

Macro-anatomy of Radius and Ulna in Indian Wildcat (*Felis lybica ornata*)

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Received: 08 May 2018; Accepted: 21 June 2018

SUMMARY

Radius was a rod-shaped bone with a shaft and two extremities. Bicipital tuberosity was rough tubercular present on proximal part of the posterior surface and towards the lateral border. Proximal extremity had concave facet circumscribed by a bony rim which was sharp and prominent in its lateral part. The styloid process was placed medially, which was prominent distally. Ulna was longer and heavier than the radius and located medio-laterally to radius. The proximal extremity of ulna had an olecranon process, an anconeus and trochlear notch for trochlea of humerus. The olecranon process was well developed with trifid summit. The distal extremity was much smaller than the proximal and was consisted of the styloid process laterally and one small convex facet for ulnar notch of radius.

Key words: Radius, Styloid process, Ulna, Wild cat

According to the conservation status, this species is listed under the species of least concern in International Union for Conservation of Nature and Natural Resources red list due to its wide ranged distribution. Apart from the wide distribution of this species, the available literature revealed that the anatomical description on the morphology of the bones of Indian wild cat is very meagre, thus the present study was planned on the radius and ulna bones of Indian wild cat to record its specific anatomical characteristics.

The present study was conducted on radius and ulna of four adult Indian wild cats. The bones were collected after maceration and observed for gross morphological features.

The forearm skeleton was formed by radius and ulna, which were articulated at their extremities with a narrow interosseous space.

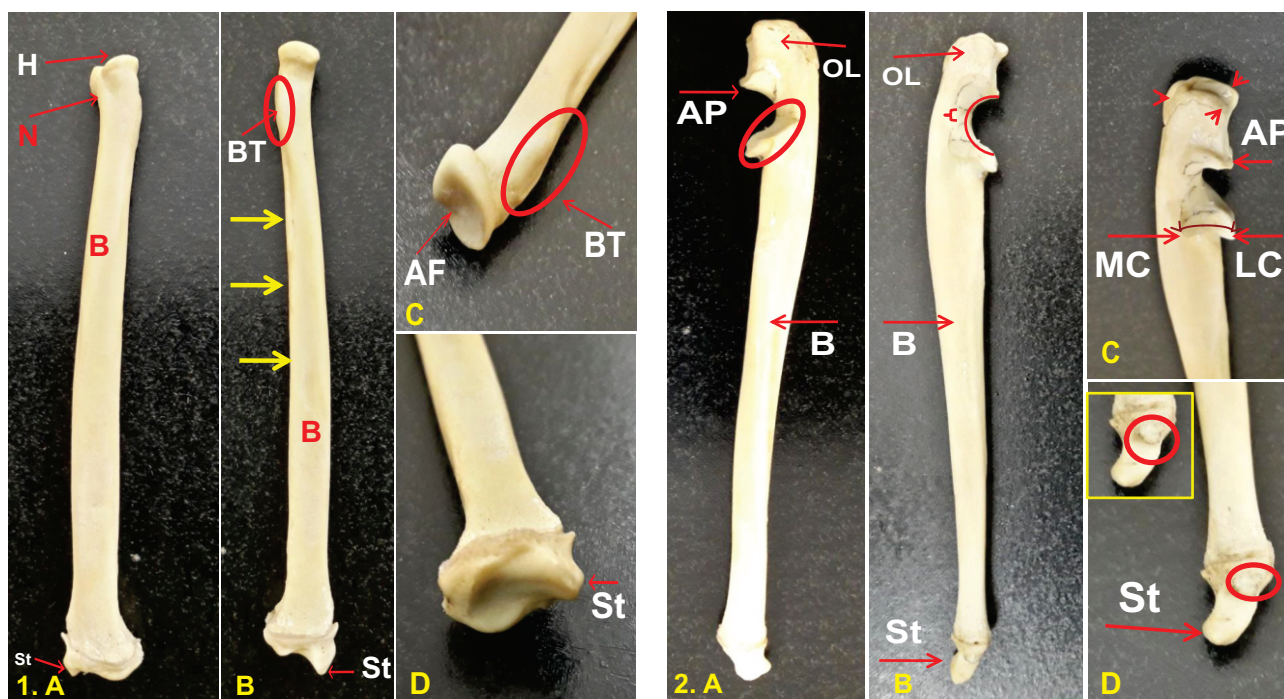
Radius: The radius was a rod-shaped bone which was composed of shaft, proximal and distal extremities. The shaft was curved above downward and compressed cranio-caudally. It was consisted of two surfaces and two borders. The anterior surface (Fig. 1A) was convex while the posterior surface was flattened as reported by Rosu *et al.* (2016) in cheetah and Tomar *et al.* (2018) in royal Bengal tiger. The muscular ridge was present on the middle third of the

anterior surface. Bicipital tuberosity was rough and tubercular and it was present on proximal part of the posterior surface (Fig. 1B), towards the lateral border whereas, Tomar *et al.* (2018) mentioned it as semilunar-quadrangular shaped. The radial tuberosity was closely located to the rim of articular fovea of radius and was in the form of small rough area as observed by Nzalak *et al.* (2010) in lion. In contrast, the shaft of the radius and ulna of the cheetah were relatively straight and slender, with poorly developed distal ends (Ohale and Groenewald, 2003).

