reported earlier by Rezk (2015) in cattle erget. It presented a shaft and two extremities (proximal and distal).

The proximal extremity presented lateral and medial condyles (Fig. 2). Medial condyle was larger than the lateral condyle which was in agreement with the findings of Sreeranjini *et al.* (2013) in peahen. The condyles were separated by a ridge. These condyles articulated with the

[1] Professor, [2] Assistant Professor, [3] Professor and Head, Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu, Jammu & Kashmir, India.
[*] Corresponding author. email: jssasan216@gmail.com

condyles of femur. The lateral border of lateral condyle presented a facet for articulation with the head of the fibula. The proximal end of tibiotarsus possesses a sharp cranial cnemial crest (Fig. 1 and Fig. 2) as also observed by Sreeranjini *et al.* (2013) in peahen and Rezk (2015) in cattle erget. The crest was short and located towards the medial aspect. This crest provided attachment site for the extensor muscles of knee joint (McLelland 1990). Another cnemial crest was also observed located caudo-lateral to the cranial cnemial crest (Fig. 2). Al-Sadi (2012) and Rezk (2015) also reported the presence of two cnemial crests in turkey and cattle erget, respectively. Between these two crests there was a wide inter-cnemial sulcus (Fig. 2) whereas the proximal ends of these crests were connected by an oblique patellar crest (Fig. 1). Similar observations were also made by Rezk (2015) in cattle erget. Posteriorly, the medial and lateral condyles were separated by a notch (Fig. 2).

Table 1. Different parameters of the tibiotarsus and fibula of Indian eagle owl.

S.No.	Parameters	Values (cm)
1.	Length of tibiotarsus	10.10
2.	Width of tibiotarsus at proximal extremity without fibula	1.21
3.	Width of tibiotarsus at proximal extremity with fibula	1.41
4.	Width of tibiotarsus at middle of the shaft	0.56
5.	Width of tibiotarsus at distal extremity	1.10
6.	Length of fibula	6.32
7.	Width of fibula at proximal extremity	0.70
8.	Length of cranial cnemial process	0.81
9.	Circumference of tibiotarsus at proximal extremity	3.30
10.	Circumference of tibiotarsus at middle of the shaft	1.90
11.	Circumference of tibiotarsus at distal extremity	3.50
12.	Width of lateral condyle	0.41
13.	Width of medial condyle	0.32
14.	Antero-posterior length of lateral condyle	2.00
15.	Antero-posterior length of medial condyle	2.00
16.	Width of inter-condyloid space	0.50
17.	Width between trochlear ridges	0.40

Table 2. Different parameters of the tarsometatarsus of Indian eagle owl.

S. No.	Parameters	Right tarsometatarsus	Left tarsometatarsus
1.	Length of tarsometatarsus	7.00	7.10
2.	Width at proximal extremity	1.06	1.04
3.	Width at middle of the shaft	0.57	0.58
4.	Width at distal extremity	1.24	1.23
5.	Length of hypotarsus	0.61	0.55

The distal extremity presented large lateral and small medial condyles anteriorly separated by the inter-condyloid fossa (Fig. 1). Lateral condyle was at slightly higher level than the medial condyle. Extensor canal (Fig. 1) was seen immediately proximal to the condyles as also earlier observed by Sreeranjini *et al.* (2013) in peahen. The condyles continued caudally to constitute wide grooved trochlea (Fig. 3). On either side of the condyles there were depressions for the attachment of collateral ligaments as seen in fowl (Getty 1975). The extensive articular surface provided by the condyles and trochlea permits great deal of movement of the hock joint (Fitzgerald 1969).

Shaft was straight. Just below the lateral condyle, the shaft presented a distinct fibular crest (Fig. 3) for the attachment of the shaft of the fibula. It extended up to the proximal one-third of the shaft. Beyond this, it continued as an oblique faint line over the dorsal surface of the shaft. About the middle of the lateral surface there was a nutrient foramen (Fig. 3). Similar observation was made by Kumar and Singh (2014) in emu. However, Sreeranjini *et al*. (2013) observed nutrient foramen proximal to the extensor canal in peahen which might be due to species variations. A distinct bony ridge was observed towards medial border just above the extensor canal.

