INVITED REVIEW

A Clinically Oriented Comprehensive Pictorial Review of Canine Elbow Anatomy

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The clinically oriented canine elbow anatomy in its complexity earned a high importance in surgery especially after multiple imaging modalities have been used in the benefit of diagnosis and treatment of canine elbow disorders. The bony, joint, and muscular structures, the arteries, the veins and the nerves supplying the elbow are described and illustrated in textbooks and atlases in the context of the comparative anatomy. Nevertheless, there is no publication focused on all of these structures described together from the skin to the bones in a systematic and topographic order, nor through cross and/or sagittal and coronal sections. The figures used in this article are original and drawn after dissection, cross, sagittal, and coronal sections of the elbow structures. The sections are correlated to the multiple imaging modalities shown in the next article.

Keywords: clinical comprehensive anatomy, elbow, canine

INTRODUCTION

THE ANATOMY of the canine elbow has been fully presented in a number of texts, but with one exception, illustration and description from a diagnostic and therapeutic perspective is not readily available. We provide a comprehensive review of the anatomy of the canine elbow for clinical reference. Presentation of anatomic features of the canine elbow is presented so that it can be readily correlated to diagnostic imaging, used for understanding disease mechanisms, and applied to current and novel treatment strategies. A comprehensive review is provided covering all tissues from superficial to deep, cross-sectional anatomy to correspond to diagnostic imaging, and functional relationships to address disease mechanisms and treatment strategies, which are the topics of the subsequent articles in this issue.

CANINE ELBOW ANATOMY

Fasciae, Cutaneous Blood Vessels, and Cutaneous Nerves

Just beneath the skin, a subcutaneous olecranon bursa may be present to facilitate the smooth gliding of the skin over the olecranon. The elbow is entirely surrounded by the brachial and antebrachial fasciae and on the medial aspect, the superficial antebrachial fascia is added.

The arteries are cutaneous branches of the caudal circumflex humeral A. (cranially), thoracodorsal A. (caudo-laterally and caudomedially), and superficial brachial A. (craniolaterally and craniomedially). Cutaneous branches of the recurrent interosseous A. reach the elbow caudodorsally.

The superficial veins are branches of the collateral ulnar V. (caudally), cephalic V. (cranially), median cubital V. (medially), and branches of the collateral radial and
The cranial cutaneous antebrachial N. (branch of the axillary N.) runs on the cranial aspect of the elbow, in front of, and close to, the lateral cutaneous antebrachial N. (from the superficial branch of the radial N.); the latter splits into a lateral branch for the craniolateral aspect of the elbow, and a medial branch for the craniomedial aspect of the elbow. The medial cutaneous antebrachial N. (from the musculocutaneous N.) supplies the craniomedial aspect of the elbow, caudal to, and close to, the medial branch of the lateral cutaneous antebrachial N. The proximal branch of the caudal cutaneous antebrachial N. (from the ulnar N.) supplies the caudolateral and caudomedial aspects of the elbow. Branches of the intercostobrachial N., and lateral cutaneous branches of the intercostal N. II can also be found on the laterocaudal extent of the elbow.

The arteries and nerves of the elbow, superficial and deep, in topographic relationship with the muscles are shown in Fig 1 (lateral aspect), Fig 2 (medial aspects), and Fig 3 (cranial aspect).
Muscles

The muscles surrounding the elbow belong to the brachial and antebrachial groups of muscles. From the brachial group, the biceps brachii and brachialis Mm. run on the cranial aspect, the long and lateral heads of the triceps brachii M., and the anconeus M. cover the lateral aspect of the elbow, and the medial head of triceps runs on the medial aspect of elbow accompanied by the tensor fasciae antebrachii M. (Figs 1–3). A subtendinous bursa (of the triceps brachii M.) is located between the tendon of this...
muscle and the olecranon (Fig 4). Another subcutaneous
(bicipitoradial) bursa is located between the radius and
the insertion of the biceps brachii M. (Fig 5).

From the antebrachial group, starting on the cranial
aspect and continuing laterally, caudally and medially,
the muscles around the elbow are the brachioradialis M.,
the extensor carpi radialis M., the common digital extensor
M., the lateral digital extensor M., the extensor
carpi ulnaris M., the ulnar head of the deep digital flexor
M., the ulnar and the humeral heads of the flexor carpi
ulnaris M., the superficial digital flexor M., the humeral
head of the deep digital flexor M., the flexor carpi radialis
M., and the 2 deep muscles: the pronator teres M. and the
supinator M. (Figs 1–3). Within the tendon of origin of
the supinator M. an inconstant sesamoid bone can be
found and is outlined as an interrupted circle in Fig 3.

