Practical note of

Lameness & Radiology

By Staff Members

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DIAGNOSIS OF LAMENESS IN EQUINE

Definition: -

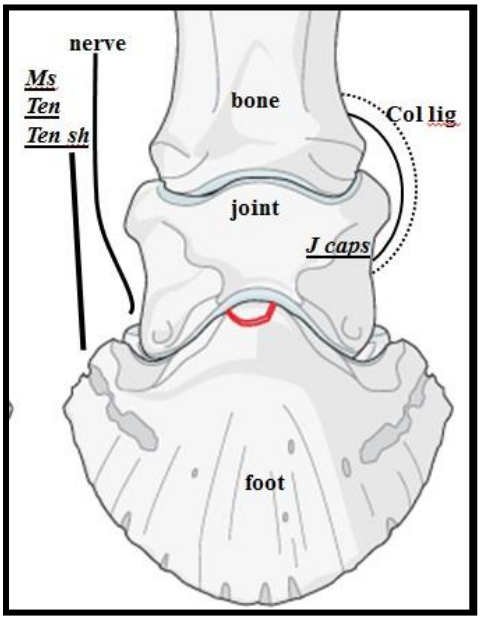
Lameness is an indication of functional or structural disorder in one or more limbs that is manifested in progression by inability to advance one or more limb in proper manner, or in standing position by abnormal posture of the animal.

The limb consists of bones, joints, muscles, tendons, blood supply, and nerve supply. Injury to any of them (as a result of trauma, congenital or acquired anomalies, infection, metabolic disturbance like rickets, or circulatory or nervous disturbance) may predispose to lameness.

The majority of lameness is found in the forelimb, and 95%of them observed in the carpus or below. The greatest number of lameness occurs in the forelimb because they carry 60 to 65% of the weight of the horse and thus subjected to greater concussion than the hind limbs. The hind limbs act as propelling limbs, while the forelimbs receive the shock of landing. In the hind limbs, approximately 80% of the lameness observed in the hock or stifle.

CLASSIFICATION OF LAMENESS

1-Supporting-leg lameness



It is evident when the horse supporting weight on foot or when the horse lands on it. The main causes of such type of lameness are; injury of bones, joints, collateral ligaments, motor nerves, or foot.

2-Swinging-leg lameness

It is evident when the limb is in motion. It is caused by injury to joint capsule, muscles, tendons or tendons sheath.

3-Mixed lameness

It is evident both when the leg is moving and when it is supporting weight. It is caused by combination of the previously mentioned causes. Differentiation between the three types depends up on observing gait of the animal from a distance. This

classification is helpful for diagnosis but one shouldn't rely on it completely.

4- Complementary lameness

Pain in one limb may cause uneven distribution of the weight on another limb or limbs leading to lameness in a previously sound limb, also minor lesion in one limb may cause severe lesion either in the same limb or the corresponding one.

Lameness in one foreleg may lead to lameness in the corresponding foreleg (suspensory ligament, sesamoid bones and flexor tendons seem to be the structures that suffer most) and lameness in one hind leg may lead to lameness of the foreleg in the same side. On the contrary, neither lameness of one hind leg affects the other hind limb, nor a lameness of foreleg affect the hind leg of the same side.

Also one should keep in mind that minor injury to one limb may predispose to more severe injury in the same limb as navicular disease. In such cases animal lands on the toe first leading to bruised sole or soreness of the toe, but later on the animal land on the heel as the soreness of the toe hurts more than navicular area. Also landing on the toe to protect the heel may cause additional stress on suspensory ligament.

DIAGNOSIS OF LAMENESS

It depends on detection of lame limb, and seat and nature of lameness

I-HISTORY (anamnesis)

It is important that the following questions be answered when taking case history

1-How long has the horse been lame?

Lameness for more than one month is considered chronic condition, since permanent structural changes may have taken place that render complete recovery unlikely. Veterinarian should keep in mind that a young horse has better chance for recovery from a chronic condition than a mature one.

2-Does the owner know the cause of lameness?

The owner may say that he removed nail from the foot, saw the injury occur, or saw the character of lameness at the time first noticed (started acute that indicates fracture or it developed insidiously that indicates arthritis).

3-Has the lameness worsened, stayed the same, or improved?

Horses that have marked improvement in the lameness will usually have a better prognosis than horses that have remained static or have worsened.

4-Does the animal stumble?

Stumbling is an indication of

a-Interference with synergistic action of the flexor and extensor muscles

b-Pain on heel pressure like navicular disease or heel puncture wounds

c-Interference with enough flexion of the carpus as a result of painful condition of carpus, or rupture of extensor carpi radialis

5-What treatment has been done? And was it helpful?

Some drugs interfere with the signs of lameness (steroids) and some procedures predispose to infection of joint (exploratory puncture), and if the owner treated the animal in right manner with no response, we shouldn't use the same method of treatment.

6-When was the animal shoed?

The nail may be driven into sensitive tissue and pulled out, remains in it, or it is close to sensitive tissue (nail bound).

II-EXAMINATION

1-DETECTION OF LAME LIMB

A-Inspection at rest

Animal should be inspected during rest in order to observe the effort he makes to compensate for pain in supporting-leg lameness. This should be done at a distance, then up close, viewing the horse from all directions. From a distance the following changes could be noted:

i-Posture

-If the horse stands with the carpus positioned forward and raised heel, it indicates affection of the carpal, posterior fetlock, or heel areas and they should be examined.

-If the horse points with the affected foot, navicular disease or fracture of the extensor process of the 3rd phalanx should be expected.

-If the forelimb is held posteriorly with flexed carpus and the toe rests on the ground, the shoulder should be examined.

-Lameness of the elbow joint is characterized by extension of the forearm, flexion of the knee, and the foot either in the same level or posterior to the opposite member and the elbow may have dropped appearance.

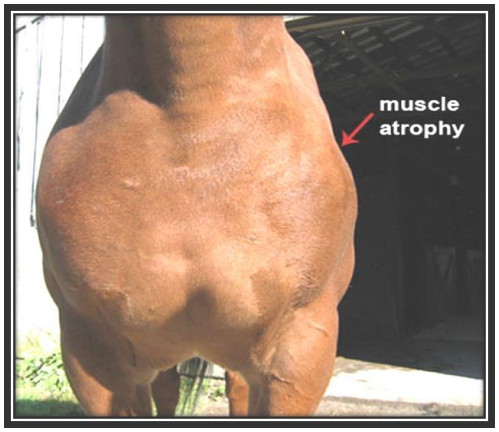
-If the limb is carried; fracture, nail punctures, severe sprains, or septic phlegmon should be considered.

ii-Shifting of the weight

It is normal in the hind limb, but it is abnormal in the forelegs. When the animal refuses to put weight on one hind limb (rests constantly on one limb) the shifting limb should be inspected.

iii-Local abnormalities and Muscular atrophy

At close observation each limb is observed critically and compared to its opposite member. Feet are observed for abnormal wear, hoof cracks, and heel bulb contraction. All joints and tendons are visually inspected for swelling. Muscular group of shoulder and gluteal regions should be inspected, the affected limb usually has atrophied muscles (disuse atrophy).

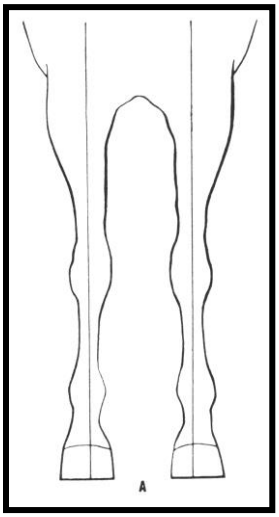


iv-Anatomical abnormalities

Like swelling, malconformation, wound, tumor, etc…Poor conformation of the limbs may be contributed to certain lameness and may actually be the cause of lameness in some cases

Malconformation

Forelimb anterior view



Both limbs should be straight and bear weight equally. A line dropped from the point of the shoulder joint should bisect the limb. The chest should be well developed and well muscled. Toes should be as far a part on the ground as the limbs are at their origin in the chest. The carpal joints should be balanced and should not deviate toward or away from one another. The cannon bone should be centered under the carpus and not to the lateral side.

a-Base narrow

The distance between the center lines of the feet is lesser than the distance of the center lines at their origin and the horse bears most of weight on the outside of the foot. This mal formation is associated with articular wind puffs of the fetlock joint, lateral ringbone, lateral side bone, and excessive wear of the outside of the foot. These animals may have toe-in or toe out but generally land on the outside of the foot.

b-Base wide

The distance between the center lines of the feet is greater than the distance of the center lines at their origin. These animals usually have toe-out with winging and tend to land on the inside of the foot leading to articular wind puffs of the fetlock joint, medial ringbone, medial side bone, and excessive wear of the inside of the foot.

c-Toe-in or Pigeon-toed

The toes point toward one another and it is usually associated with base narrow and rare in base wide horses. These animals tend to break over the outside of the toe, ***paddle*** during flight, and landing on the outside of toe.

d-Toe-out or Splay-footed

The toes point away from one another and it is usually associated with narrow or wide base. The animal tends to ***wing*** on flight and when he has base narrow, ***interference*** and plaiting are expected.

e-Base narrow, toe-in conformation

It causes paddling and great strain on the lateral collateral ligaments of the fetlock and pastern joints leading to articular wind puffs, lateral ringbone, lateral side bone, and excessive wearing of the outside of the foot.

f-Base narrow, toe-out conformation

It is the worst conformation, the closely placed feet and tendency to wing, cause interference (leading to injury of the medial aspect of the 2^{nd} and 3^{rd} metacarpal bones and medial sesamoid bone), wearing of the outside of the foot, and plaiting. This is a side from the injury of the lateral collateral ligament of the fetlock and pastern, articular wind puffs of fetlock joint, lateral ringbone and side bone, and excessive wear of outside of the foot.

g-Base wide, toe-out conformation

It causes winging and greater strain on medial collateral ligament of the fetlock and pastern joints leading to medial side bone, ringbone, wearing of the inside of the foot, medial splints, and injury of the medial aspect of the 2^{nd}, 3^{rd} metacarpal bones, and medial sesamoid bone.

h-Base wide, toe-in conformation

It causes paddling and greater strain on medial collateral ligament of the fetlock and pastern joints leading to medial side bone, medial ringbone, and wearing of the inside of the foot.

Plaiting: - It is a tendency to put one forefoot in front of the other foot during motion leading to interference and stumbling, and it is usually occurs in base narrow, toe-out conformation.

i-Medial deviation of carpal joint (Knock knees - Knee narrow conformation)

It is a medial deviation of the two carpal joints toward each other. Strain is put on inferior check ligament, suspensory apparatus, medial capsule

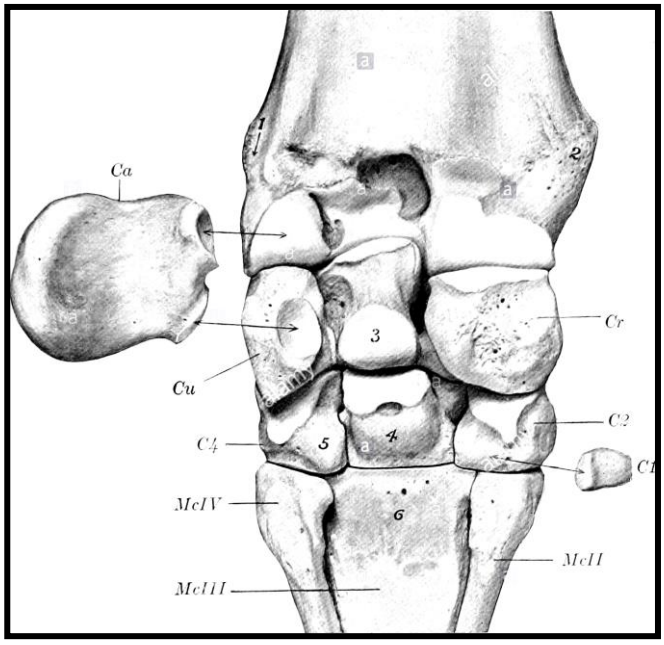
of the carpal joint, medial collateral ligament of the carpus, and lateral aspect of the carpal bones.

j-Lateral deviation of the carpal joint, Bow legs, or Bandy-legged conformation

It is an outward deviation of the two carpal joints from each other and may be accompanied with base narrow, toe-in conformation. It causes excessive strain on lateral collateral ligament of the carpus, medial side of the carpal bones, and lateral portion of the carpal joint capsule.

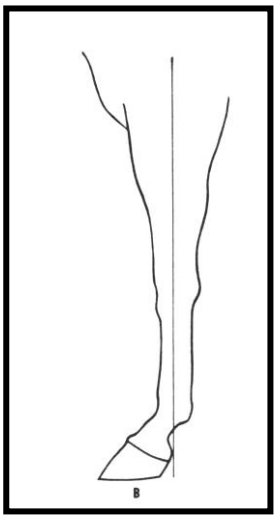
k-Lateral deviation of metacarpal bones, Offset knees, or Bench knees

The cannon bone is offset to the lateral side and doesn't follow a straight line of the radius. As a result of the anatomical feature of the medial splint bone which has flat articulation while the lateral splint bone has oblique articulation, a greater strain qill be placed on the medial splint bone and inter-osseous ligament leading to medial splints.



