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BONE DESCRIPTION OF THE PELVIC LIMB OF THE DOG: LITERATURE REVIEW

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Abstract: Osteology is a branch of anatomy that deals with the structure and function of bones. Bones are composed of highly vascular mineralized connective tissue, which is spread widely throughout the animal's body and exhibits considerable rigidity. The skeleton of the dog's pelvic limb is formed by the bones that form the hip, ilium, ischium and pubis; by the bones of the thigh, femur and patella; bones of the leg, tibia and fibula and the bones of the foot, seven of which make up the tarsus, five metatarsals, the proximal, middle and distal phalanges and the sesamoid bones. Aiming to obtain greater knowledge of the bone anatomy of the dog in order to apply it both in the teaching of veterinary medicine and in clinical and surgery, this work brings a literature review of the bone description of the pelvic limb of the dog.
Keywords: Anatomy. Canine. Veterinary. Osteology.

INTRODUCTION

The pelvic limb anatomy can be divided into bones, joints, muscles, irrigation, venous and lymphatic drainage and innervation. The bony portion is formed by the pelvic girdle, the thigh, the leg and the foot.

The sacrum, ilium, ischium and pubis bones make up the pelvic girdle, the thigh is formed by the femur and patella bones, the leg by the tibia and fibula bones and the foot by the tarsus, metatarsals, phalanges and sesamoids (GETTY, 1986; SCHALLER, 1999; EVANS; deLAHUNTA, 2001; DONE et al., 2002; EVANS; deLAHUNTA, 2010).

Knowledge of the dog's bone anatomy is important in veterinary medicine, both in the academic and clinical-surgical areas, as cases of dogs with some type of disorder in this system are common. Thus, this work aims to review the literature on the description of the bones that make up the pelvic limb of dogs.

REVIEW OF LITERATURE

PELVIC GIRDLE

The pelvic girdle is formed by the two coxal bones, ventrally united at the pelvic symphysis and dorsally attached on both sides by a flat synovial joint with the sacral bone (GETTY, 1986; SCHALLER, 1999; EVANS; deLAHUNTA, 2001; DONE et al, 2002; KÖNIG; LIEBICH, 2004; EVANS; deLAHUNTA, 2010). The coxal bones together with the sacrum and the first caudal vertebrae form the bony pelvis, which delimits the pelvic cavity (KÖNIG; LIEBICH, 2004) (Figure 1).

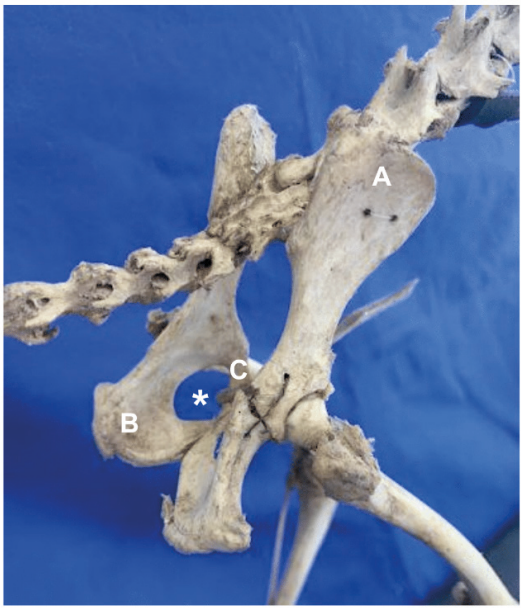

Figure 1 – Right dorsolateral view of the bony pelvis of a small dog, comprising the ilium (A), ischium (B) and pubis (C) bones. The obturator foramen is between the ischial and pubic bones (*).

Source: The authors (2023)

Each coxal bone is made up of three bones: the ilium, ischium, and pubis. These three bones come together at the acetabulum. The pubis and ischium bones on each side unite ventrally in the median longitudinal plane, through fibrocartilaginous connective

tissue, the pelvic symphysis (SCHALLER, 1999; EVANS; deLAHUNTA, 2001; DONE et al., 2002; KÖNIG; LIEBICH, 2004). The pelvic symphysis can be divided into a pubic symphysis and an ischial symphysis (GETTY, 1986; KÖNIG; LIEBICH, 2004). The hip bone is the largest flat bone and forms, with its pair on the opposite side, a synostosis along the midline, the pelvic symphysis (GETTY, 1986). (Figure 2)

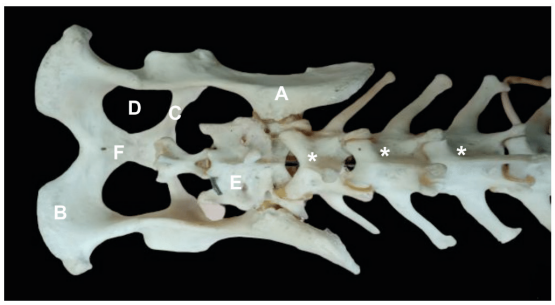

Figure 2 – Dorsal view of the bony pelvis of a small dog, composed of the ilium (A), ischium (B) and pubis (C) bones. The obturator foramen is quadrilateral in shape with rounded angles (D).

