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DESCRIPTIVE OSTEOLOGY OF THE PELVIC LIMB OF EQUINES

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SUMMARY
The equine pelvic limb performs vital functions, such as weight support, locomotion and shock absorption. Its main bones include the ilium, ischium, pubis, femur, patella, tibia, fibula, and the bones of the tarsal, metatarsal, and phalanges. The ilium, ischium and pubis form the pelvis, which connects the limb to the trunk and supports the weight of the body. The femur, the largest bone in the limb, articulates with the pelvis and tibia, allowing broad and powerful movements. The patella, located in front of the knee, facilitates the extension of the limb. The tibia and fibula, located in the leg, support and distribute the weight, while the tarsal, metatarsal and phalangeal bones form the structure of the foot, essential for absorbing impacts and propulsion. Studying the osteology of the pelvic limb is essential for veterinarians and students, as it allows a detailed understanding of the structure and function of the bones, facilitating the diagnosis and treatment of injuries, in addition to improving management practices and animal welfare. However, detailed information on the osteology of the equine pelvic limb is scarce in scientific articles, being mostly scattered in specialized books. This makes it difficult to quickly and practically access the necessary knowledge. Based on this, this article aims to fill this gap by offering a comprehensive and accessible description of the anatomy of the equine pelvic limb bones. By consolidating this information, it is expected to contribute to the advancement of knowledge and the improvement of practices in the area.

Key words: Anatomy. Equine. Hind limb. Bone.

ABSTRACT
The pelvic limb of equines performs vital functions such as weight support, locomotion, and impact absorption. Its main bones include the ilium, ischium, pubis, femur, patella, tibia, fibula, and the bones of the tarsus, metatarsus, and phalanges. The ilium, ischium, and pubis form the pelvis, which connects the limb to the trunk and supports the body's weight. The femur, the largest bone of the limb, articulates with the pelvis and tibia, allowing for wide and powerful movements. The patella, located in front of the knee, facilitates limb extension. The tibia and fibula, situated in the leg, support and distribute weight, while the bones of the tarsus, metatarsus, and phalanges form the foot structure, essential for impact absorption and propulsion. Studying the osteology of the pelvic limb is fundamental for veterinarians and students, as it allows for a detailed understanding of the structure and function of the bones, facilitating the diagnosis and treatment of injuries, and improving animal management and welfare practices. However, detailed information on the osteology of the equine pelvic limb is scarce in scientific articles, being mostly dispersed in specialized books. This hinders quick and practical access to the necessary knowledge. Based on this, this article aims to fill this gap by offering a comprehensive and accessible description of the anatomy of the bones of the equine pelvic limb. By consolidating this information, it is hoped to contribute to the advancement of knowledge and the improvement of practices in the field.
Keywords: Anatomy. Equine. Posterior Limb. Cap.

1. INTRODUCTION

The pelvic limb of domestic animals is a fundamental structure for locomotion, weight support and carrying out various motor activities. It is made up of a series of bones, joints, muscles, tendons and ligaments that work together to provide stability and movement.

Unlike the thoracic limb, the pelvic limb is directly connected to the axial skeleton through the sacroiliac joint that joins the ilium to the sacrum of the spinal column. This eliminates the need for large muscles in the hindquarters to support the weight of the tail part of the body and allow space for all the structures of the reproductive, urinary and digestive systems that are there in that region.

The first bony structure is the pelvis, which articulates with the femur at the hip joint, allowing

a wide range of movements. Below the femur are the tibia and fibula, which form the lower part of the leg and articulate with the femur at the knee joint. The knee is protected by the patella, a sesamoid bone that facilitates movement of the quadriceps tendon. The tibia and fibula connect to the tarsal bones, which form the ankle and articulate with the metatarsal bones, responsible for the formation of the foot or paw.