Forelimb side view

The shoulder should be sloppy. A line dropped from the tuber spinae of the scapula should bisect the limb as far as the fetlock and drop to a point just behind the heel. The carpus should not deviate forward or backward. Hoof wall should slope at the same angle as the pastern. Ideally the limb should form a straight column from the elbow joint to the fetlock.



a-Posterior deviation of carpal joint (Calf knee - Sheep knees)

This affection places a strain upon the inferior check ligament, anterior aspect of carpal bones, volar annular ligament of the carpus, and volar aspect of carpal joint capsule, leading to chip fracture of the 3rd, radial and intermediate carpal bones, and radius.

b-Anterior deviation of the carpal joint (Over in the knees - Goat or Bucked knees - Knee sprung)

It causes less damage than posterior deviation, and ensues as a result of contraction of carpal flexors (ulnaris lateralis, flexor carpi ulnaris and flexor carpi radials). Extra strain is placed on sesamoid bones, superficial flexor tendon, extensor carpi radialis, and suspensory ligament.

c-Open knees

It is an irregular profile of the carpal joint, which gives impression that the joints are not fully closed. It affects young horses as a result of mineral deficiency and epiphysitis.

d-Tied-in knees

The flexor tendons appear to be close to the cannon bone just below the carpus.

e-Cut out under the knees

It is cut out appearance of the knee just below the carpus on the anterior surface of the cannon bone

f-Standing under in front

The entire forelimb from the elbow down is placed back of the perpendicular and too far under the body. It may be brought about by disease not by conformation and the base of support is shorter, limbs are over loaded, steps are more frequent, the anterior phase of stride is limited, and the arc of foot in flight is low as the limb of motion comes down to the ground sooner predisposing to stumbling, diminution of speed, and falling. This affection is associated with excessive wear and fatigue of bones, ligaments, and tendons

g-Camped in front

The entire forelimb is too far forward, and it can be observed in some pathological conditions like bilateral navicular disease and laminitis.

h-Short upright pastern

It is often associate base narrow toe-in especially in short horses, and it increases the concussion on fetlock and pastern joints and navicular bone, with increased predisposition to; osselets (traumatic arthritis of fetlock joint), ring bone of pastern, and navicular disease.

i-Long sloping pastern

It is normal or subnormal angulation the forefoot (45 or under) with a too long pastern for the length of the limb. It predisposes to injury of the flexor tendons (tenosynovitis), sesamoid bones (sesamoiditis and fracture), and suspensory ligament (desmitis).

j-Long upright pastern

It predisposes to injury of the fetlock (osselets) and navicular bursa as a result of increased concussion to these areas, but affection of the pastern is not so common. Increased pressure on the navicular bone increases by corrective lowering of the heel by the horse shoer leading to break between the pastern and foot axis at the coronary band.

Hind limb posterior view

A line dropped from the point of the tuber ischii should divide the limb into equal parts. This gives equal distribution of the weight, equal bone pressure, and equal strain on collateral ligaments.

a-Base narrow

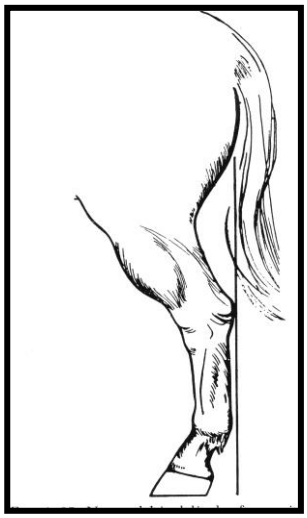
The distance between the center lines of the feet is lesser than that of the limbs in the thigh region. It is often accompanied with bow legs or a condition in which the hocks are too far apart, and the feet may be toe-in. It is associated with excessive strain on the lateral aspect of the limbs in the bones, ligaments, and joints, and may predisposes to interference with the forelegs if he has good conformation in the forelegs.

b-Base wide

The distance between the center lines of the feet is greater than that of the limbs in the thigh region. It is less frequent in hind limbs than forelimbs and the most common form is cow hock.

c-Medial deviation of the hock joints (Cow hocks)

It is the worst conformation of the hind limbs, and when viewed from behind, the limbs are base narrow to the hock then base wide from the hock to the feet so the two hocks are too close and point toward each other and the feet are widely separated leading to excessive strain on the medial aspect of the hock joints and predisposes to bone spavin. When viewed laterally, the horse may be sickle-hocked.



d-Base narrow from fetlocks down

It places great strain on the lateral aspect of the fetlock, pastern and coffin joints.

Hind limb side view

A line dropped from the tuber ischii hits the point of the hock, follows the metatarsus, and strike 3-4 inches behind the heel, and a line dropped from the hip strikes halfway between heel and toe.

a-Excessive angulation of the hock joints (Sickle hocks - Curby conformation)

The angle of the hock joint decreases so that the horse is standing under from the hock and down so the planter aspect of the hock and the planter ligament become under greater strain predisposing the horse to curb. The line dropped from the tuber ischii strike the hock then land far behind the heel (more than 4 inches).

b-Excessive straight legs (Straight behind)

The hock and pastern joint look straight, predisposing the horse to upward patellar fixation and bog spavin (as a result of increased strain on the anterior aspect of the joint capsule of the hock causing chronic distension of the joint capsule with synovia).

c-Standing under behind

The entire limb is placed too far forward or sickle hock is present. A dropped line from the tuber ischii hits far behind the hock and the heel, and a dropped line from the hip hits behind the heel.

d-Camped behind

The entire limb is placed too far posteriorly. A line dropped from the hip hits the toe or anterior to it, and a line dropped from the tuber ischii passes through the hock and hits the toe.

B-Inspection at motion

The characteristics of the gait of all limbs should be observed from a distance. In most cases it is advantageous to observe the forelimbs first and follow this with observation of the hind limbs. The shoes if present, should be removed before examination. The main objective in exercising the horse is to identify the limb or limbs involved and the degree of lameness and incoordination in movement. To do this the horse is observed at a walk, trot, and the in some cases at a gallop. Often, the trot is the most advantageous gait for the examination because there is only one other supporting foot on the ground. In general, forelimb lameness is best viewed from the front and side, and hind limb lameness is best observed from the side and rear. In most cases the evaluation of lameness is best carried out on hard surfaces. It provides more concussion than a softer surface. Plus, on using hard surface, the feet can be seen and heard, and the unsound limb produces less noise on landing..

This examination includes watching the horse move from the front, the side and from behind. Also, circling the horse or having them perform figure eight's can accentuate lameness. Look for head nodding, gait deficits, alterations in the height of the foot flight arc, phase of stride, joint flexion angle, foot placement, and symmetry in gluteal rise and duration.

The Forelimbs: -

With forelimb lameness, the head will drop when the sound foot hits the ground and rise when weight is put on the lame leg. This is logical because the animal is attempting to minimize the stress and weight put on the affected limb.

The hind limbs: -

With hind limb lameness, the arc of the foot flight is often reduced. The pelvis will rise just as the lame foot hits the ground. If the lameness is severe enough, there will be a head nod down on the contralateral forelimb as the pelvis rises.

Grading the lameness: -

The degree of lameness should be recorded. For some, simply using mild, moderate, and sever may suffice. However a more objective approach using a grading system may be more helpful. A grading system using five categories has been most commonly used:

Grade 1.

The lameness is not recognizable at the walk, (evident at the trot)

Grade 2.

The lameness is barely perceptible in the walk, (apparent at the trot)

Grade 3.

The lameness is apparent at both the walk and trot.

Grade 4.

The horse will not place the foot completely flat during weight bearing.

Grade 5.

This is a non-weight-bearing lameness

2-DETECTION OF SEAT OF LAMENESS

A-Palpation and Manipulation

Following observation of the animal from a distance, Close examination of the limbs by palpation is performed. In palpating, start at the bottom of the foot and make a complete examination of the entire limb.

Foot

Note the size and shape of the foot. Compare the normal with the abnormal. Look for any abnormal hoof wear, ring formation, heel bulb contraction, hoof wall cracks and swellings, and any other asymmetries. Palpate the coronary band for heat, swelling and pain on pressure. Have available hoof knife and hoof testers. Clean out the sole of the foot and search for any abnormalities, including frog atrophy, flat -footedness, or puncture wounds. Use hoof testers on the entire sole and frog region of

the foot. Try to localize any hoof sensitivity or signs of laminitis.

Pastern

Palpate this region for detection of heat and or enlargement. Compare any suspected abnormalities with the opposite pastern. Check for any thickening of the tendons. Rotate the joint to detect presence of pain in the collateral ligaments.

Fetlock

Palpate both the dorsal and palmar aspect for detection of any thickening and swelling of the joint capsule. Palpate the superficial and deep digital flexors for presence of heat, pain or swelling. Palpate the sesamoid bones and the associated ligaments. Rotate and flex the fetlock to check the collateral ligaments and range of motion.

Metacarpus/tarsus

Palpate the tendons on both the dorsal and palmar surfaces for any swelling, pain or heat. Also, palpate the length of MC3/MT3 and the splint bones looking for abnormalities. With the fetlock flexed and raised, check the suspensory ligaments and compare them to the opposite side.

Carpus

Visualize for swelling on the dorsal and palmar surfaces. Try to associate any swelling with a particular joint space. Is the swelling diffuse or local? Palpate all the regions individually. This evaluation is most affective while the carpus is flexed. Also, note the degree of flexion and any associated pain. Evaluate the individual carpal bones and accessory carpal bone with thumb pressure.

Antebrachium (Forearm)

Evaluate all the soft tissues for any swelling and inflammation. Also, palpate the bones of the region (i.e. radius) for any fractures.

Elbow

Palpate the soft tissues of the elbow joint. Abduct the elbow and carpus to place stress on the medial support structures looking for pain. Flex and

extend the elbow. Palpate the olecranon, collateral ligaments, and distal humerus.

Shoulder

Palpate all the soft tissue of the scapulohumeral joint and look for atrophy or swelling. Palpate the bicipital bursa region. Flex, extend, abduct and adduct the shoulder looking for abnormalities. Look for any atrophy in the region of the scapula.

Tarsus

Evaluate the tarsocrural/tibiotarsal joint for any distension, thickening of the joint capsule, bone proliferation of the distal tarsal joints, distension of the tarsal sheath. Also, look at the distal intertarsal and tarsometatarsal joints. Also, while in that region, observe the tibia for any swelling or pain.

Stifle

Appreciate any changes in the femoro-patellar joint or distension of the joint. Observe the associated muscles for atrophy or swelling. Palpate the patellar ligaments. Note the location of the patella itself, looking for any luxation.

Femur and Hip

Examine the muscles of the region for inflammation and/or atrophy. Palpate the femur looking for fractures. Examine the hip for asymmetry and muscle atrophy. Measure the distance from the tuber ischii to the greater trochanter, and the tuber sacrale to the greater trochanter. With any luxation of the hip there may be disparity in these measurements.

B-Diagnostic Anesthesia

Using appropriate nerve blocks can help localize the causative area of the lameness. To determine the specific area, begin with a block at the lowest point of the affected limb. Remember, you DESENSITIZE everything below your nerve block, so it is safest to start distally. One can choose either an intra-articular (into a joint) or peri-neural (around a nerve) nerve block. After the nerve block, the patient is reevaluated for any changes in condition. When alleviation of lameness is achieved, one can proceed with a diagnostic imaging of the appropriate region.

C-Diagnostic imaging

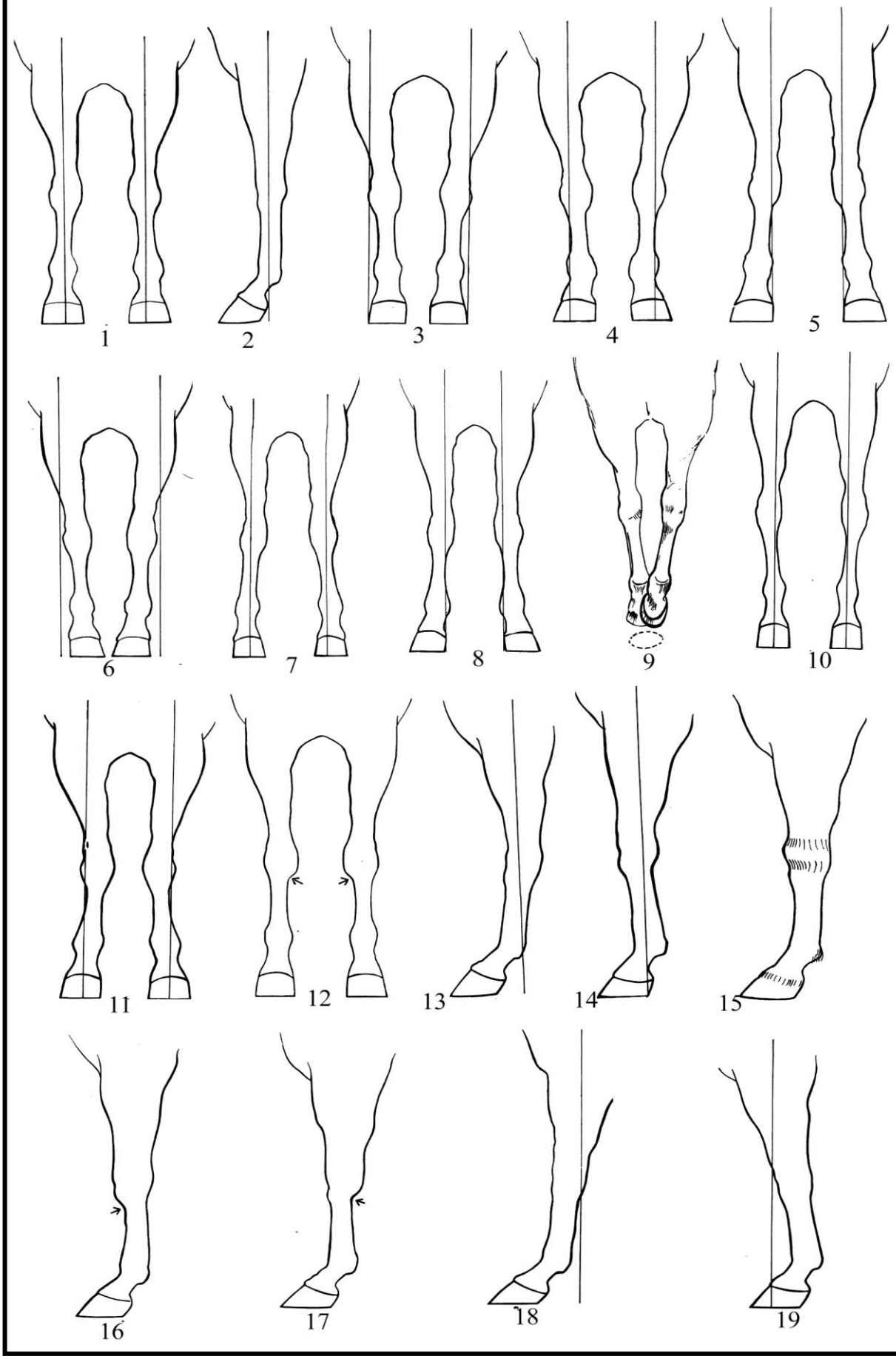
The suspected area is examined radiographically to identify damage or changes in bony structures. Ultrasonography, nuclear scintigraphy (bone scan), or magnetic resonance imaging (MRI) are used for soft-tissue problems involving tendons, ligaments, joint surfaces, and muscle tissue. Computer tomography (CT) may be used for both tissue and bone.