Source: The authors (2023). It is possible to observe the last four lumbar vertebrae (*) and the relationship of the coxal bones with the sacrum (E) and the first caudal vertebrae forming the bony pelvis. The ischial and pubic bones fuse in the midline with the opposite antimere forming the pelvic symphysis (F).

The acetabulum (Figure 3) is a deep cotyloid joint cavity like a half-sphere, where the body of the ilium projects craniolaterally, the body of the ischium caudolaterally, and the body of the pubis medially). The acetabular cavity receives the head of the femur and its ligaments forming a spheroid joint. In the joint cavity we find the lunate face, which has a semilunar shape and represents the peripheral zone of the cavity. The acetabular cavity is enlarged by the fibrocartilaginous acetabular labrum. The acetabular margin is interrupted medially between the body of the pubis and the ischium by an acetabular notch, which is crossed by the ligament of the head of the femur, which inserts into a depression within the acetabulum, the acetabular fossa. LIEBICH, 2004). The acetabular notch is small and located caudally. The acetabular fossa is deep, is limited medially by a flat bone plate and its floor is very thin that it becomes translucent (GETTY, 1986). The acetabular fossa is formed by the ischium and the acetabular bone and is where the femoral head ligament attaches. The acetabular fossa and notch are the non-articular parts and the two sides of the notch are joined by the acetabular transverse ligament.

Figure 3–Left lateral view of the bone pelvis of a small dog, where it is possible to observe the acetabulum(*).

Source: The authors (2023)

The obturator or obturator foramen (Figure 1 and 2) has a quadrilateral shape with rounded angles (GETTY, 1986). The foramen is closed by the obturator membrane and the external and internal obturator muscles (EVANS; deLAHUNTA, 2001). The obturator foramen is a large opening in the pelvic floor, where the obturator nerve passes through the obturator groove (GETTY, 1986; EVANS;

deLAHUNTA, 2001).

The cranial opening of the pelvis is oblique, almost circular in the female, and is elliptical and larger in the male. The cavity is narrowest between the acetabulum and is long caudally. The floor is concave and relatively narrow cranially and wide and flat caudally (GETTY, 1986).

The ilium is almost parallel to the median plane and its axis is slightly oblique to the horizontal plane. It is a flat bone, with two surfaces and three margins. The body of the ilium is almost sagittal, the caudal part is narrow and laterally compressed. It is smooth, rounded dorsally and has a ventrolateral crest, the ventral gluteal line, which ends in a tuberosity cranial to the acetabulum (GETTY, 1986; EVANS; deLAHUNTA, 2001).

The wing of the ilium is the broad cranial part of the bone and laterally concave (EVANS; deLAHUNTA, 2001). In the wing of the ilium, the coxal tuberosity stands out, which forms the lateral angle of the coxal bone, which is palpable in dogs and has an alar spine ventrally (KÖNIG; LIEBICH, 2004). The medial end of the wing presents the sacral tuberosity, which is a thickened, palpable area divided by two eminences, the cranial dorsal iliac spine and a caudal dorsal iliac spine (GETTY, 1986; KÖNIG; LIEBICH, 2004).

The coxal tuberosity is composed of the ventral cranial iliac spine and part of the ventral border of the wing of the ilium, the remainder of the ventral border being concave and ending in the area lateral to the rectus femoris, cranial to the acetabulum.) The coxal and sacral tuberosities are united by the iliac crest, convex and rounded (KÖNIG; LIEBICH, 2004). The coxal tuberosity has two prominences, the cranial and caudal ventral iliac spines (GETTY, 1986). The angle of junction of the iliac crest with the ventral margin is the ventral cranial iliac spine, which serves as the site of origin for the sartorius muscles and part of the tensor fascia lata muscle. The dorsal cranial iliac spine is a rounded prominence formed from the junction of the dorsal border of the ilium (which is broad and massive) with the iliac crest. Caudal to the dorsal cranial iliac spine is the dorsal caudal iliac spine and both form the sacral tuberosity, which occupies half the length of the dorsal margin of the ilium.