In horses, the pelvic limb is highly specialized for speed and endurance, with long bones and powerful muscles that allow for rapid, sustained movements. In-depth knowledge of the descriptive anatomy of these bones is crucial for veterinary students and professionals, as it helps in the diagnosis and treatment of injuries, in addition to improving management practices and animal welfare. However, there is a lack of detailed information about the osteology of the equine pelvic limb in scientific articles. Most of the available data is fragmented into specialized books, which makes quick and practical access difficult for students and professionals. This article aims to fill this gap, providing a complete and accessible description of the anatomy of the bones of the equine pelvic limb, contributing to the advancement of knowledge and the improvement of practices in the area.

2 THEORETICAL FRAMEWORK

2.1 Pelvis

The equine pelvis is an anatomical structure of great complexity and functionality. Also called the thigh or pelvis, the pelvis forms the hip region and is made up of three paired bones: the ilium, the ischium and the pubis.

The ilium is the most cranial bone of the pelvis, while the ischium is the most caudal and the pubis is the most ventral and central of all. Together, these bones form different anatomical features that are important for articulation with other bones, to support the animal's weight, even to facilitate the passage of puppies during birth, among other diverse functions. But, individually, each bone is also made up of several details, as follows.

A wing of the ilium , with its large surface, is essential for the insertion of powerful muscles that control the movements of the hind legs. It is made up of two faces: the gluteal face and the sacropelvic face. A gluteal face , in particular, is crucial for fixing the gluteal muscles, responsible for hip extension and abduction, essential movements for walking and running. A sacropelvic face , when articulating with the sacrum, it forms a robust joint that supports the weight of the body and transmits forces between the spinal column and the lower limbs. On this sacropelvic surface, there is a specific, irregular surface that increases adhesion between the ilium and the sacrum, preventing displacements and ensuring the stability of the sacroiliac joint, called the sacroiliac joint. joint rough area .

A thigh tuberosity is a bony prominence at the lateral end of the wing of the ilium. Just like the sacral tuberosity , but in this case, this prominence is located at the medial end of the wing of the ilium. Between these two tuberosities is the iliac crest , an upper, curved edge of the wing of the ilium.

Proceeding caudally, the wing of the ilium narrows into a body, called body of the ilium , being the central portion of the bone. The body of the ilium is followed by the greater and lesser sciatic notches. A greater sciatic notch , a curvature at the posterior edge of the ilium, allows the passage of important nerves and blood vessels to the posterior region of the pelvis. Just below, the lesser sciatic notch , another but less pronounced curvature, also facilitates the passage of neurovascular structures. Between these two ischial notches is the ischial spine , a bony projection that also serves as an insertion point for ligaments and muscles that stabilize the pelvis.

Caudal to the greater sciatic notch, the ischial tuberosity It is a double, robust prominence that supports the weight of the animals when they are at rest, sitting, distributing pressure evenly, among other functions. Between the ischial tuberosities is the ischial arch , a curve formed by the junction of the ischial branches and which helps to form the pelvic opening, facilitating childbirth and allowing, thus, the passage of the fetus during birth.

O acetabulum is a deep cavity formed by the different bones of the pelvis and which provides a stable and mobile joint with the head of the femur, allowing a wide range of movements in the hip.

O obturator foramen It is a large, double opening that allows the passage of neurovascular structures, ensuring the functionality of the lower limbs, in addition to providing lightness to the pelvis.

Already the pelvic symphysis It is the union of the right and left parts of the pelvis. It is divided into pubic symphysis It is ischial symphysis , both provide flexibility and shock absorption, adapting to different possibilities.

tures and movements of the animal.

Ailiopubic eminence , as its name suggests, is an eminence between the ilium and pubis, which, by serving as an insertion point for muscles and ligaments, contributes to the stability and coordination of pelvic movements.

Finally, thepecten of the pubis , is a central prominence, cranial to the pubic symphysis, that helps maintain the integrity of the abdominal wall and support internal organs.

2.2 Femur

The femur, being a long bone, can be divided, along its length, into proximal, distal epiphyses and diaphysis. Aproximal epiphysis of the femur is the upper end of the bone, which includes the femoral head, neck, and trochanters. Adistal epiphysis , in turn, is the lower end of the femur, which articulates with the tibia and patella, forming part of the knee joint. Between these two ends is thediaphysis , which is the long, cylindrical portion of the bone, responsible for supporting and transmitting forces.