D-Synovial fluid analysis

Synovial fluid sample is taken for examination to determine if infection or inflammations are present. These tests usually require laboratory evaluation before results are available.

In some cases, one or two of these steps in the examination of lameness may allow the veterinarian to make diagnoses and determine treatment. In other cases, all of these factors will need to be considered and additional steps taken based on the over-all condition of the horse, the severity of the lameness, and the horse owner's plans for the horse.

A thorough lameness workup with the development of related rehabilitations regimens can be complicated and time-consuming. Owners should make sure they understand what is causing the lameness, the prognosis for recovery, and the medications, exercises, therapies and other requirements to restore the lame horse to its best possible condition.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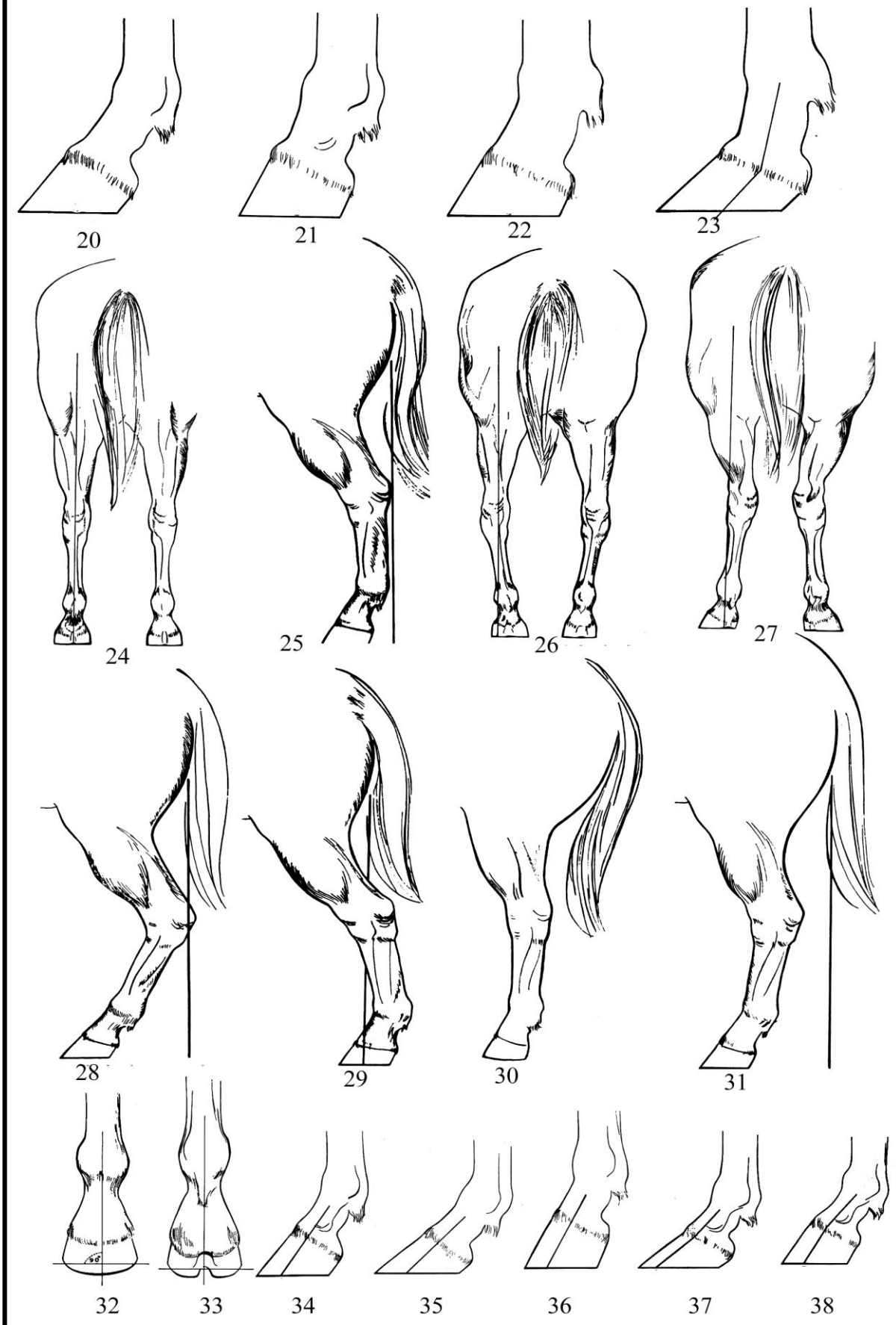
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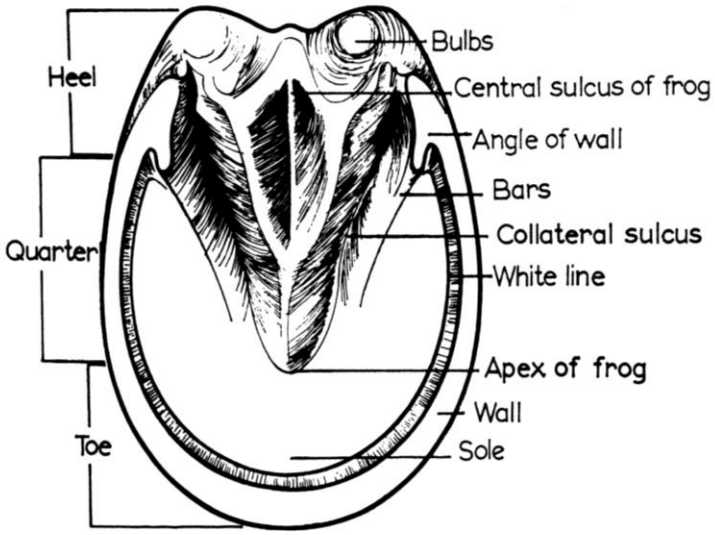

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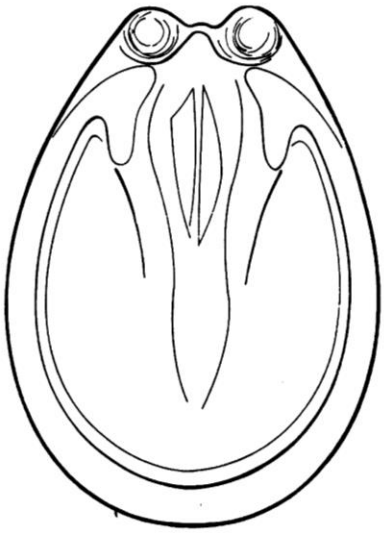

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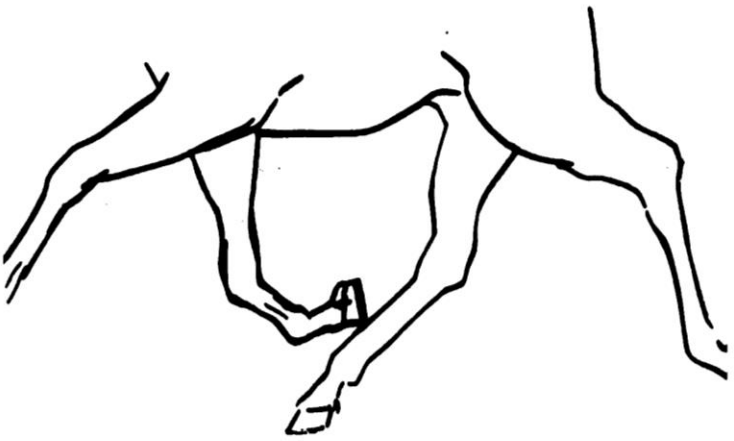

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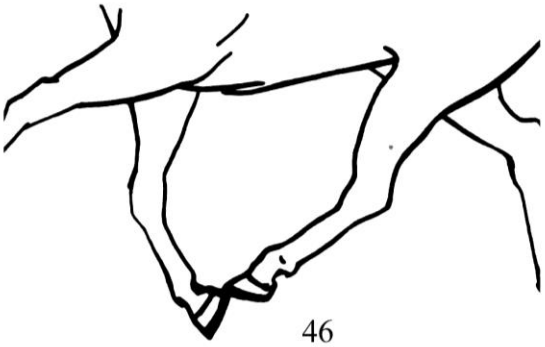

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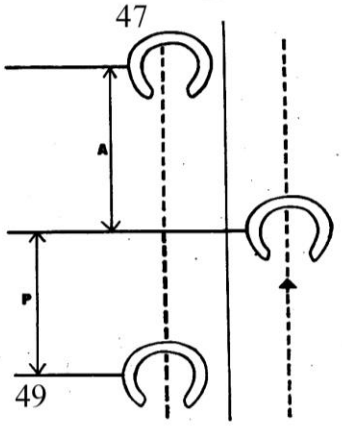

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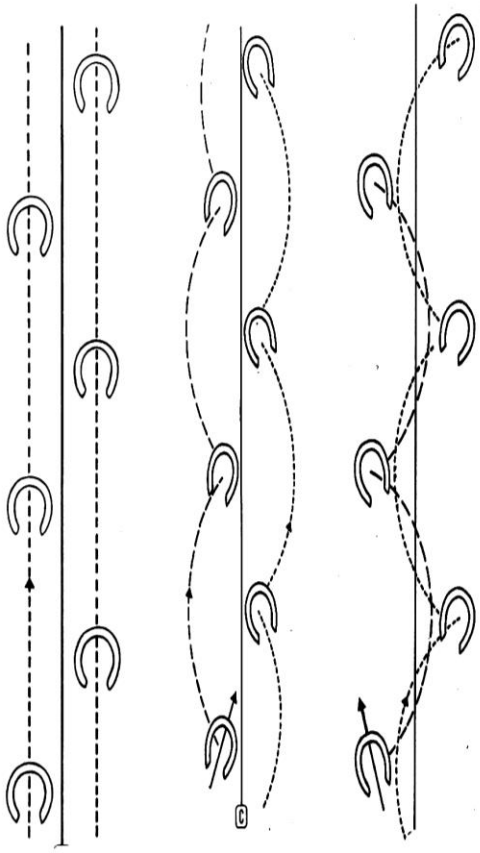

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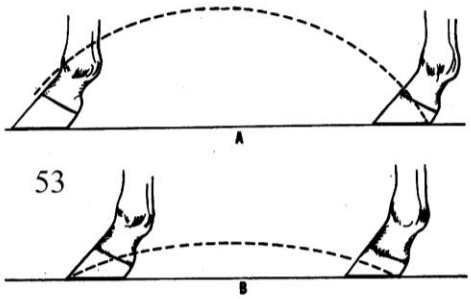

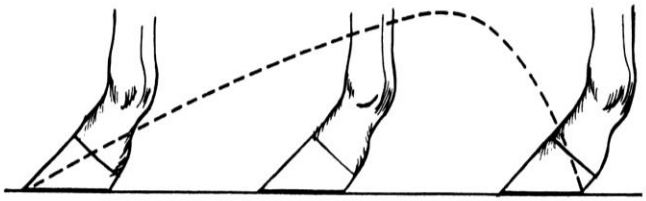

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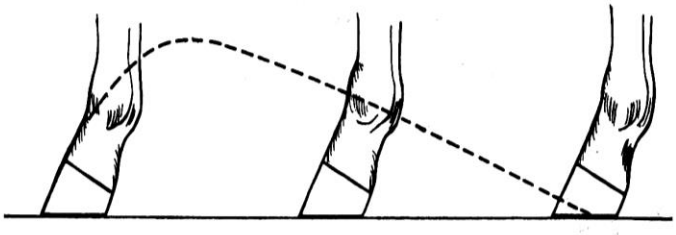