The wings of the ilium have an external surface or gluteal face, which serves with its extensive concave surface for the insertion of the gluteal muscles. This surface is divided by the gluteal lines in carnivores. The inner surface of the wing of the ilium or sacropelvic surface is divided, its lateral surface presents the iliac surface for insertion of the thigh muscles and its medial surface has the iliac tuberosity and the auricular surface. The gluteal surface is ventrocranially rough and concave and the sacropelvic surface is almost flat and smooth (GETTY, 1986). The gluteal or outer surface of the wing of the ilium is flattened caudally and concave cranially, where it is bounded by the iliac crest. The dorsal part of this concave area is bordered by a massive ridge. The sacropelvic or inner surface of the wing of the ilium provides attachment for the longissimus and quadratus lumborum muscles.

Cranial to the dorsomedial border of the sacrum is a large depression, the greater sciatic notch, where the sciatic nerve passes. The ventral border of the sacropelvic surface of the body of the ilium to the auricular surface (to the iliopubic eminence of the pubis) extends in the arcuate line, where in the medial portion the tubercle of the psoas minor muscle rises, on which the psoas minor muscle inserts (EVANS; deLAHUNTA, 2001; KÖNIG; LIEBICH, 2004). According to Getty (1986), the arcuate line is distinct and uninterrupted.

The auricular surface lies medially, is rough, and articulates with the auricular surface of

the sacrum, forming the sacroiliac joint. The greater sciatic notch is elongated, very shallow (GETTY, 1986; EVANS; deLAHUNTA, 2001), and it is formed by the caudal half of the dorsal margin (gently concave) of the ilium and this also helps in the formation of the ischial spine, dorsal to the acetabulum. (EVANS; deLAHUNTA, 2001).

The crest of the ilium is the arciform cranial margin of the ilium, strongly convex, rough and thin, but gradually increases in thickness in the dorsal direction (GETTY, 1986; EVANS; deLAHUNTA, 2001)

The ischium has a twisted appearance, as its acetabular part is almost sagittal and the caudal part is almost horizontal. The bone diverges caudally with the contralateral ischium and the tuberosities are flattened and inverted (GETTY, 1986). It forms the caudal part of the coxal bone and participates in the formation of the acetabulum, the obturator foramen and the pelvic symphysis (EVANS; deLAHUNTA, 2001).

The ischial bone is formed by the body, the board and the ramus. The board delimits the obturator foramen with a symphysial branch and, caudally, with the acetabular branch. The ischial branch, together with the branch on the opposite side, forms the sciatic symphysis as a caudal segment of the pelvic symphysis (KÖNIG; LIEBICH, 2004).

The body, with its acetabular branch, contributes to the formation of the acetabulum and forms with the ilium an ischial spine, continuing caudally into the lesser sciatic notch. The table of the ischium forms a protruding ischial tuberosity caudolaterally, which represents a thick protuberance in carnivores (KÖNIG; LIEBICH, 2004). The lateral angle of the ischial tuberosity is dilated, hook-shaped, and provides attachment for the sacrotuberous ligament.

The medial angle is rounded. The ventral surface is the point of origin for the biceps femoris, semitendinosus, and semimembranosus muscles. The root of the penis and the muscle surrounding it also attach at the ischial tuberosity.

The ischial spine is low, thick and its caudal part is marked by transverse grooves (due to the tendon of the obturator internus muscle) and has a prominent lateral lip (GETTY, 1986). The ischial spine is a rounded ridge dorsal to the acetabulum, where the body of the ischium meets the ilium. The coccygeal muscle inserts into it. (EVANS; deLAHUNTA, 2001).

The lesser sciatic notch is shallow, smooth and rounded for the passage of the tendon of the obturator internus muscle. The sciatic arch is relatively small and semi-elliptical (GETTY, 1986) and is formed in the caudal margin of the ischium (EVANS; deLAHUNTA, 2001).

The ramus of the ischium is the thin and wide medial part of the bone. It is limited laterally by the obturator foramen. The ramus joins with the contralateral bone at the ischial symphysis and merges with the pubis cranially. The adductor and obturator externus muscles originate on the ventral surface of the ramus and the obturator internus muscle originates on the dorsal surface (EVANS; deLAHUNTA, 2001).

The pubic bone has an "L" shape and is composed of the body, the cranial acetabular branch and the caudal branch (EVANS; deLAHUNTA, 2001; KÖNIG; LIEBICH, 2004). The pubis extends from the ilium and ischium, laterally to the symphysis, which is medial (EVANS; deLAHUNTA, 2001).

The body is cranial to the obturator foramen. The cranial branch extends from the body to the ilium and participates in the formation of the acetabulum. The caudal branch merges with the ischium in the middle of the pelvic symphysis. The ventral surface of the pubis is the site of origin for the gracilis, adductor, and obturator externus muscles. The dorsal surface is where part of the internal

obturator. (EVANS; deLAHUNTA, 2001).