Furthermore, the femur has four faces: the cranial, the caudal, the lateral and the medial. Acranial face of the femur is the anterior surface of the bone, facing the front of the body, while thecaudal face it is the posterior surface, facing backwards. Aside face is the outer surface of the femur, while themedial face it is the inner surface, facing the center of the body.

Ahead of the femur It is a spherical structure that articulates with the acetabulum of the pelvis, forming the hip joint. Afovea of femoral head It is a depression on the surface of the head, where the femoral head ligament is inserted, contributing to the stability of the joint. In horses, this depression is particularly large, compared to the fovea of the bovine head, for example. Ofemoral head neck is the narrow region that connects the head to the body of the femur, providing leverage for the muscles that move the hip.

Still on the proximal epiphysis, there are some very evident prominences. Ogreater trochanter is one of these bony prominences, it is located lateral to the neck of the femur. Olesser trochanter It is already a smaller prominence located medially and inferiorly to the greater trochanter. Othird trochanter , is another prominence located on the lateral surface of the femur, below the greater trochanter and which is much more developed in horses, when compared to the bovine femur.

Atrochanteric fossa It is a depression located between the greater trochanter and the lesser trochanter, where the hip rotator muscles are inserted. Aintertrochanteric crest is a bony line that connects the greater trochanter to the lesser trochanter on the posterior surface of the femur, serving as an insertion point for muscles and ligaments.

Continuing distally is thefemur body , the long, cylindrical portion of the bone. And more distally, in the distal epiphysis, is thetrochlea It is a groove-shaped structure, where the femur forms a socket to articulate with the patella, allowing the knee to flex and extend.

Still in the distal epiphysis, but on the caudal surface, are the lateral and medial condyles. Both are rounded prominences, thelateral condyle located laterally, while themedial condyle is located medially. These prominences articulate with the condyles of the tibia, forming part of the knee joint. In this region, on the femur, there are two fossas, the intercondylar fossa and the supracondular fossa. Aintercondylar fossa It is a depression between the condyles, as the name suggests. Similarly, thesupracondylar fossa is a depression located above the condyles. Olateral epicondyle is a prominence on the side of the lateral condyle, while the medial epicondyle it is similar, but on the medial surface of the medial condyle.

Comparing the femur of cattle with that of horses, it is observed that the greater trochanter of horses is divided into two parts: thecranial part , which projects anteriorly, and thecaudal part , which projects posteriorly, being divided by a space calledtrochanteric notch . Furthermore, in summary of what has already been mentioned, the third trochanter of horses is much more pronounced and evident, and the fovea of the head of the femur is also a larger and deeper depression in this species, compared to cattle. These anatomical differences reflect the specific adaptations of each species to their locomotor and biomechanical needs, allowing both cattle and horses to perform efficient movements and support the physical demands of their respective ways of life.

2.3 Patella

The patella, also known as the kneecap, is a sesamoid bone that plays a crucial role in the biomechanics of the knee, facilitating extension of the joint and protecting the underlying structures. A cranial face of the patella, facing the front of the body, is relatively smooth and convex, providing a super-

contact area for the tendons and muscles that attach to it. Acaudal face , on the other hand, is concave and articulates with the trochlea of the femur, forming a sliding joint that facilitates smooth and efficient movement of the knee. This face is covered by articular cartilage, which reduces friction and absorbs impacts, protecting both the patella and the femur from excessive wear.

Aside edge The patella, located on the outside, is thicker and more robust, providing additional resistance to the lateral forces acting on the knee joint. Amedial border , located on the inside of the patella, is equally important for the stability of the joint. It offers an insertion area for ligamentous structures that keep the patella aligned with the femoral trochlea, ensuring coordinated and efficient movement. Abase of the patella , which is the upper end of the bone, serves as the insertion point for the quadriceps tendon, a fundamental muscle group for knee extension. The base is relatively wide and flat, providing a robust insertion area that withstands the forces generated during muscle contraction. Oapex of the patella, located at the lower end, is the insertion point of the patellar ligament, which connects the patella to the tibia. This ligament is crucial for transmitting forces during knee extension. The apex is narrower and more pointed compared to the base.