Fibula

Fibula was a much reduced bone and reached up to two-third of the lateral border of the tibiotarsus. It presented a distinct head and rudimentary shaft (Fig. 1). Head articulated with lateral condyle of tibiotarsus. Shaft was needle-like, tapering distally. Body of the fibula had a rough area for attachment with fibular crest of

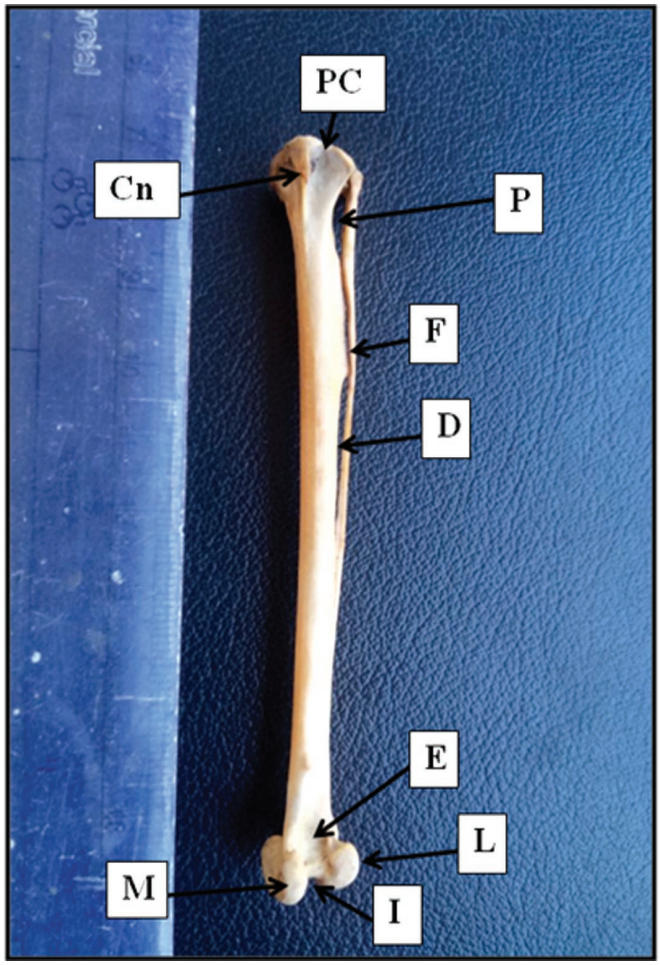

Fig. 1. Dorsal surface of tibiotarsus of Indian eagle owl showing cranial cnemial crest (Cn), patellar crest (PC), extensor canal (E), lateral condyle (L) and medial condyle (M) separated by inter-condyloid fossa (I), fibula (F), proximal (P) and distal (D) interosseous space.

tibiotarsus and thus enclosed proximal and distal interosseous spaces (Fig. 1).

Tarsometatarsus

Tarsometatarsus was a long bone but smaller than tibiotarsus as also reported earlier by Kumar and Singh 2014. It was formed by metatarsal bones II, III and IV which were fused with each other and with distal tarsal bones. This finding was in accordance with Tully *et al.* (2003) and Tahon *et al.* (2013) in chicken. For description, the bone presented a shaft and two extremities.

The proximal extremity presented 2 concave articular facets for the condyles of tibiotarsus. The lateral facet was separated from the medial facet by a distinct bony protuberance (Fig. 5) which was also present in cattle erget (Rezk 2015) but absent in emu (Kumar and Singh 2014). On planter surface of proximal extremity there was hypotarsus (Fig. 4) laterally. Two foramina were present on either side of the hypotarsus.

