OrganKits for STEAM

SPORTSHEALTH AND DEPENDENCE

OBTAINING A PLASTINATED BOVINE ELBOW

Co-funded by the European Union

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1.SUBJECT

Indications for, starting from a complete thoracic limb, isolating the humeroradioulnar joint and performing its dissection and subsequent fixation in formaldehyde, in order to study elbow flexion, together with its extension.

2. SCOPE

Procedure applicable to the dissection of thoracic limb joints.

3. REFERENCE DOCUMENTATION and CONSULTATION

- López Albors, O. M. (June 27, 2012). Skeleton of the thoracic limb in canids: humerus [Video file]. University of Murcia TV. https://tv.um.es/video?id=37701&serie=8771&cod=a1b1c2d18
- López Albors, O. M. (June 27, 2012). Skeleton of the thoracic limb in canids: radius and ulna [Video file]. University of Murcia TV. https://tv.um.es/video?id=37711&serie=8771&cod=a1
- López Albors, O. M. (June 27, 2012). Elbow joint [Video file]. University of Murcia TV. https://tv.um.es/video?id=37761&serie=8781&cod=a1
- Gil Cano, F., Latorre Reviriego, R., Ramírez Zarzosa, G., López Albors, O., Ayala Florenciano, M. D., Martínez Gomariz, F., Orenes Hernández, M., & Vázquez Autón, J. M. (2012). Manual of Veterinary Anatomy Practices: Locomotor System. DM.
- PNT-49 Elbow Joint Dissection (Discover-IN)

4. REAGENTS, PRODUCTS & MATERIALS

REAGENTS

- Formaldehyde

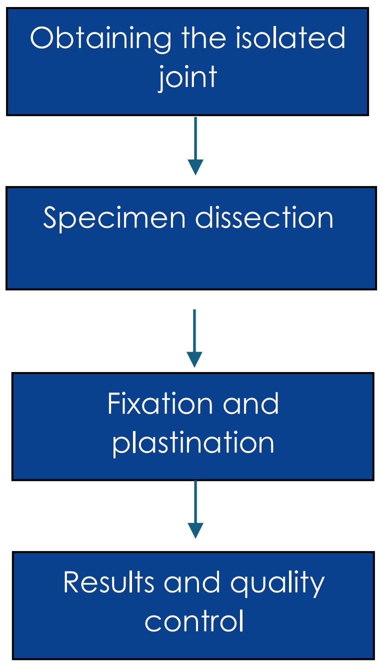
MATERIALS

- Scissors
- Clamps
- Forceps
- Rope
- Scalpel
- Pipes

PERSONAL PROTECTIVE EQUIPMENT

- Scrubs
- Laboratory coat
- Mask for air filtration
- Gloves
- Glasses
- Polyethylene sleeves
- Protective footwear

5. OPERATING PROCEDURE



5.1. Obtaining the isolated joint

As mentioned above, we start with a complete thoracic limb from the slaughterhouse. Once in the dissection room, with the aid of a saw, we will divide the specimens by means of two transverse cuts, thus obtaining three portions corresponding to:

- Glenohumeral joint.
- Humeroradioulnar joint.
- Joints of the manus.

Thus, it will be possible to work independently on the dissection and processing of each of the limb's joints.

5.2. Specimen dissection

Before beginning the dissection of the specimen itself, both the bone structures and the surfaces involved in this joint must be recognized. The elbow joint is made up of two joints:

Humeroradial joint
The trochlea of the humerus and the articular fovea of the head of the radius are involved.

Humerocubital joint
The trochlea of the humerus and the trochlear notch of the ulna are involved.

The ligaments that reinforce the humeroradioulnar joint are the lateral and medial collateral ligaments. The location of these will first be identified.

Starting from the lateral surface, the lateral epicondyle of the humerus will be located in the specimen since the lateral collateral ligament is attached proximally to this anatomical accident and distally to the radius. Once the path of the lateral structure has been located, its medial homonym will be located, which is fixed proximally to the medial epicondyle of the humerus and distally to the radius.

Secondly, the radioulnar ligaments, other structures that are equally important when dissecting this joint, will be located in the sample. These ligaments are located along the radius, along the caudal surface of the specimen, to be located on both sides of the body of the ulna and in a proximal position with respect to the interosseous space of the forearm.