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1-Normal anterior view
2-Normal lateral view
3-Base narrow
4-Base narrow, toe-out
5-Base wide
6-Base narrow, toe-in
7-Base wide, toe-in
8-Base wide, toe-out
9-Plaiting
10-Bow legs
11-Knock knees
12-Offset
13-Calf knee
14-Bucked knees
15-Open knee
16-Cut out under knees
17-Tied-in knees
18-Camped in front
19-Standing under in front
20-Normal hoof & pastern angulation
21-Short upright pastern
22-Long upright pastern
23-Long upright pastern with broken foot and pastern axes and low heels
24-Normal hind limb posterior view
25-Nnormal hind limb side view
26-Base narrow bowed legs
27-Cow hocks
28-Sickle hocks
29-Camped behind
30-Straight behind
31-Standing under behind
32-Foot & pastern axes anterior view
33-Foot and pastern axes posterior view
34-Normal foot and pastern axes side view
35-Foot and pastern axes less than normal
36-Foot and pastern axes greater than normal
37-Broken foot axis low heel
38-Broken foot axis high heel
39-Normal ground surface of hoof
40-Rings in the hoof
41-Contracted heels
42-Bull-nosed foot
43-Buttress foot
44-Coon-footed
45-Scalping
46-Cross-firing
47-Forging
48-Overreaching
49-Normal stride
50- Normal stride
51-Paddling
52-Winging
53-Normal & low arc foot in flight
54-Arc in flight low heel
55-Arc in flight high heel

In the light of what you studied, make examination to the following cases and fill the report

Case No. 1: -

Diagnosis: -

Acquired affections: -

Congenital anomalies: -

Expected surgical affections that may be caused by these congenital anomaly: -

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Case No. 2: -

Diagnosis: -

Acquired affections: -

Congenital anomalies: -

Expected surgical affections that may be caused by these congenital anomaly: -

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Case No. 3: -

Diagnosis: -

Acquired affections: -

Congenital anomalies: -

Expected surgical affections that may be caused by these congenital anomaly: -

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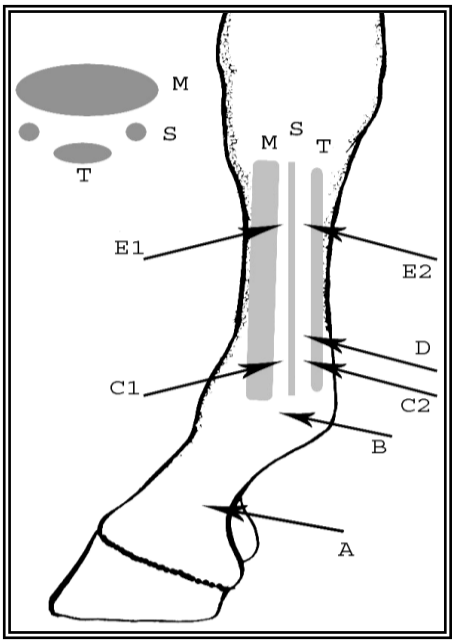
HIGH VOLAR NEURECTOMY (palmar/planter digital)

Anatomy: -

The medial high volar nerve (palmar/ planter nerve) passes with the vein and artery (VAN) in the groove between the suspensory ligament and digital flexor tendons. At the middle of the cannon bone, the medial high volar (palmar/ planter nerve) sends small branch to the lateral high volar (palmar/ planter nerve) that passes behind the flexor tendons and join the lateral branch at the level of the button of splint bone.



A: Low volar (palmar/planter digital) n. block
B: Abaxial (basisesamoid) n. block
C1 &C2: Low palmar/planter (low 4-point) n. block
D: High volar (palmar/planter) n. block
E1&E2: High palmar/planter (high 4-point) nerve block
M: Metacarpal bone
S: Suspensory ligament
T: Superfecial and deep flexor tendons

Indications: -

All painful affections that not response to medical treatment, from fetlock joint and downwards including

1-Ring bones
2-Old fracture of 3rd phalanx

Anesthesia: -

1-Basal narcosis
2-Local analgesia

Surgical Technique: -

1-Casting of the animal
2-Aseptic precautions
3-Tourniquet above carpal joint
4-Inducttion of incision between flexor tendons and suspensory ligament between middle and lower 3rd of cannon bone
5-With minimal dissection, the three structures should be distinguished, including the nerve caudally, the artery in the middle and the vein cranially
6-The vein is characterized by its thin wall and dark blood, the artery is characterized by presence of pulsation and its elasticity, and the nerve is characterized by longitudinal striation and pain response on pressing it with tissue forceps

7-The nerve is cut dorsally 1st then another cut is made 2 cm lower to the 1st cut, to minimize induced pain to the animal and to avoid regeneration and re-anastomosis of the nerve after surgery
8-The wound is sutured in routine manner

After Care: -

1-Anti biotic 2-Anti inflammatory
3-Anti tetanic serum 4-Daily dressing
5-Removal of stitches in the proper time

Complications: -

1-General complications of wounds like
-Hemorrhage
-Infection
-Stitch abscess
2-Specific complications like
-Cutting the artery or the vein accidentally
-Regeneration of the nerve
-Neuroma (Painful)
-Absence of sensation may predispose the animal to have picked up nail without any signs of pain until infection advanced and signs of severe swelling of the limb appear
-Sloughing of the hoof, months after surgery as a result of fibrosis around the artery
-Rupture of insertion of deep digital flexor tendon

In the light of what you studied, illustrate the steps of surgical technique in diagram and clarify the three main structures at the site of surgery

LOW VOLAR NEURECTOMY (posterior digital)

Anatomy: -

At the fetlock region, every volar nerve *(palmar/ planter nerve)* divides into three branches named *low volar nerves (palmar/ planter digital nerve)*) and pass in the same relation to the artery and vein (VAN) but the artery sinks slightly.

1-The *anterior* branch innervates coronary cushion
2-The *middle* branch innervates coronary cushion and sensitive laminae
3-The *posterior digital* branch innervates sensitive laminae and os pedis.

Palmar nerves in the forelimb are continuation of the median and ulnar nerves that fuse at the carpus then separate to form medial and lateral palmar nerves at metacarpal region and downward, while in the hind limb, planter nerves are the continuation of posterior tibial nerve. They have the same anatomical position like the forelimb, but their clinical significance is lower than that of the forelimb, because the digit is innervated by branches from the anterior tibial nerve (deep peroneal) and saphenous nerve.

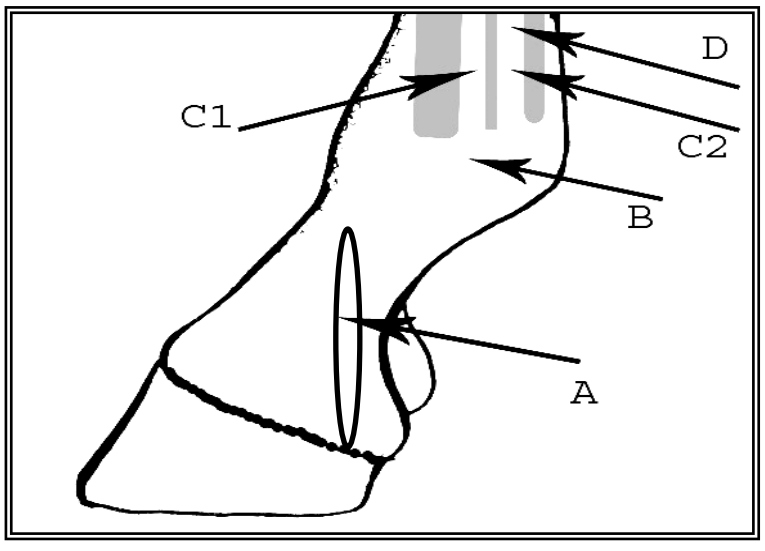
Indications: -

Mainly for treatment of navicular disease

Anesthesia: -

1-Basal narcosis
2-Local analgesia

Surgical Technique: -



1-Casting of the animal
2-Aseptic precautions
3-Tourniquet above carpal joint
4-Inducttion of incision between flexor tendons and 1st phalanx, perpendicular on the line of coronet
5-With minimal dissection, the four structures should be distinguished, including the nerve caudally, the artery in the middle (in a deeper location that allows the vein to come closer to the nerve), the vein cranially, and the ergot ligament

6-The vein is characterized by its thin wall and dark blood, the artery is characterized by presence of pulsation, deeper location and its elasticity, the nerve is characterized by longitudinal striation and pain response on pressing it with tissue forceps, and the ergot ligament is characterized by its low elasticity, striation and luster.
7-The nerve is cut dorsally 1st then another cut is made 1 cm lower to the 1st cut, to minimize induced pain to the animal and to avoid regeneration and re-anastomosis of the nerve after surgery
8-The wound is sutured in routine manner

After Care: -

1-Anti biotic 2-Anti inflammatory
3-Anti tetanic serum 4-Daily dressing
5-Removal of stitches in the proper time

Complications: -

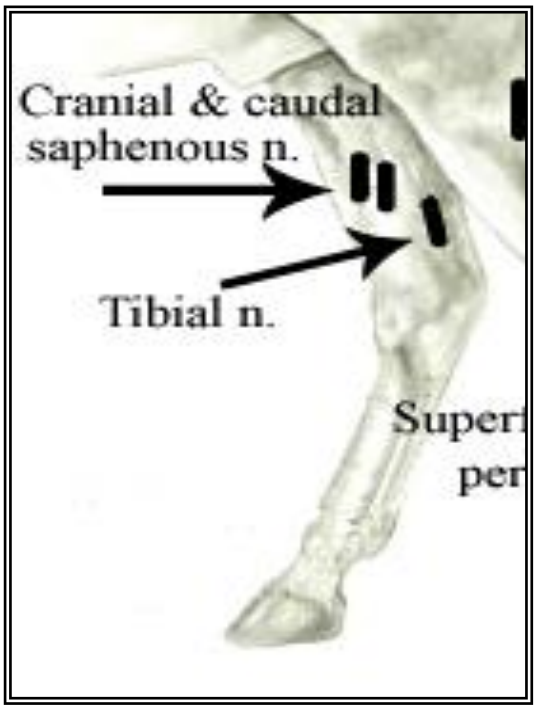
1-General complications of wounds like
-Hemorrhage
-Infection
-Stitch abscess
2-Specific complications like
-Cutting the artery, ergot ligament or the vein accidentally
-Regeneration of the nerve
-Neuroma (Painful)
-Absence of sensation may predispose the animal to have picked up nail without any signs of pain until infection advanced and signs of severe swelling of the limb appear
-Sloughing of the hoof, months after surgery as a result of fibrosis around the artery
-Rupture of insertion of deep digital flexor tendon

In the light of what you studied, illustrate the steps of surgical technique in diagram and clarify the four main structures at the site of surgery

POSTERIOR TIBIAL NERVE NEURECTOMY

Anatomy: -

The *tibial* nerve lies 15 cm above the point of the hock in the space between Achilles tendon and long digital flexor on the medial aspect of the limb. The nerve becomes palpable closer to the Achilles tendon as the limb is flexed and vice versa. It innervates planter structures of metatarsus and most of the foot.



Indications: -

Tibial neurectomy is used for desensitization of the posterior aspect of metatarsus, the medial and lateral aspects of the fetlock, and the whole digit.

Anesthesia: -

1-Basal narcosis
2-Local analgesia

Surgical Technique: -

1-Casting of the animal and flexion of operated limb to permit the nerve to move back to the space anterior to Achilles tendon and long digital flexor
2-Aseptic precautions
3-Application of tourniquet above site of surgery
4-Incise the skin on the medial aspect and make dissection to separate the nerve
5-Cut the nerve two cuts with distance of 2 cm, and start with dorsal cut 1st then the ventral cut to minimize induced pain
6-Suture the wound in routine manner

Complications: -

General complications of wounds like
-Hemorrhage
-Infection
-Stitch abscess

In the light of what you studied, illustrate the steps of surgical technique in diagram and clarify the posterior tibial nerve location

PATELLAR DESMOTOMY

Aim: -

Treatment of upward patellar luxation which is permanent or temporary fixation of the patella, over the medial ridge of the femoral trochlea, between the medial and middle patellar ligaments

Etiology of upward patellar luxation: -

1-Bad conformation as straight-leg conformation
2-Overstretching of the patellar ligaments from injury to the leg
3-Sudden taken out of the animal of training and confined to a stall (in equine). The sudden loss of tone of stifle muscles and ligaments allows for increase range of movement of the patella with resultant fixation
4-Excessive contraction of quadriceps muscle during hyperextension of the limb. This may occurs in slipping, jumping, kicking or forcibly pulling out of the limb from a stock.