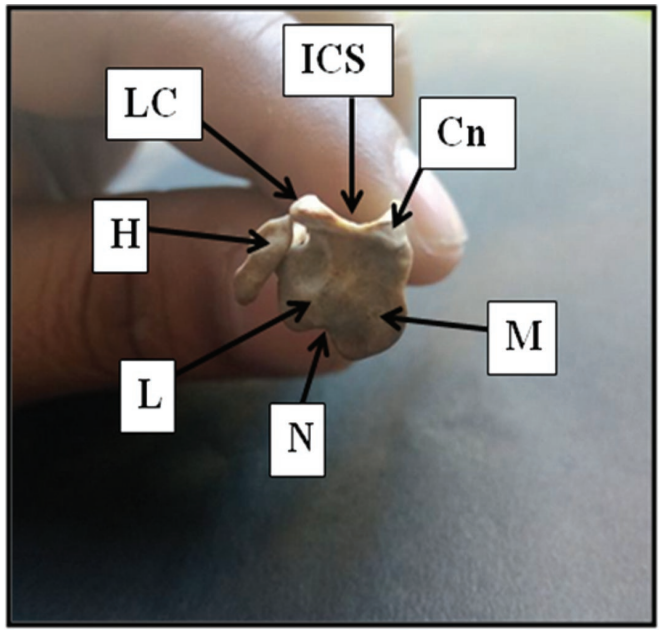

Fig. 2. Proximal extremity of tibiotarsus of Indian eagle owl showing lateral condyle (L) and medial condyle (M) separated by a notch (N), cranial cnemial crest (Cn), lateral cnemial crest (LC), inter-cnemial sulcus (ICS), head of fibula (H).

The shaft presented longitudinal lateral and medial crests on both dorsal and planter surfaces. Crests were more prominent on planter surface. On dorsal surface, crests were prominent in upper half and became indistinct distally. Crests were most wide below the proximal articular facets. This area bears a deep fossa where two foramina opens (Fig. 5). In cattle erget (Rezk 2015), three such foramina were present. Another foramen was observed on the dorsal surface just above the medial inter-

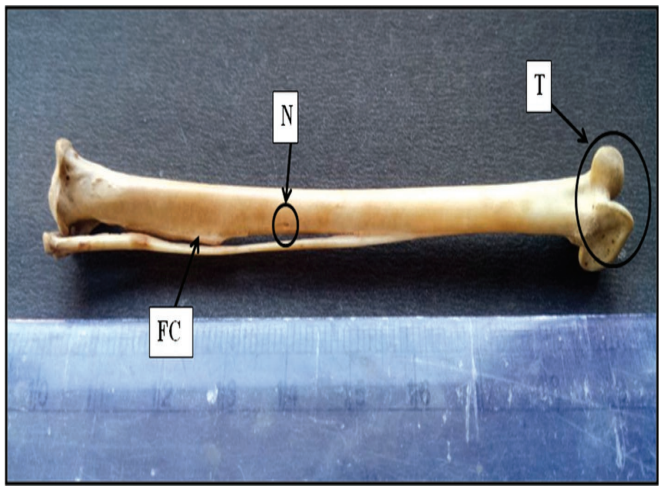

Fig. 3. Postero-lateral aspect of tibiotarsus of Indian eagle owl showing wide grooved trochlea (T), nutrient foramen (N) and fibular crest (FC).