After identifying the position of the main structures, the specimen will be cleaned, removing the fascia, periosteum, fat, blood vessels, muscles that are not of interest for the specific dissection to be performed.

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The orientation of the olecranon allows us to easily identify which side of the specimen we are on, meeting the concave part medially and the convex part laterally.

5.2.1. Lateral surface

Within the lateral axis it is the *lateral collateral ligament,* which originates from the lateral epicondyle and extends to the radius, giving stability to the anatomical structure of the elbow.

With the aid of a scalpel and forceps, the muscle and fascia are delimited, carefully removed, to identify the structures to be preserved. In addition, the periosteum will be abraded, until it is completely clean.

5.2.2. Medial surface

On the medial surface, *the medial collateral ligament* that begins the journey from the medial epicondyle of the humerus and extends to the radius and part of the ulna, is observed.

Again, with the aid of a scalpel and forceps, the structure will be delimited by removing the unwanted muscle and fascia from the specimen. In addition, the periosteum will also be abraded, until the bone surfaces are clean.

5.2.3. Caudal surface

In a caudal view of the joint, the *radioulnar ligaments* will be observed, as mentioned. When dissecting this side of the specimen, especially when cleaning the area of the interosseous space, care must be taken not to damage these structures.

To finish the dissection of this surface, the olecranon area will be refined. To do this, the periosteum will be abraded until the bone surface is as clean as possible, so that the result of the piece is optimal.

5.3. Fixation and plastination

Once the dissection is complete and prior to the immersion fixation of the specimen, the bone marrow will be extracted from inside the bone. This will require:

- Scalpel with a No. *22 blade*
- Metal instruments to help remove it, if the marrow is very compact and it is difficult to remove it.

On the other hand, a series of perforations will be made in the bone structures, with the help of a drill, which will allow the specimens to be cleaner and prevent the accumulation of fat inside.

In addition, these perforations will help in the following processes, so that the next chemicals used are more effective in their journey. For example, in dehydration, it will help to dehydrate and degrease inside it more quickly and effectively.

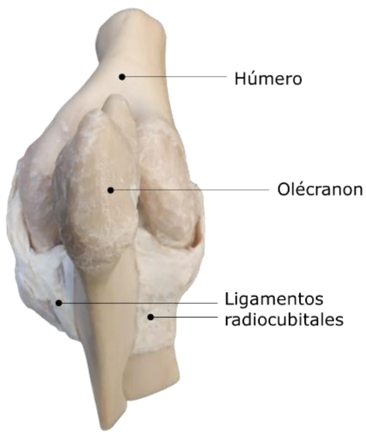
The plastination of the piece is carried out according to the usual protocol of the S10 technique.

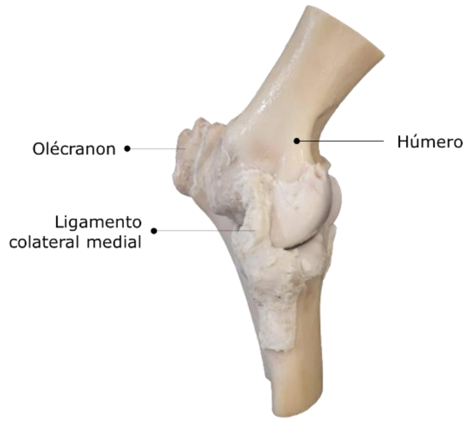
6. RESULTS AND QUALITY CONTROL

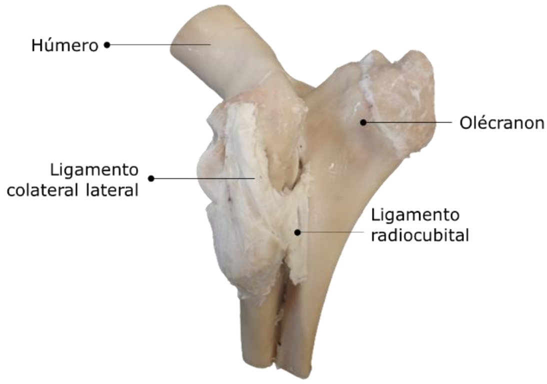
The plastinated part must allow a certain degree of recoverable flexion.