Signs of upward patellar luxation: -

1-Hind limb locked with extension of stifle and hock, and flexion of fetlock
2-Catching of the patella especially on short circle turning toward the affected limb
3-Dragging the front of the hoof
4-Low arc of foot flight
5-Short anterior phase stride
6-Snapping sound on release of the patella
7-In chronic cases, presence of gonitis (characterized by excess fluid or thickening of joint capsule) or chondromalacia of the patella

Diagnosis of upward patellar luxation: -

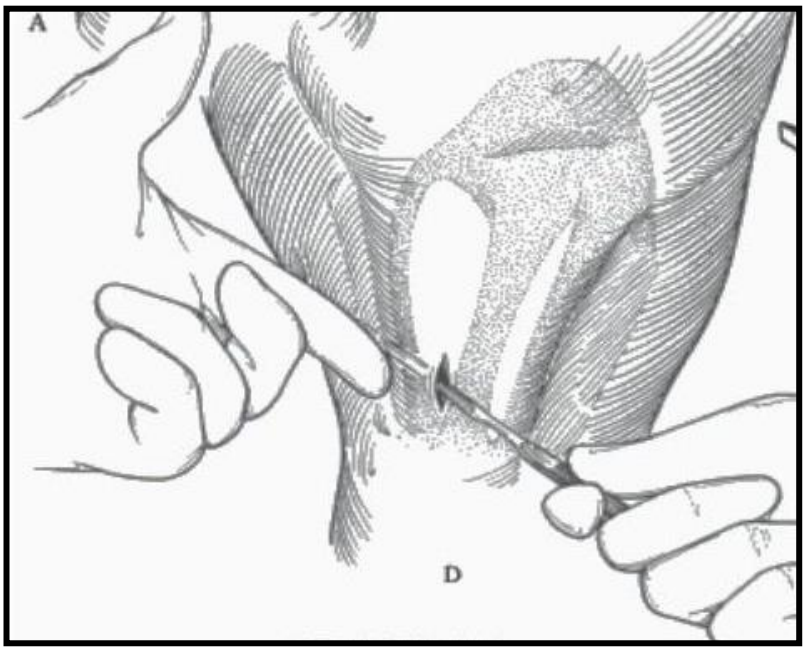
1-Signs
2-Examination
3-Locking of the patella by upward outward forcing
4-Differential diagnosis from stringhalt (examination, and absence of catching of the patella)

Surgical treatment of upward patellar luxation: -

Medial patellar desmotomy is the treatment of choice. It means transaction of the medial patellar ligament at its tibial attachment. The

gait is slightly altered and 3-6 weeks should be allowed for accommodation to the functional loss of this ligament.

-The surgery is performed in standing position but also can be performed in recumbent position.



-The area over the medial and middle patellar ligaments is clipped and prepared aseptically for surgery.

Subcutaneous and deep infiltration with 10 mL of 2% lignocaine-hydrochloride was performed over the medial and middle patellar ligaments close to their insertion on the tibial crest. A 2 cm linear incision is made 0.5 cm lateral to the medial patellar ligament near its insertion on the tibial tuberosity. A blunt-end, curved bistoury is inserted vertically. The bistoury is rotated 90 degrees and the distal aspect of the medial patellar ligament was severed with a short sawing motion. The medial patellar ligament could no longer be palpated under the skin. The skin edges were opposed with #2 monofilament nylon

Complications: -

1-General complications of wounds like
-Hemorrhage
-Infection
-Stitch abscess
2-Specific complications like
-Partial or failure of cutting of the ligament indicated by persistent signs of luxation
-Cutting of middle patellar ligament indicated by sudden recumbence of the anima, and this animal should be slaughtered
-Gonitis

In the light of what you studied,

1-Mention signs of upward patellar luxation

2-Mention complications of operation

3-By a diagram, clarify the position of the patella in relation to femur and illustrate the three patellar ligaments

CUNEAN TENECTOMY

Degenerative joint disease or osteoarthritis of the tarsometatarsal, distal intertarsal (and less commonly the proximal intertarsal joint), colloquially known as “bone spavin,” is a common cause of lameness or poor performance in horses from all disciplines.

Lameness may be unilateral or bilateral, and pathology may develop in one joint only, or two or even three concurrently. Distal hock joint pain may be a sequela of incomplete ossification of the central and third tarsal bones; certain conformational abnormalities (sickle hock, cow hocked, or excessively straight hock conformation) are also believed to be predisposing.

It has been proposed that degenerative joint disease of the distal tarsal joints may be caused by excessive compression and rotation of these joints as the horse jumps or stops. In Icelandic horses, bone spavin is thought to be heritable

In most horses, few clinical signs are evident on physical examination, although in horses with more chronic distal hock pathology, the soft tissues over the medial aspect of the distal hock joints may be appreciably thickened. Lameness varies from subtle loss of performance without overt lameness to moderate or severe lameness. A characteristic gait related to lameness from the distal hock joints has been described as adduction of the hind limb with an abrupt abduction occurring just before the limb contacting the ground; this has been referred to as a "stabbing" gait, which, although frequently evident, is not pathognomonic. Horses can exhibit this gait with lameness originating from other causes, and distal hock pain may also present with a different gait. Lameness may be exacerbated when the horse is on a circle, with some horses showing more lameness with the affected limb on the inside and some with the limb on the outside. A proximal limb flexion test will exacerbate lameness in some, but not all, horses with distal hock joint pain.

Radiographic changes include narrowing or loss of joint space, sclerosis of the subchondral bone, lysis of the subchondral bone, periarticular osteophyte formation, and periosteal new bone formation. The severity of lameness and degree of radiologic change are poorly correlated. In those horses in which distal hock joint pain is suspected but there is little radiologic change, scintigraphy of the tarsus may reveal an increased focal uptake of radionuclide in the distal tarsal bones.

The aim of treatment is to provide pain relief so that the horse may remain in work. It has been suggested that by maintaining the horse in work, the distal hock joints will eventually ankylose and the horse will become pain free. However, progressive radiologic ankylosis is rarely observed and has not occurred in lame horses without intervention.

Cunean tenectomy may result in a temporary improvement in lameness but is unlikely to restore soundness. It is believed to reduce the pressure over the medial aspect of the distal tarsus and cunean bursa and to reduce the rotational and shear stress over these joints during contraction of the tibialis cranialis muscle.

The most common surgical technique used in treatment of distal tarsal osteoarthritis is facilitation of fusion of the affected joints. Drilling across the distal intertarsal and tarsometatarsal joints is the most frequently used procedure to promote distal tarsal arthrodesis. Initial techniques described a more aggressive procedure, with 60% of the articular cartilage removed. Significant postoperative pain was associated with this procedure, and a more conservative approach using three drill tracts is currently recommended. Return to full athletic performance usually takes 10–12 mo. Retrospective studies evaluating this technique report ~60% of horses successfully return to their previous level of performance.

Another surgical option for treating bone spavin is cunean tenectomy. Performed under sedation and a local anesthetic, a portion of the cunean tendon, which runs diagonally across the inside of the lower hock, is removed through a small incision. The proposed theory is that removal of this tendon might relieve pressure over the inside of the hock and alleviate pain associated with the cunean bursa (a small synovial fluid sac which lies underneath the tendon).

Anesthesia: -

1-Deep narcosis

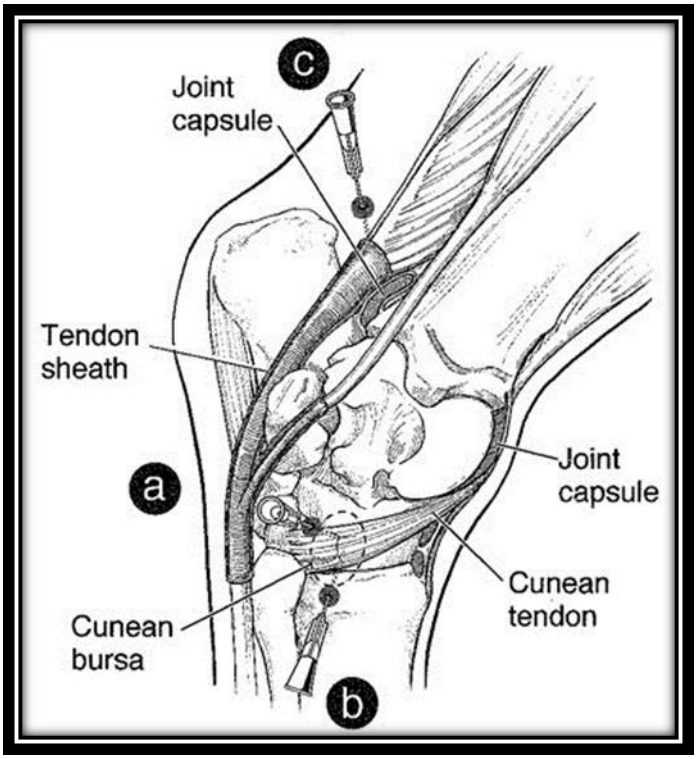
2-Local analgesia

Cunean tenectomy technique: -

Cunean tendon is the medial branch of the insertion of tibialis crainialis muscle located at the medial aspect of the tarsal joint passing obliquely over the distal intertarsal and tarsometatasal joints and inserts in the 1st tarsal bone

An incision is made on the medial aspect of the hock joint either vertical or in an oblique manner (parallel to the tendon), then the tendon is dissected and a piece of one inch is cut from the tendon.

The SC and skin are sutured in routine manner.

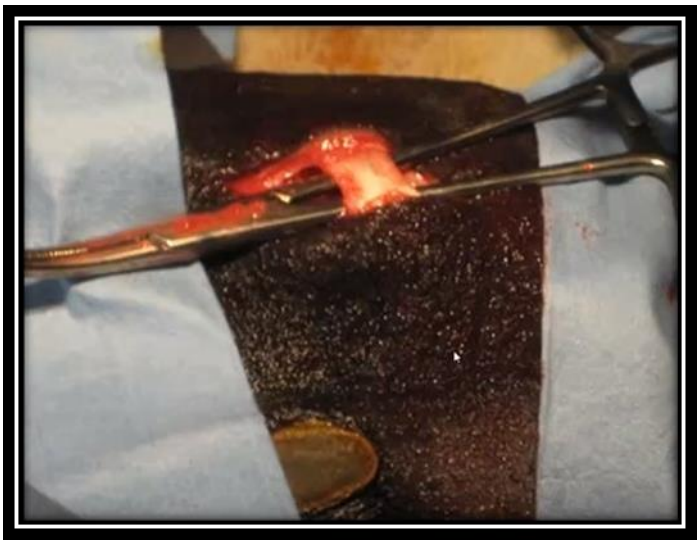


After care: -

Bandage

Antitetanic sera

Dressing to the wound



3-By a diagram, clarify the position of the cunean tendon in relation to hock joint

Radiology

The X-ray machine

1. The X-ray tube (fig. 1):

Glass or metal and glass, evacuated to produce high vacuum, into which are sealed 2 electrodes; the cathode (-) containing filament and the anode (+) containing target. The filament formed from Tungsten that acts as a source of electrons. The electrons move towards the target that is made up of a small block of Tungsten in a copper base placed at angle (20°) so the major portion of X-rays produced is directed downward through the window of the X-ray tube.

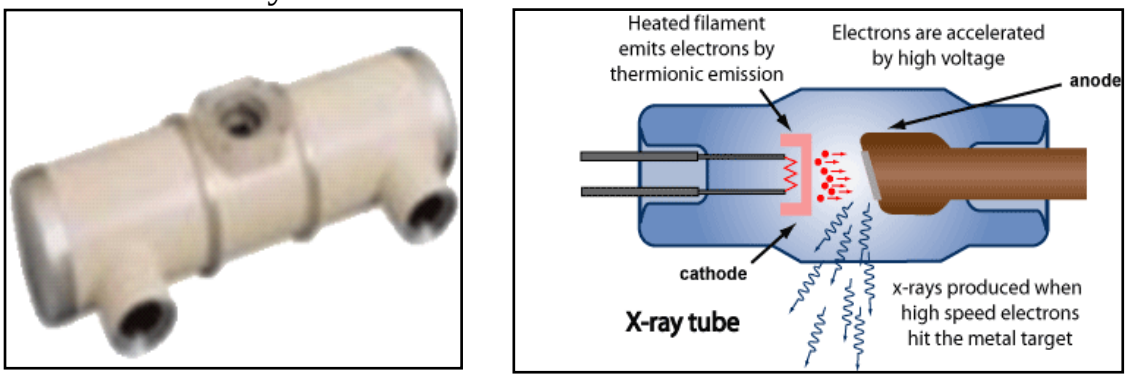


Fig.1: X-ray Tube

2. The Transformers (fig. 2):

Transformers are essential to supply a suitable current to x-ray machine.

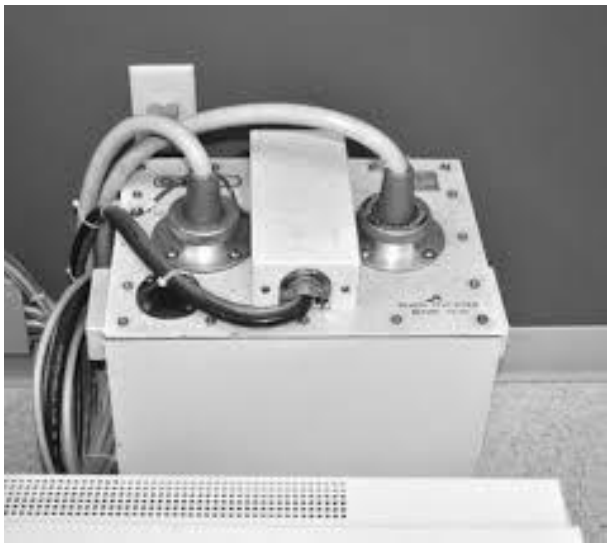


Fig. 2: the transformer

3. The Tube stand (fig. 3):

Denote to the apparatus which support the X-ray tube during performing radiography. It is constructing in different forms. It is important that the type of stand employed should be suitable for the type of examination to be carried out.