The proximal extremity (Fig. 1C) was oval in outline and contained concave articular fovea for the capitulum (completely) and trochlea (up to the groove) of humerus. The anterior border of rim was notched centrally whereas posterior border contained convex articular facet for articulation with ulna and termed as articular circumference. The observations were found similar to the findings of Sreeranjini *et al.* (2014) in leopard and Lucky and Harshan (2014) and Tomar *et al.* (2018) in tiger. The rim was more prominent in its lateral part than medial side as reported by Podhade (2007) in leopard and Tomar *et al.* (2018). However, Sundaram *et al.* (2015) mentioned that the proximal extremity of the radius in orange rumped agouti, presented an ovoid articular surface with a groove in the middle to articulate with the humerus and the groove ended in a notch on both the cranial and the caudal margin of the articular surface.

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Figs. 1-2. A-D. **1.** **A.** Radius of Indian wildcat showing anterior surface, head(H), neck (N), body (B) and styloid process of radius (St); **B.** Posterior Surface: bicipital tuberosity(BT), lateral border (yellow arrows), body (B) and styloid process of radius (St); **C.** Proximal extremity: articular fovea (AF) and bicipital tuberosity (BT and encircled); **D.** Distal extremity: styloid process of radius (St). **2.** **A.** showing ulna of Indian wild cat: **A**) Lateral surface: olecranon process (OL), anconeal process (AP), articular surface for humerus (encircled) and body (B); **B.** Medial surface: olecranon process (OL), body (B), trochlear notch (curved line), rough area in trochlear notch (bracket) and styloid process of ulna (St); **C.** Proximal extremity: tubercles of olecranon (arrowheads), anconeal process (AP), lateral coronoid (LC) and medial coronoid (MC) processes of ulna and radial notch (double headed arrow) and **D.** Distal extremity: styloid process of ulna(St) and facet for radius (encircled).

The distal extremity (Fig. 1D) was approximately two times wider than proximal one and had concave articular facets for the carpal bones. The styloid process was placed medially, which was prominent distally. The ulnar notch was elliptical in outline and placed on the lateral aspect of this extremity. The observations were in agreement with those quotations of Pandit (1994) and Tomar *et al.* (2018) in tiger, Ohale and Groenewald (2003) in cheetah, Podhade (2007) and Sreeranjini *et al.* (2014) in leopard. However, Sundaram *et al.* (2015) stated that the styloid process was noticed on the lateral side of the radius in orange rumped agouti. Sreeranjini *et al.* (2014) mentioned that horizontally elongated ulnar notch in leopard helps them to have more degree of rotation between radius and ulna.

ULNA: The ulna was slightly curved laterally in its proximal part followed by medially in its distal part. It was longer and heavier than the radius and located medio-laterally to its fellow. It was comprised of a shaft and two extremities. The shaft was long, straight and compressed medio-laterally. It was two sided in proximal third and three sided (prismatic) towards

distal two third as reported by Sreeranjini *et al.* (2014) in leopard and Tomar *et al.* (2018) in tiger. The proximal part of shaft was laterally compressed with convexity towards lateral side whereas it was opposite in distal part. It had two surfaces with two borders proximally while three surfaces with three borders distally. In proximal part, the lateral surface (Fig. 2A) was rough and convex whereas the medial surface (Fig. 2B) was slightly concave and smooth with rough margins. The distal part had three surfaces viz. anterior, lateral and postero-medial, in which the postero-medial was the broadest surface and it was continuous with the medial surface of the proximal part of ulna. This surface was rough for muscular attachments. Similar reports were made by Sreeranjini *et al.* (2014) in leopard and Tomar *et al.* (2018) in tiger. The proximal extremity (Fig. 2C) had an olecranon process, an anconeus and trochlear notch for trochlea of humerus. The olecranon process was well developed with trifold summit. The caudal tubercle of summit was the largest while lateral tubercle was prominent, thick and smooth and placed cranial to the medial one. These observations were in agreement

with the reports of Sreeranjini *et al.* (2014) in leopard, Lucky and Harshan (2014) and Tomar *et al.* (2018) in tiger. The anconeal process (Processus anconeus) was located immediately proximal to the trochlear notch and it was sharp, saddle shaped and valentine heart shaped in outline. The trochlear notch was smooth, semilunar in shape and rough in middle thus the anconeal process and the facet for humerus were discontinued from each other (Fig. 2B). The trochlear notch was wider distally and contained medial and lateral projections on either side of this notch which were named medial and lateral coronoid process of ulna (Sreeranjini *et al.*, 2014). The lateral coronoid process over hanged the shaft. Between these processes there was a concave surface, the radial notch, which articulated with the caudal rim of the head of the radius as also reported by Lucky and Harshan (2014), Sreeranjini *et al.* (2014) and Tomar *et al.* (2018). The distal extremity (Fig. 2D) was much smaller than the proximal and was consisted of the styloid process, laterally and a small convex facet for ulnar notch of radius, medially which tallied with the reports of Sreeranjini *et al.* (2014) in leopard, Lucky and Harshan (2014) and Tomar *et al.* (2018) in tiger.

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