2.4 Tibia

The tibia is a long bone that plays a fundamental role in supporting body weight and locomotion. Aproximal epiphysis The tibia is located at the upper end of the bone. In this region, there arelateral condyles It ismedial , which are joint surfaces covered by cartilage, allowing smooth and efficient movement of the joint. Between the condyles, theintercondylar eminence stands out as a prominent structure that serves as an insertion point for crucial ligaments, contributing to knee stability. This eminence is formed by two tubercles: thelateral tubercle , located laterally over the proximal epiphysis of the tibia, and themedial tubercle , located medially. Between the two tubercles there is also a curved depression calledpopliteal notch .

Adistal epiphysis , located at the lower end of the tibia, articulates with the tarsus, forming the ankle joint. This region is characterized by the presence ofcochlea , an articular surface that facilitates the transmission of forces between the tibia and tarsal bones. Olateral malleolus is a bony prominence located on the side of the distal epiphysis of the tibia, as well as themedial malleolus , but this one, located medially.

Connecting the proximal and distal epiphyses is thetibial shaft , or body of the bone, which is the long, cylindrical portion of the bone.

Being a long bone, the tibia has four faces: the cranial, the caudal, the lateral and the medial. A cranial face is cranially facing, is relatively smooth and serves as an insertion point for extensor muscles, while thecaudal face It is directed caudally and is rougher, providing insertion for flexor muscles. Aside face it is located laterally in the bone, on its external surface; while themedial face It is located medially, hence the name.

Atibial tuberosity , located on the cranial surface of the proximal epiphysis, is a bony prominence that serves as an insertion point for the patellar ligament. Oextensor groove , located close to the tuberosity, is a depression that facilitates the sliding of the extensor tendons, ensuring smooth and efficient movements. At the same height as the bone, but caudally are thetibia muscle lines , which are bony ridges that run along the diaphyses, and also serve as insertion points for various muscles.

2.5 Fibula

The fibula is a very thin and, depending on the species, long bone. In cattle, the fibula is very small, In horses, it is medium in size, ending its length in the middle of the body of the tibia, unlike other species, such as dogs and cats, whose fibulae are similar in size and follow the same path as the tibia. Afibula head , located at the proximal end of the bone, articulates with the tibia. This region is characterized by an articular surface that allows a firm connection with the tibia, in addition to serving as a insertion point for ligaments and tendons that stabilize the joint. The body of the fibula is the longest and slenderest portion that extends from the head towards the distal end of the tibia, but which, as already mentioned, in horses and, especially in cattle, is not complete.

2.6 Tarsus

The tarsal bones have at least four faces or surfaces: dorsal, plantar, lateral and medial. A dorsal side is the dorsal surface of the tarsus, facing the animal's head, while theplantar face it is the reverse surface, facing caudally and towards the ground. Aside edge is the outer margin of the tarsus, facing

out of the member, and themedial border is the inner margin, facing the center of the animal's body.

The tarsus is made up of different rows of bones that form the base of the hind limb. Aproximal row The tarsus includes robust bones such as the calcaneus and talus. Ocalcaneus , the largest tarsal bone, projects posteriorly and forms the base of the heel. Acalcaneal tuberosity is a bony prominence that serves as the insertion point for the common Achilles tendon, also known as the Achilles tendon, allowing ankle extension and propulsion during gait.

Otalus , located anterior to the calcaneus, articulates with the tibia and fibula, forming the ankle joint. A talar trochlea is a articular surface that facilitates smooth, coordinated movements between the talus and tibia. Otalus support , a bony projection on the medial aspect of the calcaneus, provides additional support to the talus.

The distal row of the tarsus is made up of smaller bones, which are numbered. In the case of the horse, these are the following tarsal bones: I + II, III, IV and central.

Ocentral bone, It is located between the proximal row and the distal tarsal bones, acting as a point of articulation and transmission of forces. Tarsier I is fused with tarsier II, forming thetarsier I + II. Following laterally are thetarsier III and thetarsier IV . These smaller bones in the distal row articulate with the metatarsals, allowing the foot flexibility and adaptation to irregular surfaces during locomotion.