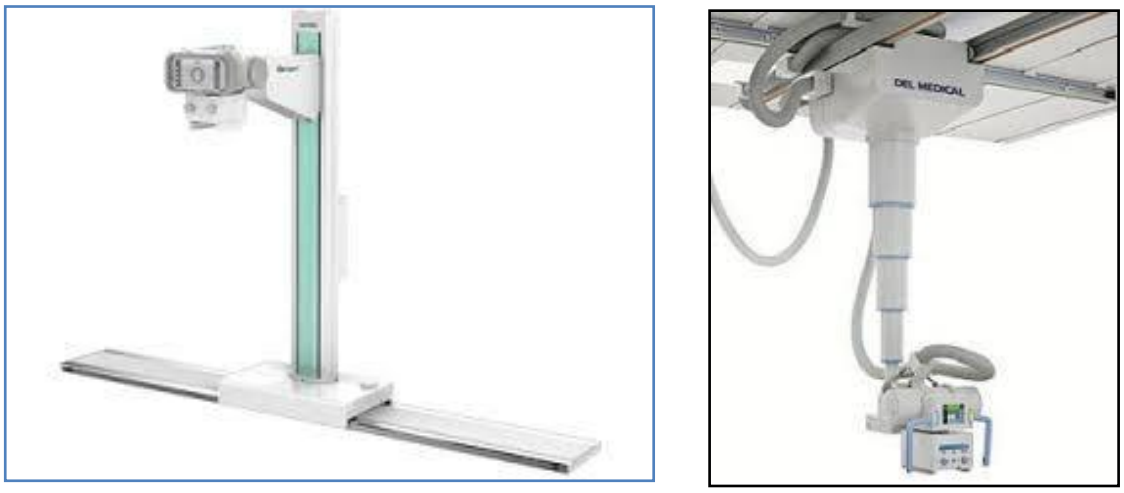


Fig. 3: the tube stand

4. The Control Panel (fig. 4):

Contains the meters and switches necessary for operating the x-ray machine. It comprises some or all of the following:

- **The on/off switch:**
- **The kilovoltage selector:** Kilovoltage (KV) in the X-ray machine provides a potential difference between the cathode and the anode of sufficient amount to cause electrons to be draw across the space between the filament and the target. The more KV, the greater is the attraction. The kilovoltage will be directly calibrated, usually in ascending 5 KV values. A range from 45 to 75 KV is adequate for most small animals and 75-125 KV for large animals.
- **Milliamperage selector:** Milliamperage affects the amount of X-ray produced. However, the amount of radiation is also controlled by the length of the exposure and is best expressed in milliamperage seconds. Various milliamperage levels can be pre-selected by adjusting the milliamperage selector.
- **Timer and exposure button (fig 5):** The exposure button is normally attached to the control panel by a length of cable so that the person making the exposure may position himself at a safe distance from the primary beam. It is necessary that the cathode filament should be activated and heated to produce electrons for a short time before the

exposure is actually made. For this reason, the exposure button consists of two stages; depression of the first half activates the filaments, and after a short pause, complete depression closes the circuit and makes the radiographic exposure.

Fig. 4: the control panel

Fig. 5: the exposure button

Types of X-ray Apparatus

There is a very wide variety of machines of different size, power, and manufacture. They may be divided into 3 main groups:

1. Portable X-ray apparatus (fig. 6): Can easily be taken to pieces and transported by car. Range of use in large animals is restricted to radiography of the feet of horses but not above the carpus or tarsus. In small animals, portable apparatus is satisfactory.

2. Mobile X-ray apparatus (fig. 7): This machine can be moved over level surface.

Fig. 6: Portable X-ray apparatus

Fig.7: Mobile X-ray apparatus

3. Fixed X-ray apparatus (fig. 8): The transformers for such apparatus are built into a special room and provided with special electrical connection to the mains.

Fig. 8: fixed x-ray apparatus

X-rays imaging room

Definition:

The room where the radiographic imaging and processing take place

1. Dark room:

The room where the radiography process begins and ends where films are loaded into cassettes ready for exposure and returned for processing into a finished radiograph.

2. Exposure area:

The room where the radiographic image is taken and its wall should be leaded.

3. Control panel room:

The room where the technician stand

X-ray processing dark room

A. Dark room must have the following requirements:

- The floor area must not be less than 2.5 X 2 m.
- Light proofing. The room must be sealed in complete darkness. Doors must fit closely into the frame.
- Presence of an inside locks on the door to prevent sudden opening during film processing.
- The room must be kept clean at all times and should not be used as storage.
- Windows can be completely sealed, but it is desirable that they should be opened occasionally to let in fresh air and sunshine.

•The walls should be painted with white or cream enamel. The part of the wall near the chemicals should be protected by china tiles or stainless steel.

•The ceiling should be painted by white or cream enamel.

•The floor must be easily washed and imperious to processing solutions (acid- proof cement or earthenware tiles).

B. Dark room equipment:

There are 2 main parts (dry bench and wet bench).

1. Dry bench: The dry bench on which the cassettes are unloaded and recharged with fresh films. The top surface of the dry bench must be large enough to accommodate the largest cassette when opened out. It should be made of wood or linoleum. Beneath the dry bench, there are store film boxes. The processing frames should hang above the bench each size alone.

Film cassettes (fig.9): A cassette is a light-tight metal container which holds the X-ray film and intensifying screens in close contact. The front face, which is made of aluminum or plastic, faces the tube. It is fixed by hinges to the back face, which is more strongly made and incorporates the pressure pad and a sheet of lead to absorb back scatter. Screens and cassettes are, of course, made in various sizes to correspond with the standard film sizes.

X-ray films (fig. 10): X-ray film consists of a flexible base of either cellulose acetate or polyester plastic coated on both sides with thin layers of apple-green photographic emulsion. Emulsion consists of a special gelatin containing finely dispersed tiny grains of silver halide. Type of X-ray films includes Screen films (standard, fast and ultra fast) and Nonscreen films. This type of film has been developed for use without intensifying screens and utilizes only the photographic effect of the X-ray beam. Long exposure time is necessary.

Fig.9: Film cassettes.

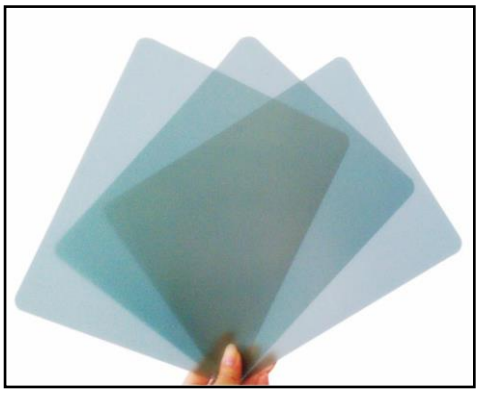


Fig 10: X-ray films

2. Wet bench (fig. 11): The wet bench in which the processing of the X-ray film is carried out. The processing equipment has a set of four tanks; the first for developer, the second for water rinse, the third for fixer and the fourth for washing the films. The tanks stand in a deep water jacket which keeps the solutions at the correct working temperature of 20°C by thermostatic control. Nine-liter developer and fixer tanks are suitable where not more than 3 films need developing at the same time. The tanks are made of stainless steel or porcelain. The washing tank should be at least 4 times larger than the developer tank.

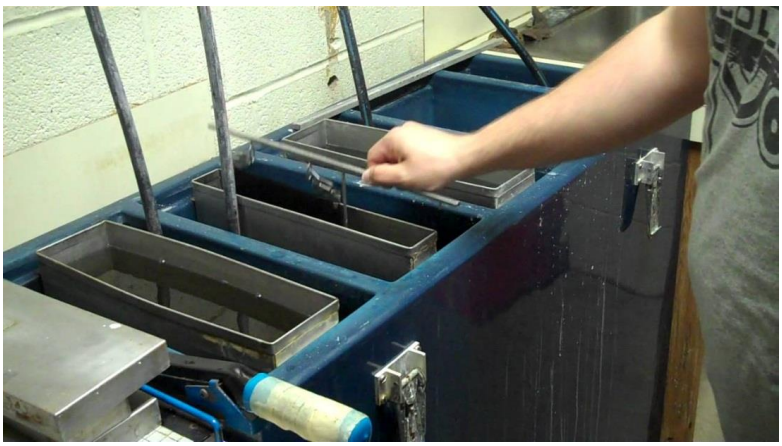


Fig. 11: Wet bench

Film processing (fig. 12)

The radiographic processing involves the following steps:

1. Storage of unexposed X-ray film.
2. Loading cassettes with X-ray films.
3. Storing of loaded X-ray cassettes.
4. Removing X-ray film from the cassette.
5. Placing the X-ray film on the film hanger (frame).
6. Developing of the X-ray film.
7. Water rinse.
8. Fixation of X-ray film.
9. Washing of X-ray film.
10. Drying X-ray film.
11. Identification of X-ray film.

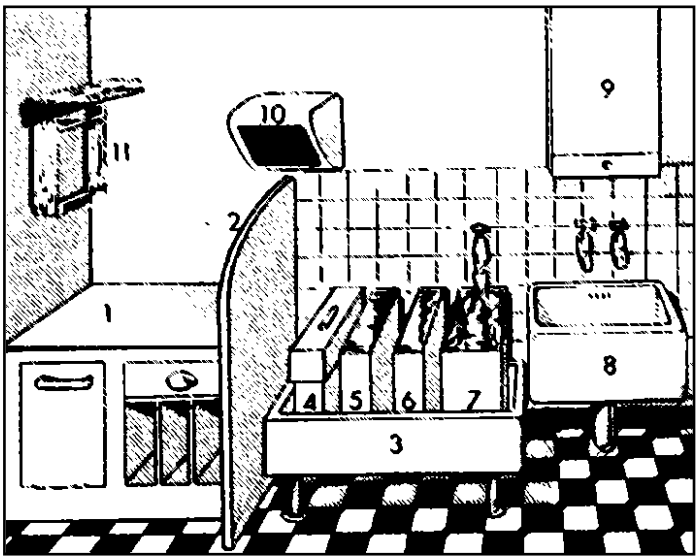


Fig. 12: A simple dark room layout (1) dry bench (2) partition between dry and wet benches (3) Sink to hold processing tanks (4) developer tank (5) rinse water tank (6) fixer tank (7) wash tank (8) sink (9) viewing box (10) safe light (11) film hangers

Review questions

Complete the following sentences:

1. The X-ray tube is containing the following functional parts……..,…….

2. Radiographic dark room should fulfill the following requirements:

a ……

b……..…

c……

d……..……..

e……

f…….

g……

h……

3. Dry bench is a place on which …… ……while, wet bench is a place in which…… ……is carried out.

4. The optimum developing time of an x-ray film is…… …….at ……while, the optimum fixation time is …….

5- Identification of an X-ray film involves the following points:

a……

b…….

c…….

d…….

Principles of radiographic interpretation

The opinion formed from the study of a radiograph.

Principals: -

Before interpreting any X-rays image, we should put in mind:

1. Only licensed doctor allow interpreting the radiographic image.
2. Using the correct terminology when interpreting the X-ray image.
3. Obtain a full knowledge about case history: A complete knowledge of the case history must be known for proper evaluation of the radiographs.
4. Perform a complete physical examination.
5. Establish a correct radiographic procedure.

Radiographic interpretation procedure

For optimal interpretive yield from a radiograph, it is important to follow the following guidelines:

1. Radiographic interpretation should preferably be done in a darkened room to allow good illumination of the radiographs on the X-ray view box.
2. Examine radiographs in a logical, systematic manner. Develop a routine of examining every radiograph from corner to corner.
3. It is important to know [radiographic] anatomy and pathology to be able to read a radiograph.
4. Cover unused portions of the viewing box to be able to see subtle changes in gray.
5. Use a magnifying glass and a millimeter ruler to maximize the perception of image detail.
6. When an abnormality is found do not neglect to examine the rest of the radiograph.
7. Record all relevant findings.

Steps of radiographic reading: -

All structures should be examined for abnormalities. Radio graphically, examine bone, and soft tissue separately.

Radiographic abnormalities include changes in position, size, shape, number, architecture, opacity and/or function.

The radiographs are placed on radiographic illuminator. The normal anatomy must be known for each area of the animal body. Radiographs show the anatomical structures in only one plane. In order to help establish a mental picture of normal anatomical parts, place the radiographs in a standard manner that is:

a-Ventrodorsal and dorsoventral radiographs are placed on the illuminator with the left side of the animal's body to the radiologist's right with the head upward.
b-Lateral/lateromedial and mediolateral radiographs are placed on the illuminator with the anterior of the animal's body to the radiologist's left with the vertebrae upward.
Once a pathological lesion has been located on the radiographic film, it becomes necessary to determine the type of the lesion. This determination depends upon the basic knowledge of surgery and experience of the radiographer making the interpretation. A more logical conclusion about each lesion can be obtained if the following categorization was taken into consideration:

1- Development changes.
2- Metabolic changes (rickets).
3- Traumatic changes (fractures).
4- Infectious changes (arthritis and osteomyelitis).
5- Neoplastic changes (metastatic neoplasm of the lung).
6- Degenerative changes (osteoarthritis).

- Integrate the finding with clinical data.
- Formulate a list of differential diagnosis.
- Write the opinion (Interpretation).