On the cranial margin of the acetabular branch are the lateral and medial iliopubic eminences for the insertion of the abdominal musculature and the pectineus muscle. The symphyseal part of the pubis is thick and merges with the opposite bone (GETTY, 1986; EVANS; deLAHUNTA, 2001). The pubic tubercle projects cranially from the pubis in the midline. The pecten is the rough cranial border of the pubis between the iliopubic eminences and into it the muscles of the abdomen are inserted by the prepubic tendon. The prepubic tendon is composed of the tendons of the rectus abdominis and the pectineus muscle (EVANS; deLAHUNTA, 2001).

THIGH

The thigh skeleton is formed by the femur bone, which is the longest bone in the body, and by the patella (SCHALLER, 1999; EVANS; deLAHUNTA, 2001; DONE et al., 2002; KÖNIG; LIEBICH, 2004). (Figure 4)

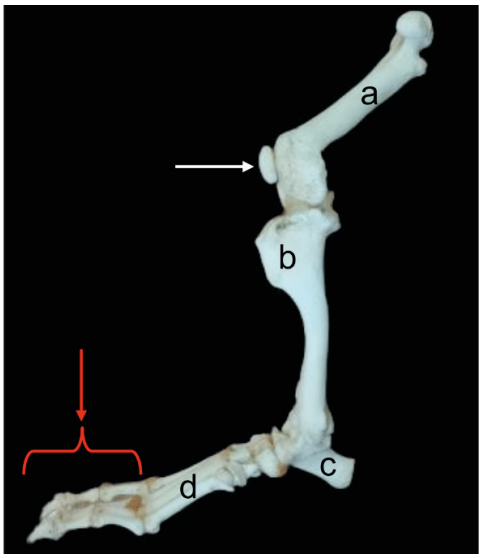

Figure 4 – Medial view of part of the right pelvic limb of the dog. In the image it is possible to visualize the femur (a), the patella (white arrow), the tibia (b), the tarsus (c), the metatarsals (d) and phalanges (red arrow)

Source: The authors (2023)

The femur (Figure 5) has a proximal end, a middle portion or body and a distal end (KÖNIG; LIEBICH, 2004). The proximal end (Figure 6) has the femoral head, with a cartilage-free articular zone. The medial surface of the head is smooth and almost hemispherical. The fovea capitis is circular, shallow, centrally located, and serves for the insertion of the femoral head ligament (EVANS; deLAHUNTA, 2001; KÖNIG; LIEBICH, 2004). For Getty (1986), the fovea of the head of the femur is caudal and lateral to its center. The head of the femur is joined to the body by the neck of the femur, which is well defined, short and serves as a connection for the joint capsule. Lateral to the head there is the greater trochanter, which does not extend as high as the head and is where the gluteus medius and deep muscles are inserted (GETTY, 1986; EVANS; deLAHUNTA, 2001; KÖNIG; LIEBICH, 2004). The trochanteric fossa is a round, deep cavity located between the greater trochanter and the femoral neck, medially to the greater trochanter, and serves as the insertion point for the deep musculature of the coxofemoral joint (twin muscles and external and internal obturator). Medially, the head of the femur has the lesser trochanter, where the iliopsoas muscle is inserted (EVANS; deLAHUNTA, 2001; KÖNIG; LIEBICH, 2004). The lesser trochanter has the shape of a blunt tuberosity (GETTY, 1986), it is a pyramidal projection at the proximal end of the medial side of the body of the femur. The intertrochanteric ridge is a bony ridge from the end of the greater trochanter to the lesser trochanter, it represents the caudolateral limit of the trochanteric fossa and is where the quadratus femoris muscle inserts. At the base of the greater trochanter there is a small rough area where the superficial gluteal muscle is inserted. Most of the quadriceps muscle of the thigh attaches to the cranial proximal part of the femur (EVANS; deLAHUNTA, 2001).

Figure 5 - Canine right femur, cranial view

Source: The authors (2023)

Figure 6 - Proximal end of canine right femur, caudomedial view

Source: The authors (2023)

The middle segment is the body of the femur, where the popliteal surface is found distally (KÖNIG; LIEBICH, 2004). The body of the femur is regularly cylindrical, except near the ends, where it is wider and compressed craniocaudally, appearing convex cranially and the surface is smooth and rounded. It is strongly curved in its distal two-thirds and convex cranially. The caudal surface (Figure 7) or rough face is rough and is flattened transversely, narrows in the middle, and widens towards the ends. It is bounded by two rough lines (lateral and medial lips), which diverge towards the ends. The third trochanter is small, less developed (GETTY, 1986; EVANS; deLAHUNTA, 2001). The proximal part of the medial labrum ends at the lesser trochanter and the distal part at the medial supracondylar tuberosity. The proximal part of the lateral labrum ends at the third trochanter and the distal part at the lateral supracondylar tuberosity. The adductor muscle inserts on the caudal rough surface and a tendon extends from the pectineus muscle to the distal part of the medial labrum, where the semimembranosus muscle also inserts.