Quality Checklist

- Suitable color ( )
- Adequate size, no alterations due to retraction ( )
- Firm and non-greasy texture ( )
- Absence of odours ( )
- List of structures:
    - Humerus ( )
    - Radio ( )
    - Ulna ( )
    - Lateral collateral ligament ( )
    - Medial collateral ligament ( )
    - Radioulnar ligaments ( )
    - Joint capsule debris ( )







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SPORTSHEALTH AND DEPENDENCE

OBTAINING A SHEEP HINDLIMB

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1. SUBJECT

Indications of the modus operandi to follow to carry out the dissection of the pelvic limb of sheep.

2. SCOPE

This protocol is applicable to the dissection of pelvic limbs of the ovine species.

3. REFERENCE DOCUMENTATION and CONSULTATION

- Gil Cano, F., Latorre Reviriego, R., Ramírez Zarzosa, G., López Albors, O., Ayala Florenciano, M. D., Martínez Gomariz, F., Orenes Hernández, M., & Vázquez Autón, J. M. (2012). *Manual of Veterinary Anatomy Practices: Locomotor System*. DM.
- PNT-50 Dissection of the pelvic limb of sheep.

4. REAGENTS, PRODUCTS & MATERIALS

REAGENTS

- Formaldehyde

MATERIALS

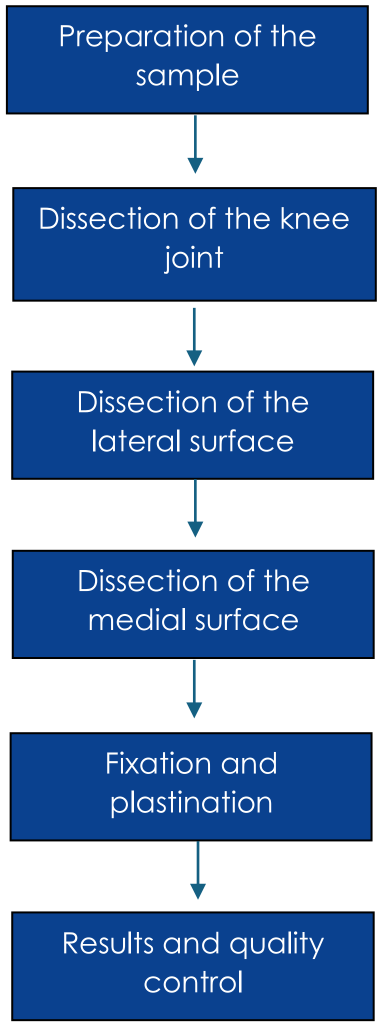
- Scissors
- Clamps
- Forceps
- Rope
- Scalpel
- Pipes

PERSONAL PROTECTIVE EQUIPMENT

- Scrub

- Laboratory coat
- Mask for air filtration.
- Gloves
- Glasses
- Polyethylene sleeves
- Protective footwear

5. OPERATING PROCEDURE



5.0. Preparation of the sample

Prior to dissection, the sample can be prepared by formaldehyde fixation, in increasing concentrations, in order to ensure that the part does not deteriorate during the dissection process. This "*prefixing*" will be carried out in two steps:

1. Fixative injection through the *femoral artery*.
2. Immersion of the piece in fixative.

If the sample retains the skin, it will be carefully removed, trying to do so as superficially as possible so as not to damage any structure when the scalpel passes. For this particular dissection, the skin will be removed only halfway through the metatarsal.

With the exception of the most distal portion of the quadriceps muscle, the muscles corresponding to the thigh area will not be preserved in this dissection. Therefore, once the skin has been removed, the piece will be fleshed. In this regard, the following should be taken into account:

- The *quadriceps muscle* will be sectioned proximally to the patella and preserving the integrity of the *patellar ligament at all times*.
- In this dissection, both the *tibial nerve* and the *common peroneal nerve* must be preserved. Both come from the branching of the *sciatic nerve* that is covered by the *biceps femoris* in its path through the thigh, so special care must be taken when sectioning this muscle to avoid damaging the nerve structures.

5.1. Dissection of the knee joint

The knee joint or femorotibial-patellar joint is in turn composed of two joints:

Patellofemoral joint

The trochlea of the femur and the articular surface of the patella are involved.

Femorotibial joint

The condyles of the femur and the tibial plateau are involved.