Radiographic projections (Radiographic views)

The practice of producing two-dimensional images using x-ray radiation
At least two projections are required:

- Lateral (thorax, abdomen, Head and Neck and tail).
- Latero-Medial (LM) / ML) (extremities).
- Dorso-Ventral (DV) /VD
- Cranio-Caudal (Cr.Cu /Cu.Cr) (extremities till carpus/tarsus)
- Dorso-Palmer or Planter (DP/PD) (extremities below carpus/tarsus)
- Specific projections.

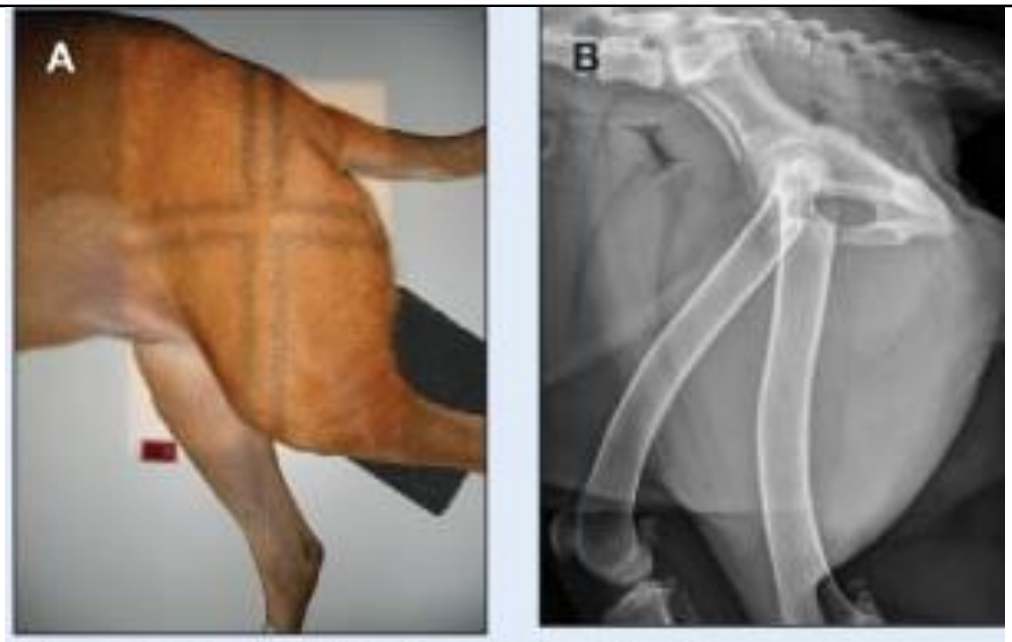


Figure 1. Lateral Radiograph of Pelvis
*(**A**) Dog positioned for a lateral radiograph of the pelvis. Note the sponge placed between the right and left pelvi limbs and, in this case, the right pelvic limb has been pulled cranially in a scissors fashion. (**B**) Right lateral radiograph of the pelvis from the dog in A.*

Fig.13: Lateral radiographic projection

Fig 14: Latero-medial projection

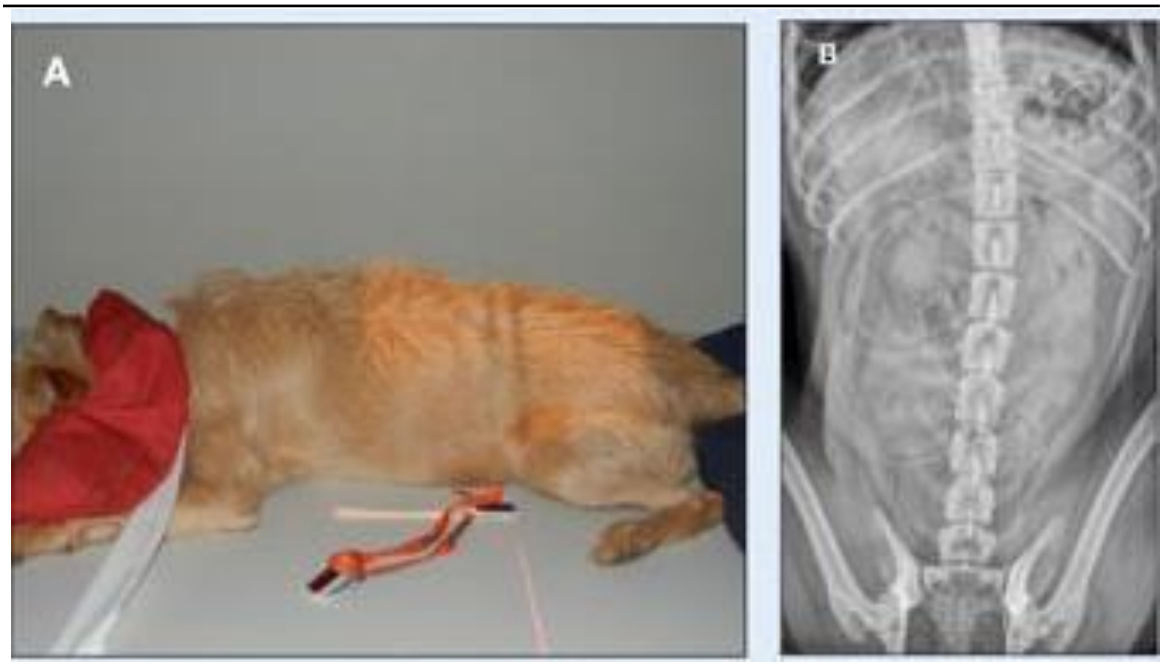


Fig.15a: Dorso-ventral radiographic projection.

Fig.15b: Frog-Leg Ventrodorsal radiographic projection.

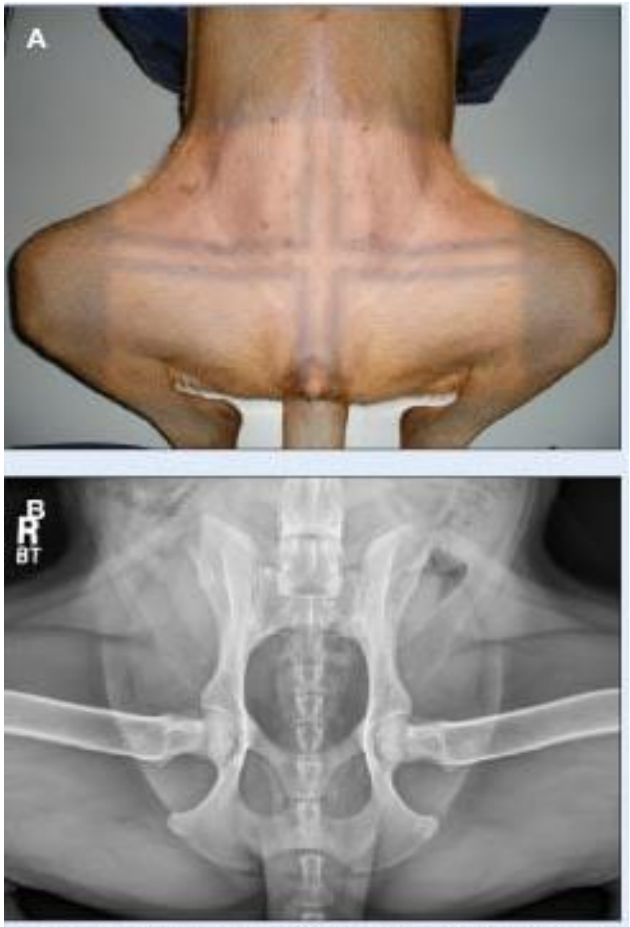


Figure 3. Frog-Leg Ventrodorsal Radiograph of Pelvis: *(**A**) Dog positioned for a frog-leg ventrodorsal radiograph. In this case, the dog's legs are allowed to lie outward, somewhat perpendicular to the pelvis. (**B**) Corresponding radiograph of the dog in A.*

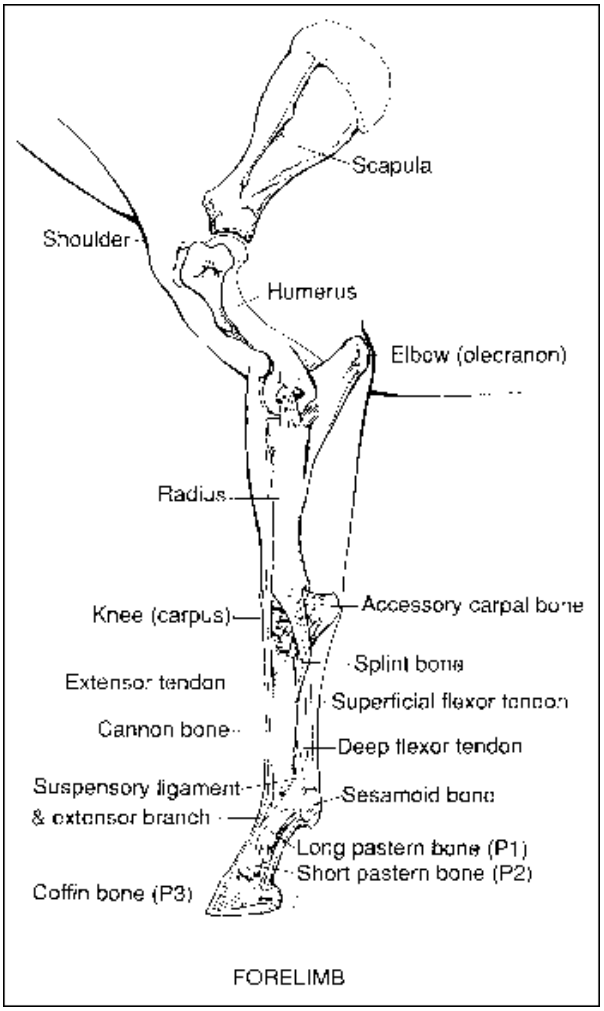


Fig.16: Diagram of fore limb of horse.

Radiograph of the equine forelimb.