Figure 7 - Caudal view of canine right femur

Source: The authors

In the body of the femur, the supracondyloid

fossa is absent. There are two supracondyloid tuberosities, the medial one being smaller. The nutrient foramen is located in the proximal third of the caudal surface (GETTY, 1986).

The distal end has two articular surfaces, the lateral and medial condyles, which articulate with the tibia and the two menisci at the femorotibial joint. The two condyles are separated by an intercondylar fossa and above them are the lateral and medial epicondyles (EVANS; deLAHUNTA, 2001; KÖNIG; LIEBICH, 2004). The intercondylar notch is wide, a wide, deep space and is where the cruciate ligaments are inserted (GETTY, 1986; EVANS; deLAHUNTA, 2001). Caudally to the lateral condyle there is a popliteal fossa, as the surface of origin of the popliteus muscle (KÖNIG; LIEBICH, 2004). The condyles are convex transversely and longitudinally, and in carnivores the caudal surface of each condyle is occupied by small, flat articular surfaces that serve to articulate with the two small sesamoid bones of the gastrocnemius muscle (fabella), situated in the tendon of origin of the muscle (GETTY, 1986; EVANS; deLAHUNTA, 2001; KÖNIG; LIEBICH, 2004). Proximal to the sesamoid facets are the medial and lateral supracondylar tuberosities, and on the lateral side also originates the flexor digitorum superficialis muscle. The popliteal surface is a flattened triangular area on the caudal surface of the distal end, proximal to the condyles and the intercondylar notch (EVANS; deLAHUNTA, 2001).

The medial and lateral epicondyles are rough areas on each side, proximal to the condyles, and serve as the attachment for the collateral ligaments of the knee. The lateral epicondyle also gives rise to the popliteus muscle. The extensor fossa is small and is located over the lateral epicondyle at the junction of the lateral condyle and the lateral lip of the trochlea, where the extensor digitorum longus muscle originates. The semimembranosus muscle is inserted proximally to the medial epicondyle (EVANS; deLAHUNTA, 2001).

At the distal end, the femoral trochlea is a smooth groove in the craniodistal part of the bone to the patellar joint, and the medial trochlear labrum is thicker than the lateral one. The trochlea of the femur is continuous with the condyles (EVANS; deLAHUNTA, 2001).

Cranially, the femoral trochlea presents two low and rounded eminences, separated by an intermediate groove and more or less the same size (KÖNIG; LIEBICH, 2004).

The patella (Figure 8) is long and narrow (GETTY, 1986), and it behaves like a sesamoid bone in the tendon of the quadriceps femoris muscle and presents its joint surface facing the femur. Its free surface is convex and lies on the skin. The proximal base serves as a muscle insertion surface and its apex is directed ventrally (EVANS; deLAHUNTA, 2001; KÖNIG; LIEBICH, 2004). The articular surface is convex, from side to side, and slightly concave proximately (GETTY, 1986). The patella helps protect the tendon and the joint and directs the quadriceps insertion tendon (EVANS; deLAHUNTA, 2001).

LEG

The skeleton of the leg (Figure 9) is the distal segment of the pelvic limb and is composed of the tibia, which is a stronger bone and is located medially, and the fibula, which is more fragile and lateral. In carnivores, the fibula reaches the length of the tibia (SCHALLER, 1999; DONE et al., 2002; KÖNIG; LIEBICH, 2004).

The tibia is approximately the same length as the femur (GETTY, 1986). The tibia participates in the formation of the knee joint. The tibia is composed of a proximal end, a body and a distal end (KÖNIG; LIEBICH, 2004).

The proximal end (Figure 10) has articular

surfaces for the femoral condyles and menisci and serves as the attachment surface for the collateral and cruciate ligaments. It also presents a popliteal notch for the popliteus muscle (KÖNIG; LIEBICH, 2004). The proximal joint surface projects transversely and widens craniocaudally, being wider than the distal end of the femur (EVANS; deLAHUNTA, 2001). The proximal end has a triangular structure and two condyles, one lateral and one medial. Each condyle has a proximal articular surface that receives the condyles of the femur and the menisci. The lateral condyle is more prominent. Between the two joint surfaces it has a central intercondylar eminence, which divides into a central intercondylar area and a lateral and a medial intercondylar tubercle, and cranially there is a cranial intercondylar area. The cranial intercondylar area is a depression cranial to the eminence between the condyles and provides attachment to the cranial parts of the menisci and the cranial cruciate ligament. The caudal intercondylar area is caudal to the intercondylar eminence and provides attachment for the caudal parts of the menisci and the caudal cruciate ligament. On the lateral face of the lateral condyle there is the articular face for the head of the fibula and craniolaterally there is the extensor groove for the long digital extensor muscle. According to Getty (1986) and Evans and deLahunta (2001), there is a small facet for the fibula on the caudolateral part of the lateral condyle, and a small sesamoid bone (in the tendon of origin of the popliteus muscle) is in contact with the caudal angle of the latter. The menisci are two biconcave fibrocartilages that are between the condyles of the femur and tibia, making the joint congruent. The popliteal notch is caudal to the caudal intercondylar area, is located between the two condyles and through it pass the popliteal vessels (EVANS; deLAHUNTA, 2001).