The main structures found when approaching the knee joint and should be preserved in its dissection are:

- Patellar ligament.

It joins the vertex of the patella to the tuberosity of the tibia and will be the starting point of the dissection, since the delimitation of this ligament will allow access to the interior of the joint capsule.

- Lateral and medial patellofemoral ligaments.

It attaches the kneecap to the epicondyles of the femur.

- Lateral and medial collateral ligaments.

It attaches the epicondyles of the femur to the condyles of the tibia.

- Tendon of the extensor digitorum longus muscles and third peroneal.

It is located on the surface of the lateral meniscus. To make it visible, the infrapatellar fat pad must be removed.

- Lateral and medial menisci.

They will be visible once the fat pad has been removed.

- Cranial cruciate ligament.

It joins the femur and tibia, projecting from the intercondylar fossa of the femur to the central intercondylar area of the tibia. As in the previous cases, to reach this structure it is necessary to remove the *infrapatellar fat pad*.

5.2. Dissection of the lateral surface

Once the knee has been dissected, the lateral surface of the sample will be worked on. To avoid damaging the structures, the order to be followed in the dissection, both on the lateral and medial side, will be:

Innervation and vascularization→ Musculature → Other

A) INNERVATION AND VASCULARIZATION

- **Common peroneal nerve**: it runs along the lateral surface of the limb and divides into two nerve branches:
  - **Deep peroneal nerve**: this is the most cranial branch and its trajectory continues in a deeper plane, entering posterior to the long digital extensor.
  - **Superficial peroneal nerve**: its path is more caudal. *This branch will not be retained for dissection.*
- **Tibial nerve**: it is located in the most caudal area of the piece, entering between the heads of the gastrocnemius muscle at the level of the popliteal hollow.
  - **Lateral plantar nerve**: distal branch of the tibial nerve that can be seen in the calcaneal area and along the metatarsal, innervating the muscles of the foot along the way.

In this dissection, it will not be necessary to preserve any vascular structure.

B) MUSCULATURE *(proximal to distal and caudal to cranial):*

The following can be observed: m. gastrocnemius (composed of a lateral and a medial head), m. soleus, m. lateral digital flexor, m. lateral digital extensor, m. peroneal longus, m. long digital extensor, m. 3rd peroneal.

It is worth noting the presence of the common calcaneal tendon, whose main constituent is the lateral and medial heads of the gastrocnemius muscle. This tendon starts from the fusion of these heads into a single muscle belly and runs through the piece until it inserts into the tuberosity of the calcaneus. It is an essential structure in the pelvic limb and therefore its preservation in dissection is essential.

Once the anatomy of this face is known, the fascia and superficial fat that covers these muscles are removed, respecting the original morphology to guarantee an optimal result.

C) OTHER STRUCTURES

In the most distal portion of the tibia, the proximal and distal retinaculums of the extensor muscles are located, which are located on the surface of the tendons of the muscles and must be preserved in the dissection.

When working on these retinaculums, they must be cut perpendicular to the axis of the limb to avoid damaging the underlying tendons and structures.

5.3. Dissection of the medial surface

A) INNERVATION AND VASCULARIZATION

- **Tibial nerve**: on this side, the continuation of the tibial nerve's path is observed, reappearing from the most distal part of the m. gastrocnemius to the calcaneus, where it branches giving rise to the lateral and medial plantar nerves.
  - **Medial plantar nerve**: distal branch of the tibial nerve that runs through the metatarsal innervating the intrinsic muscles of the foot.

As in the previous case, in the dissection of this face it is not necessary to preserve the vascular structures.

B) MUSCULATURE *(from proximal to distal and caudal to cranial):*

The following were observed: gastrocnemius, popliteal m, caudal tibial, medial digital flexor m, lateral digital flexor m, cranial tibial m, 3rd peroneal m.

5.4 Fixation and plastination

Once the dissection is completed and prior to the fixation by immersion, a series of perforations will be made in the bone structures, with the help of a drill, which will allow the pieces to be cleaner and prevent the accumulation of fat inside.

In addition, these perforations will help in the following processes, so that the next chemicals used are more effective in their journey. For example, in dehydration, it will help to dehydrate and degrease inside it more quickly and effectively.