Blood Vessels (Figs 1–3)

The arteries supplying structures of the elbow accom-
panied by veins are the brachial A.V.; collateral radial
A.V.; middle collateral A.V. forming an articular arterial
network caudally and medially (medial cubital articular
rete); collateral ulnar A.V. building an articular arterial
network caudally and laterally (lateral cubital articular
rete); recurrent interosseous A.V. contribute to the lateral
cubital articular rete; recurrent ulnar A.V.; transverse
cubital A.V.; and superficial brachial A.V. which con-
tinue as superficial antebrachial A.V.

The veins without arterial satellite are the cephalic and
the median cubital Vv.
**Nerves (Figs 1–3)**

The nerves around the elbow are the median N., deep and superficial branches of the radial N., and ulnar N.

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**The Elbow Joint**

The elbow joint is a compound joint, consisting of the humeroradial, humeroulnar, and proximal radioulnar joints. There is a joint capsule, collateral ligaments, and other ligaments. The joint capsule covers only the cranial aspect of the elbow. The fibrous joint capsule is attached on humerus proximal to the radial fossa and foramen supratrochleare, and under the head of radius after blending with the annular ligament. The fibrous joint capsule ends laterally and medially at the lateral and medial collateral ligaments, respectively. The collateral ligaments attach proximally to the lateral and medial epicondyles of humerus, respectively, and are divided dis-
Tally into 2 crura. The crura of the lateral collateral ligament blend with the annular ligament and often contain a sesamoid bone. The cranial crura of both ligaments attach to the radius, whereas the caudal crura attach to the ulna. They are considered thickenings of the fibrous joint capsule. There is no fibrous joint capsule on the caudal aspect of the elbow in the dog.

Despite the fact that the oblique ligament is not listed in the Nomina Anatomica Veterinaria (NAV), it is a constant structure listed in books and atlases. It attaches proximal to the lateral aspect of the radial fossa and distally on the medial side of the neck of radius. The distal attachment is bifurcated to allow the passage of the tendons of biceps brachii and brachialis Mm. An additional elastic ligament joins the medial border of the olecranon.
Fig 20. Elbow in extreme flexed medial position.


Fig 22. Transverse section through a dog elbow—oleranon level.

Fig 23. Transverse section through a dog elbow—humeral epicondyle level.
fossa to the medial aspect of the olecranon, just distal to
the olecranon tuberosity. This is the olecranon ligament.

The proximal radioulnar joint is provided with the
annular ligament, which attaches to the lateral and med-
dial ends of the radial notch of ulna and is covered by the
collateral ligaments. It blends its fibers with the fibrous
joint capsule. The annular ligament does not attach to the
radius, to allow it to rotate during pronation and supi-
nation (Figs 6–9).

Figures 10 and 11 show the relationships between the
radius and ulna during the maximal pronation and max-
imal supination, respectively.

The synovial membrane intimately lines the fibrous
joint capsule, and also the olecranon fossa. During flex-
ion and extension, several recesses are formed (Figs 6–9).
Cranially, 1 recess lies in the fossa radialis. It delegates 1
small recess under the attachments of the biceps brachii

The Bones

The distal extremity of the humerus and the proximal
extremities of the radius and ulna including the olecranon
are illustrated in Figs 12–16.

Figures 17 and 18 show the neutral lateral view, and
the caudal view of the elbow bones, respectively.

The neutral medial aspect is shown in Fig 19, and the
extreme flexed medial aspect in Fig 20.

The 15–20° craniolateral–caudomedial oblique aspect
is shown in Fig 21.
Topography

The topography of the bones, ligaments, muscles, vessels, and nerves is shown in 3 cross sections, 1 sagittal and 1 coronal section, in conjunction with computed tomography images. The cross sections are made in a proximo-distal direction, as follows: at the level of the olecranon tuberosity (Fig 22), at the level of the lateral and medial epicondyles of humerus (Fig 23), at the proximal radio-ulnar level (Fig 24). The sagittal section is made through the humerus, ulna and radius at the level of the medial coronoid process (Fig 25). The coronal section is made in front of cranial part of the medial coronoid process with the limb in pronation (Fig 26).

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