Figure 10 - Proximal end of dog tibia, dorsal view

Source: The authors (2023)

The body of the tibia forms a double curve, the proximal part being convex medially and the distal part convex laterally (GETTY, 1986). At the proximal end of the tibial body there is the tibial tuberosity and the cranial portion of the body shows a slight curvature, the cranial margin (KÖNIG; LIEBICH, 2004). The proximal third is prismatic in shape, compressed laterally and long craniocaudally, it is long in the middle of the body and has four sides distally. The cranial rim or crest of the tibia is short and prominent. The nutritional foramen is present in the proximal third of the lateral edge (GETTY, 1986).

The tibial tuberosity is a quadrangular process on the proximal and cranial surface, and is where the quadriceps femoris, biceps femoris, and sartorius muscles attach via the patella and patellar ligament. The tibial tuberosity continues distally, where the biceps femoris, semitendinosus, gracilis, and sartorius muscles attach. The extensor groove is smooth and small, it is at the junction of the lateral condyle and the tibial tuberosity. In the proximal third of the caudal surface, the popliteus muscle inserts medially and the flexor digitorum profundus muscle originates

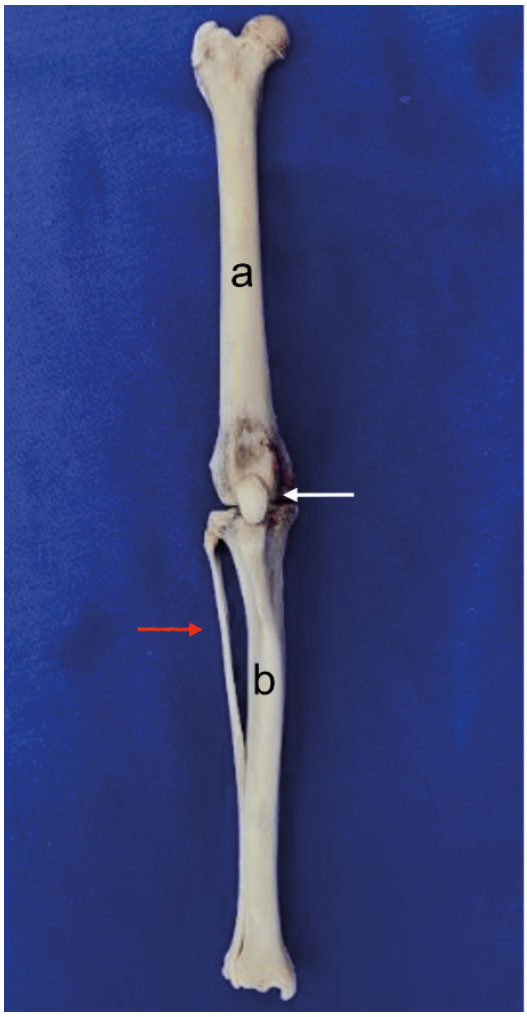

Figure 8 - Cranial view of the right canine femur (a) with the patella (white arrow), articulating with the tibia (b) and fibula (red arrow).

Source: The authors

Figure 9 - Cranial view of the dog's right leg, composed of the tibia (a) and fibula (arrow) bones

Source: The authors (2023)

laterally (EVANS; deLAHUNTA, 2001).

The distal end is square and relatively small. The grooves and the articular projection are almost sagittal (GETTY, 1986). The distal end has the division of the trochlea of the tibia that articulates with the trochlea of the talus (Figure 11). An intermediate articular crest disposed sagittally articulates in the trochlea (EVANS; deLAHUNTA, 2001; KÖNIG; LIEBICH, 2004). On the lateral side, a projection is formed, the lateral malleolus, which in carnivores articulates with the distal end of the fibula (GETTY, 1986; EVANS; deLAHUNTA, 2001; KÖNIG; LIEBICH, 2004). There is also a vertical groove, medially, and a shallower juice, caudally, for the insertion of tendons (GETTY, 1986). On the medial side of the distal end is the medial malleolus (EVANS; deLAHUNTA, 2001).