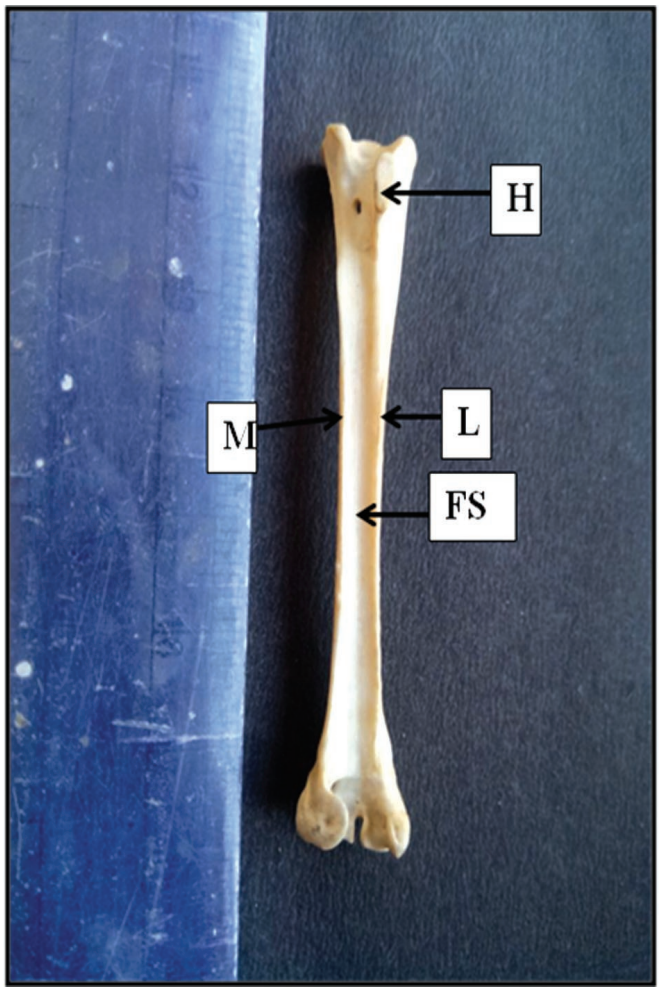

Fig. 4. Planter surface of tarsometatarsus of Indian eagle owl showing hypotarsus (H), lateral crest (L), medial crest (M) and flexor sulcus (FS).

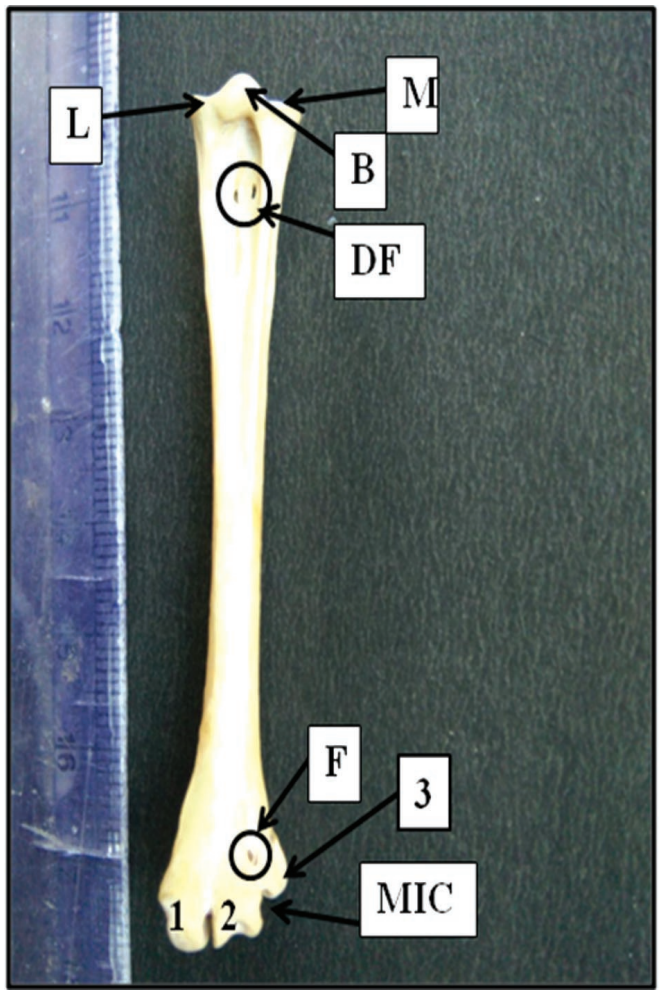

Fig. 5. Dorsal surface of tarsometatarsus of Indian eagle owl showing medial (M) and lateral (L) crests separated by bony protuberance (B), deep fossa containing two foramina (DF), 3rd foramen (F) above medial inter-trochlear cleft (MIC), medial (1), middle (2) and lateral (3) trochlea.

trochlear cleft (Fig. 5). A longitudinal groove known as flexor sulcus (Fig. 4) bounded by lateral and medial crest was observed over the planter surface of the shaft of the bone.

The distal extremity had 3 trochlea separated by two inter-trochlear clefts (Fig. 5) representing metatarsal bone II, III and IV. The middle trochlea presented a distinct groove. Medial articular trochlea was at a higher level than middle and lateral. Medial inter-trochlear cleft was wider than the lateral cleft.

All the biometrical parameters have been presented in Table 1 and Table 2.

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