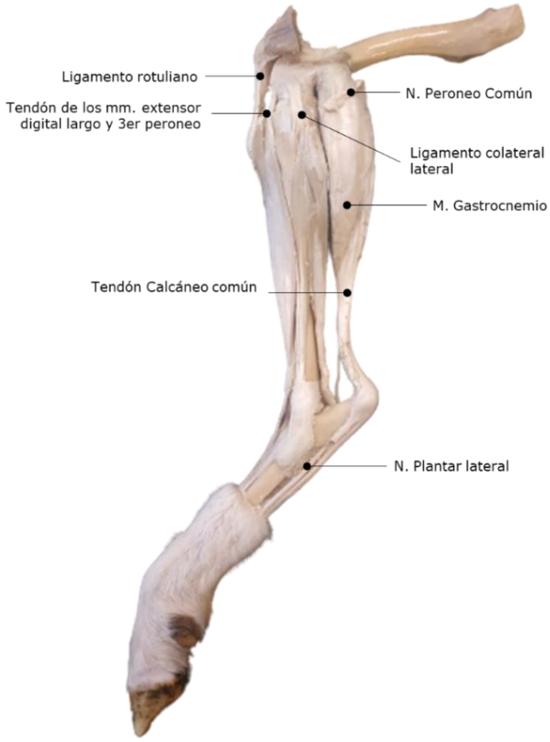
The plastination of the piece is carried out according to the usual protocol of the S10 technique.

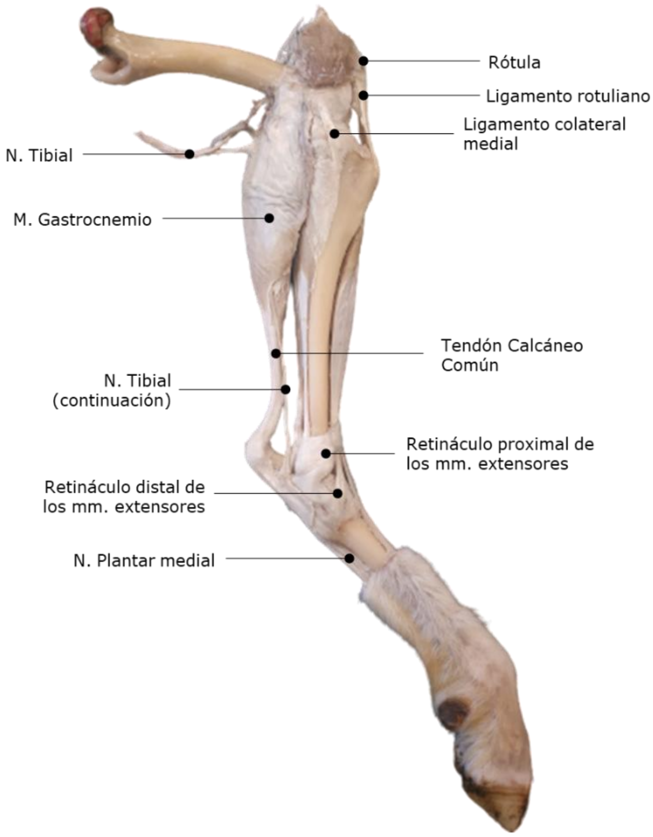
6. RESULTS AND QUALITY CONTROL

Once the dissection is completed, the specimen must retain an adequate morphology, maintaining its real anatomical structure. In addition, the mobility and flexibility of the part must be verified.

Quality Checklist

- Suitable color ( )
- Adequate size, no alterations due to retraction ( )
- Firm and non-greasy texture ( )
- Absence of odours ( )
- List of structures:
    - Patella ( )
    - Quadriceps tendon ( )
    - Patellar ligament ( )
    - Lateral collateral ligament ( )
    - Medial collateral ligament ( )
    - Menisci ( )
    - Cranial tibialis muscle ( )
    - Long digital extensor muscle and 3rd peroneus ( )
    - Peroneus longus muscle ( )
    - Lateral digital extensor muscle ( )
    - Lateral gastronemius muscle ( )
    - Soleus muscle ( )
    - Medial gastronemius muscle ( )
    - Lateral digital flexor muscle ( )
    - Common calcaneal tendon ( )
    - Superficial digital flexor tendon ( )
    - Common peroneal nerve ( )





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