Figure 11 - Trochlear cavity of dog tibia

Source: The authors (2023)

The fibula (Figure 9) is thin, slightly twisted and widened at the ends (GETTY, 1986). The fibula has a proximal end with a head and neck, a body, and a distal end with the lateral malleolus. In carnivores, the fibula follows the entire length of the tibia, complementing the insertion surface for the crural musculature and support for the tibiofibulotarsal joint (EVANS; deLAHUNTA, 2001; KÖNIG; LIEBICH, 2004). The head of the fibula articulates with the lateral condyle of the tibia (EVANS; deLAHUNTA, 2001). The fibula is separated from the tibia by a long crural interosseous space filled with connective tissue, developed only at the proximal end (GETTY, 1986; KÖNIG; LIEBICH, 2004), the distal part is flattened and closely applied to the tibia. The distal end is somewhat thicker and forms the lateral malleolus. The lateral malleolus articulates medially with the tibia and talus (GETTY, 1986). The lateral malleolus has two grooves that contain the tendons of the peroneus longus, peroneus brevis and lateral extensor digitorum muscles (EVANS; deLAHUNTA, 2001).

The fibula laterally separates the cranial musculature from the caudal musculature of the leg. In lean dogs, the fibula is palpable along its entire length, and in muscular dogs, only the fibular head and proximal segment of the body can be palpated. The head of the fibula is united with the lateral condyle of the tibia by a joint on the articular surface of the head (GETTY, 1986).

FOOT

The foot skeleton (Figure 12) forms the bone base of the extremity of the pelvic limb and is composed, from proximal to distal, of the tarsal, metatarsal and digital bones of the foot (SCHALLER, 1999; DONE et al., 2002; KÖNIG; LIEBICH, 2004).

The tarsal or hock bones are arranged in a proximal row, a middle row and a distal row. The proximal row articulates with the cochlea of the tibia as the tarsocrural joint, and the distal row articulates with the metatarsal bones at the tarsometatarsal joint.

In carnivores, there are seven tarsal bones (GETTY, 1986; EVANS; deLAHUNTA, 2001;

Figure 12 - Foot bones of chondrodystrophic breed dog, side view

Source: The authors (2023)

KÖNIG; LIEBICH, 2004). In the proximal line of the tarsus medially has the tarsotibial bone or talus and laterally has the tarsofibular or calcaneus. In the intertarsal line has the central tarsal bone, medially. In the distal line they contain, from medial to lateral, the first tarsal bone, the second tarsal bone, the third tarsal bone and the fourth tarsal bone (KÖNIG; LIEBICH, 2004).

The tarsotibial, talus or astragalus is positioned medially on the crural line of the tarsus and is characterized by a compact body, a neck and a head, and differentiates into the trochlea of the talus. The body presents the trochlea of the talus, proximally, with two ridges separated by a groove to articulate with the trochlea of the tibia, with the fibula and with the lateral and medial malleoli (this is the tarsocrural joint). The head of the talus is more medially and is joined to the central tarsal bone by an articular tubercle, is separated from the body by a neck, and projects laterally in a cone shape. The small curvature of the articular surface for the central tarsal bone restricts its movement. The plantar and lateral surfaces articulate with the calcaneus on the calcaneal articular surface (GETTY, 1986; KÖNIG; LIEBICH, 2004). The talus articulates laterally with the calcaneus and distally with the central tarsal bone.

The tarsofibular or calcaneus is positioned plantar and lateral to the talus, with which it is joined dorsally and medially by the talar articular surfaces. Distally it forms the articular surfaces for the fourth tarsal bone. At the free end, the calcaneal tuberosity is positioned, which is a palpable bone point (KÖNIG; LIEBICH, 2004). The calcaneal tuberosity is a process that projects both proximally and caudally. The extensor muscles of the tarsus are inserted into it by the common Achilles tendon (EVANS; deLAHUNTA, 2001). The calcaneus has a dorsal coracoid process and the talus sustainacle is short (GETTY, 1986). The strut of the talus is also a palpable bone projection, directed medially and which has on its plantar surface a groove for the tendon of the flexor digitorum longus muscle (KÖNIG; LIEBICH, 2004) and for the tendon of the flexor digitorum lateralis muscle (EVANS; deLAHUNTA, 2001). At the base of the tarsofibular, the coracoid process is narrow and articulates with the fourth tarsal bone. The calcaneus articulates with the talus and the fourth tarsal bone (EVANS; deLAHUNTA, 2001).

The central tarsal bone has a concave proximal surface adapted for the head of the

talus. Its distal surface articulates with the first, second, and third tarsal bones. It bears two plantar tubercles. The first tarsal bone is flattened, irregularly quadrangular and its proximal surface articulates with the central tarsal bone and its distal surface with the first metatarsal bone (GETTY, 1986).