2.7 Metatarsus

The equine metatarsus is a long bone structure and is divided into proximal, distal epiphyses and diaphysis. Aproximal epiphysis The metatarsus articulates with the tarsal bones. This region is characterized by a articular surface that facilitates firm and stable connection with adjacent bones, contributing to the stability of the hind limb.

Ametatarsal shaft , or body of the bone, is the long, cylindrical portion that extends between the proximal and distal epiphyses.

Adistal metatarsal epiphysis is the lower end of the bone, which articulates with the phalangeal bones, forming the base for the toes. This region is characterized by the presence oftrochlea , a rounded articular surface that has, in its center, thesagittal crest external.

In addition to the three divisions, the metatarsus also has four surfaces, called dorsal, plantar, lateral and medial. Adorsal side is the upper surface, while theplantar face is the lower surface, facing caudally and/or towards the floor. Already thelateral and medial faces are the lateral and medial surfaces of the bone, respectively.

2.8 Phalanges

The single toe of horses is made up of three bones, called the phalanx. These phalanges are called proximal phalanx , which is closer to the axial skeleton;distal phalanx , which is further away from the trunk, comparatively; and themiddle phalanx , which is located between the two others.

Aproximal epiphysis of the phalanx is the upper end of the bone, which articulates with the distal epiphysis of the metatarsal or with the anterior phalanx, depending on the position of the phalanx in the digital sequence. Aphalanx shaft , or body of the bone, is the elongated portion that extends between the proximal and distal epiphyses. Already thedistal epiphysis of the phalanx is the lower end of the bone, which articulates with the subsequent phalanx or with the sesamoid bone, depending on the position of the phalanx.

Adorsal side of the phalanx is its upper surface, facing dorsally and/or cranially; while theplantar face is the inferior and/or caudal surface, often associated with the insertion of flexor tendons. Already thelateral and medial faces are the lateral and medial surfaces, respectively.

2.9 Sesamoids

Finally, the sesamoid bones at the ends of the pelvic limb of domestic animals are small bones that develop within tendons or ligaments, generally in places where these tissues pass over joints. They play a crucial role in reducing friction, increasing the mechanical efficiency of tendons and protecting them against excessive wear and tear.

Sesamoids are also named according to their proximity to the body, being calledproximal sesamoids , those that are located closer to the trunk compared todistal sesamoids , which are located further away from the axial skeleton, but both in the region of the joints between the metatarsals and phalanges.

2. MATERIAL AND METHOD

This work consists of a narrative review of the literature on the bones and anatomical details of the equine pelvic limb. The bibliographic search was carried out in the PubMed, ScienceDirect and Google Scholar databases, using the following keywords: “Anatomy”, “Osteology”, “Bones”, “Leg”, “Pelvic limb”, “Equine” and “Horse ”. However, although this information is widely available in books, there is a lack of scientific articles that deal in detail with the osteology of domestic animals, including horses. Therefore, this article aims to describe the bones of the equine pelvic limb, offering a more accessible reference for students and professionals in the field.

After selecting the studies, a critical reading and analysis of the contents was carried out, seeking to identify the main details related to the bones of the equine pelvic limbs. The information obtained was organized and synthesized to prepare this literature review.

3. FINAL CONSIDERATIONS

In conclusion, the equine pelvic limb is fundamental for functions such as weight bearing, locomotion and shock absorption, with bones such as the ilium, ischium, pubis, femur, patella, tibia, fibula and the tarsal, metatarsal and phalangeal bones performing essential roles. The detailed study of the osteology of these bones is crucial for veterinarians and students, as it facilitates the diagnosis and treatment of injuries, in addition to improving management practices and animal welfare. However, most of the detailed information on equine pelvic limb osteology is dispersed in specialized books, making it difficult to quickly access the necessary knowledge. This article seeks to fill this gap, offering a comprehensive and accessible description of the anatomy of the bones of the equine pelvic limb, contributing to the advancement of knowledge and improvement of practices in the veterinary field.

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