The second tarsal bone is the smallest and wedge-shaped. It articulates distally with the second metatarsal bone. The third tarsal bone is also wedge-shaped, the base is dorsal and articulates distally with the third metatarsal bone. The fourth tarsal bone is elevated, similar to a quadrangular prism, its proximal surface articulates with the calcaneus, the distal surface with the fourth and fifth metatarsal bones, and the medial surface with the central tarsal bone and the third tarsal bone (GETTY, 1986). A groove for the tendon of the peroneus longus crosses its lateral and plantar surface; and next to it there are one or two tubercles (GETTY, 1986; EVANS; deLAHUNTA, 2001). The fourth tarsal bone has the combined length of the third and central tarsal bones (EVANS; deLAHUNTA, 2001).

The metatarsal is composed of five metatarsal bones and they articulate with the fingers (Figure 13). The first metatarsal bone is positioned medially, is narrow, short, has the shape of a blunt cone and is somewhat compressed laterally (GETTY, 1986; KÖNIG; LIEBICH, 2004). The first metatarsal bone articulates with the first tarsal bone and provides attachment for the cranial tibial muscle. In some cases, this bone can merge with the first tarsal bone (GETTY, 1986).

Figure 13 - Bones of the canine foot, dorsal view

Source: The authors (2023)

Middle pairs are the longest. The proximal epicondyles exist only laterally and at the base of the second and third metatarsals, and the distal epicondyles lie on either side. The distal trochlea presents ridges on the palmar surface for the union with the sesamoid bones (KÖNIG; LIEBICH, 2004). The proximal ends are elongated dorsoplantarly and have plantar projections. In the third and fourth metatarsal bones, they have facets for the articulation of the two small and rounded sesamoid bones (GETTY, 1986).

With regard to the phalanges, the first finger, or hallux, is often absent, but when present it may lack the middle phalanx (GETTY, 1986; KÖNIG; LIEBICH, 2004) or be a fully developed finger articulating with the first metatarsal bone (EVANS; deLAHUNTA, 2001). The distal phalanges are like claw bones, compressed laterally and at their sharp ends the hoof is attached. In the distal phalanx, a parietal surface is differentiated, with a caudal and two lateral segments, and a

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soleus surface. In the palmar direction it has a flexor tubercle, laterally and dorsally there is an ungicular crest and in the distal direction it has an ungicular sulcus. On both sides of the ungicular tuberosity there is an axial and abaxial soleus foramen. In the palmar sense, in the metatarsophalangeal joint of the second to fifth finger, the sesamoid bones are positioned, one for each finger. These bones are usually bony and rarely cartilaginous (KÖNIG; LIEBICH, 2004). In large dogs, a sixth digit may be present, which does not articulate with the metatarsus and is inserted by fibrous tissue (GETTY, 1986).

CONCLUSION

The anatomical study of the general osteology of the pelvic limb of the dog is complex and important to understand and acquire a basic understanding, which must be present in the academic training and routine of the veterinarian, because based on this knowledge, the professional will be able to carry out interpretation of exams and semiological findings, in order to perform procedures based on the fundamentals of the functioning of the studied region.

REFERENCES

CAMPOS, R. **Estudo topográfico dirigido:** dissecação em cães. Polígrafo UFRGS – Faculdade de Veterinária. Anatomia Animal. 2008

DONE, S. H. *et al*. **O membro pélvico.** In: _____. Atlas colorido de anatomia veterinária do cão e do gato. 1.ed. São Paulo: Manole, 2002. v. 3, p. 7.1-7.37.

DYCE, K. M.; SACK, W. O.; WENSING, C. J. G. **Membro posterior dos carnívoros**. In: _____. Tratado de anatomia veterinária. 2.ed. Rio de Janeiro: Guanabara Koogan, 1997. p. 367-375.

EVANS, H. E.; deLAHUNTA, A. **Guia para a dissecação do cão**. 5. ed. Rio de Janeiro: Guanabara Koogan, 2001. 250p.

EVANS, H. E.; deLAHUNTA, A. Abdomen, pelvis and pelvic limb. In: _____. **Guide to the dissection of the dog**. 7. ed. St. Louis: Saunders Elsevier, 2010. p. 137-207.

GETTY, R. **Sisson/Grossman anatomia dos animais domésticos**. 5.ed. Rio de Janeiro: Guanabara Koogan, 1986. v. 2, 2000p.

KÖNIG, H. E.; LIEBICH, H. **Membros posteriores ou pélvicos.** In: _____. Anatomia dos animas domésticos: texto e atlas colorido. Porto Alegre: Artmed, 2004. v. 1, p. 203-263.

MERIGHI, A. **Regiões do membro pélvico.** In: _____.Anatomia topográfica veterinária. Rio de Janeiro: Revinter, 2010, p. 266-209.

SCHALLER, O. **Nomenclatura anatômica veterinária ilustrada.** São Paulo: Manole, 1999. 614p.