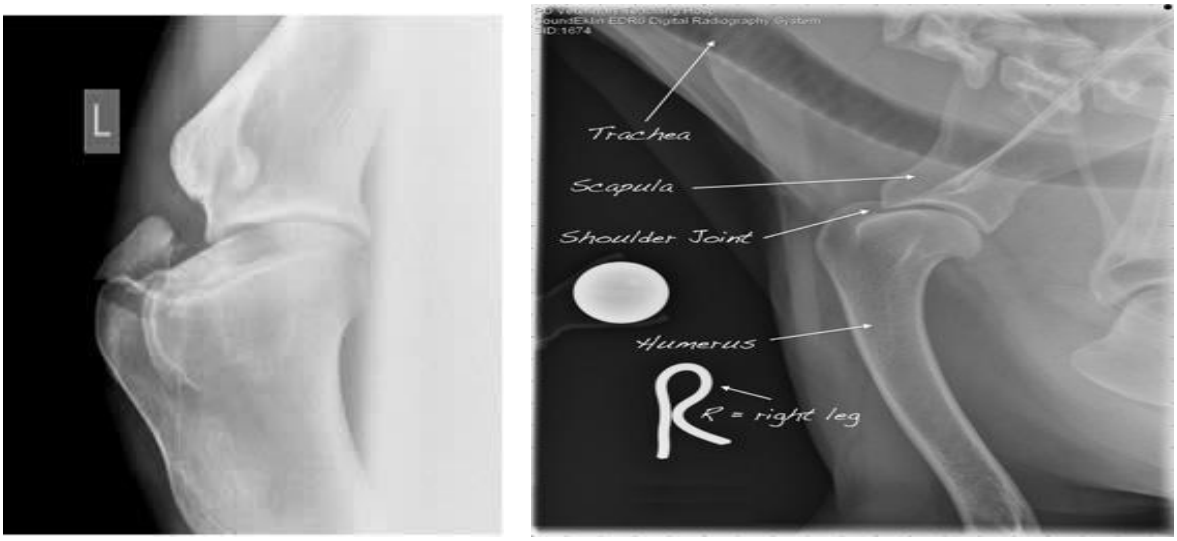


Fig. 17: Shoulder and Humerus

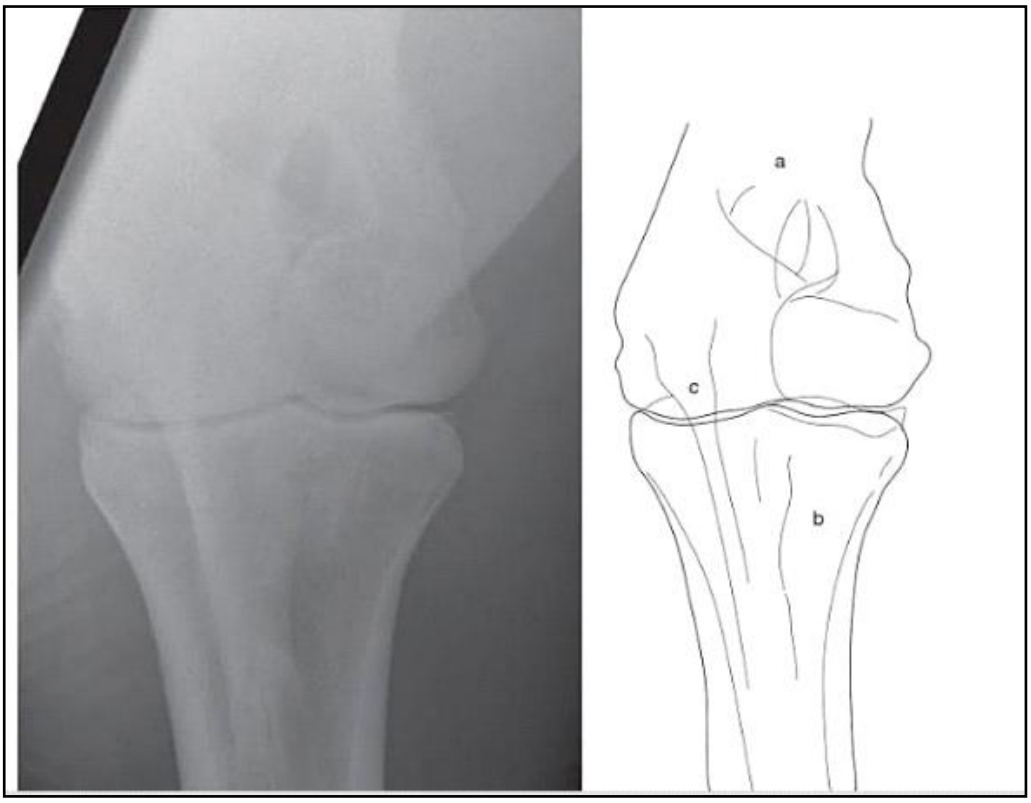
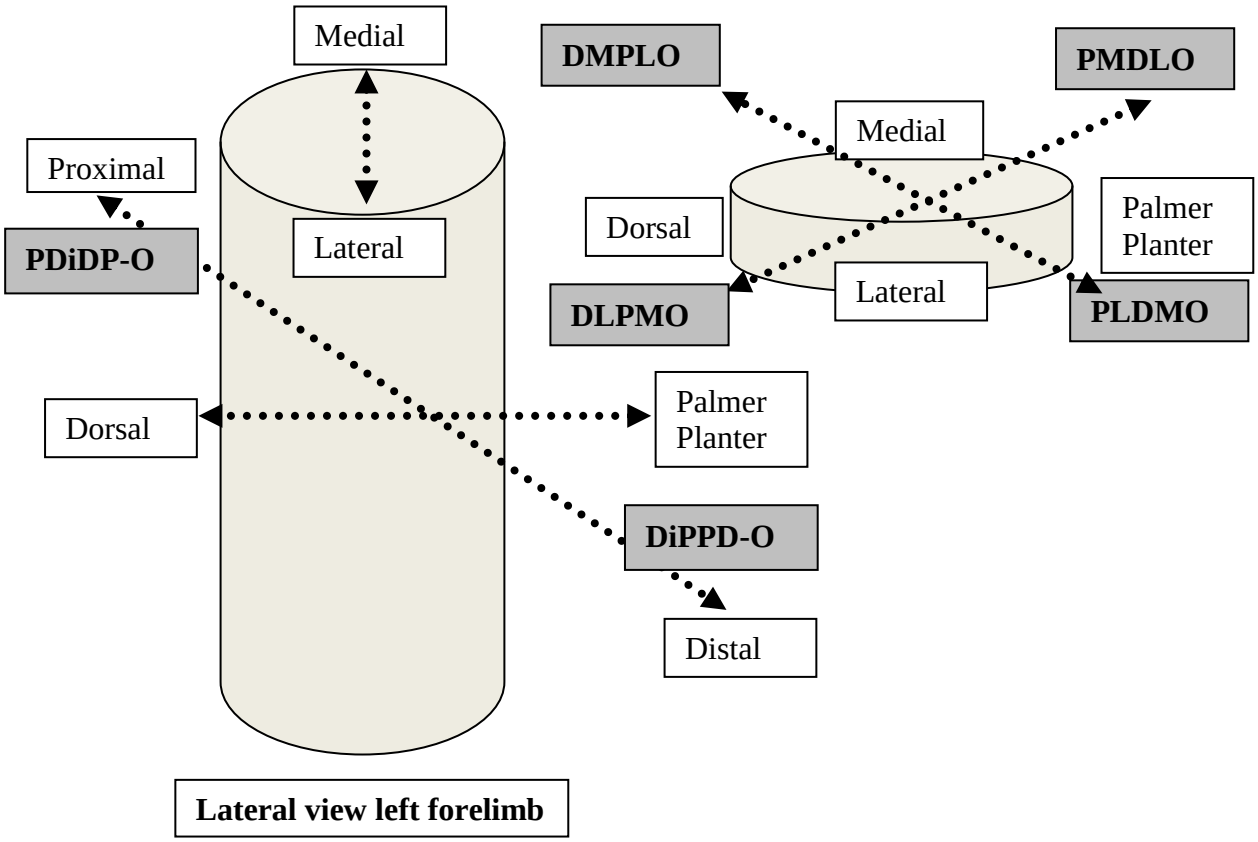


Fig. 18: Cranio-medial (caudo-lateral) view of the elbow joint
a- humerus, b radius, c Ulna

Projections are named according to direction of x- ray beam to place of the cassette



Carpal joint

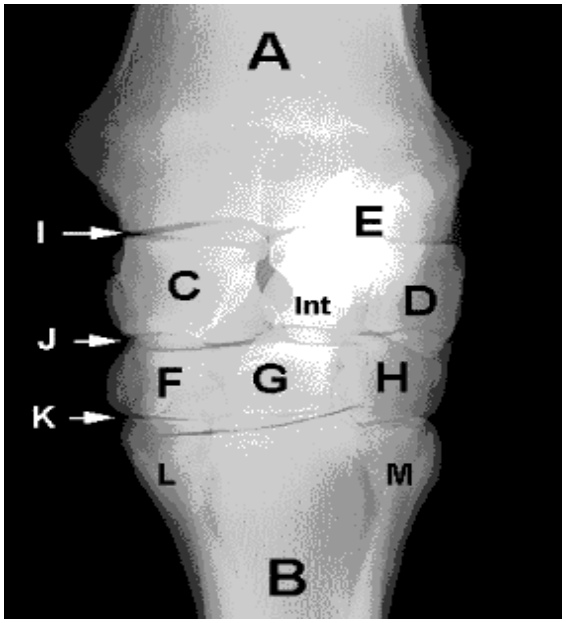


Fig. 19: Dorso-palmar view

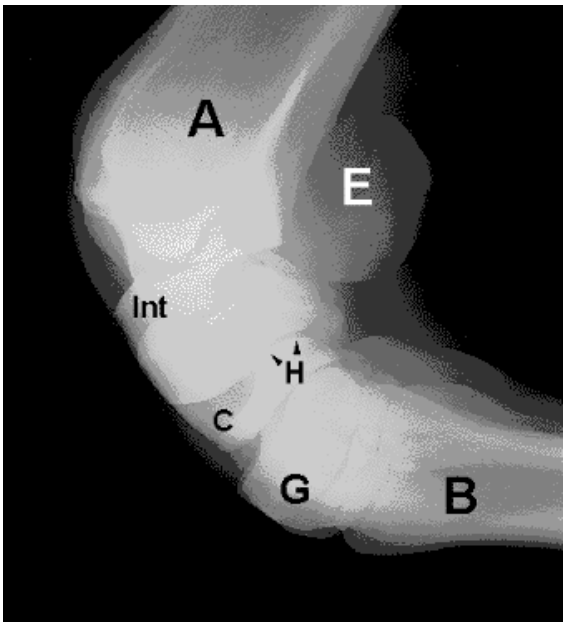


Fig. 20: Flexed lateral view

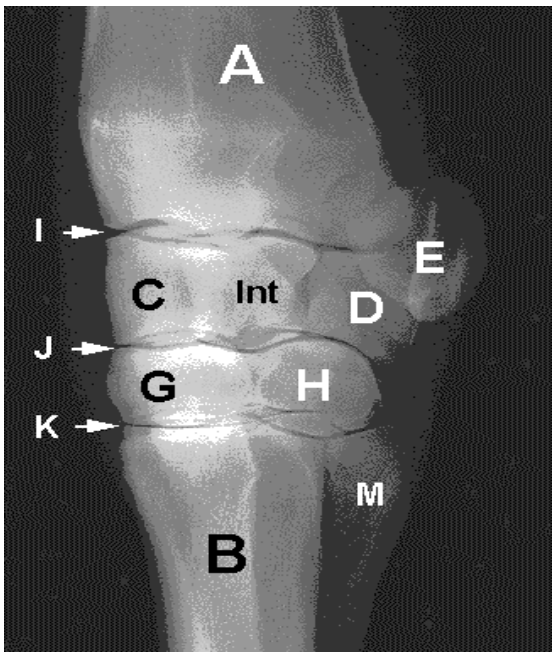


Fig. 21:Dorsolateral to Palmaromedial oblique view (DLPM-O)

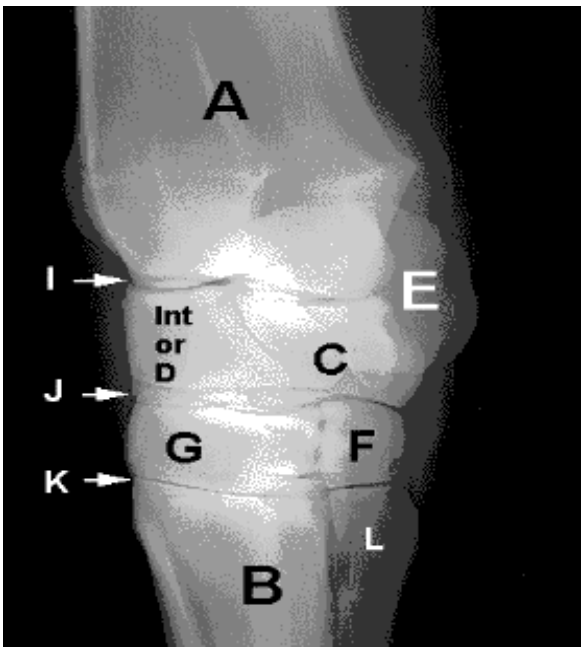


Fig.22: Dorsomedial to Palmarolateral-oblique view (DMPL-O)

A-Radius B-Third metacarpal bone C-Radial carpal bone D-Ulnar carpal bone E-Accessory carpal bone F-Second carpal bone G-Third carpal bone H-Fourth carpal bone I-Antebrachiocarpal joint J-Middle carpal joint K- Carpometacarpal joint L-Second metacarpal bone M-Fourth metacarpal bone N-Intermediate carpal bone

Metacarpal

Fig. 23: Lateral view

Fig.24: Dorsopalmar (plantar) view

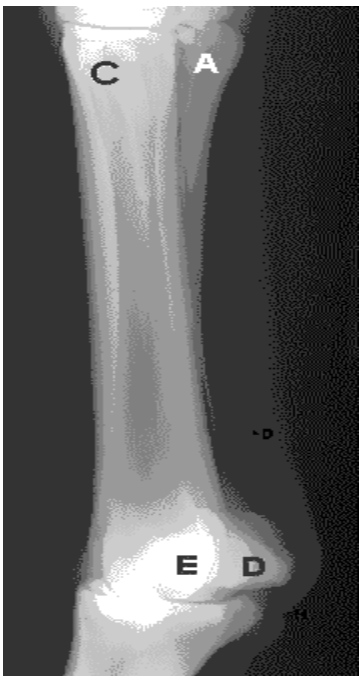


Fig 27:Dorsomedial to palmar (plantar) lateral oblique (DMPLO)

Fig 28: Dorsolateral to palmar (planter) medial oblique (DLPMO)

A-Second metacarpus/metatarsus B-Fourth metacarpus/ metatarsus C-Third metacarpus/ metatarsus D- Medial proximal sesamoid bone E-Lateral proximal sesamoid bone 1-Nutrient foramen 2-Metacarpo(tarso) phalangeal joint

Fetlock

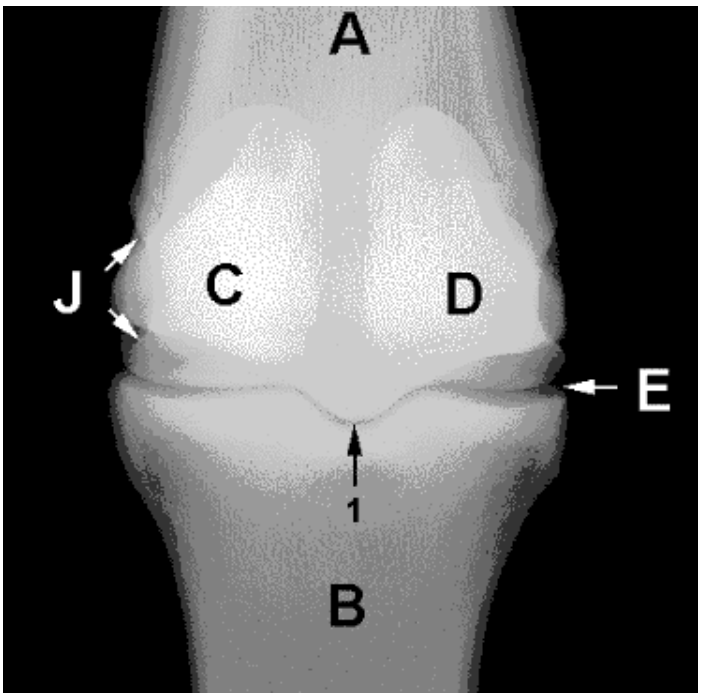


Fig. 29: Dorsopalmar (plantar) view

Equine foot

Fig. 30: lateral view of foot

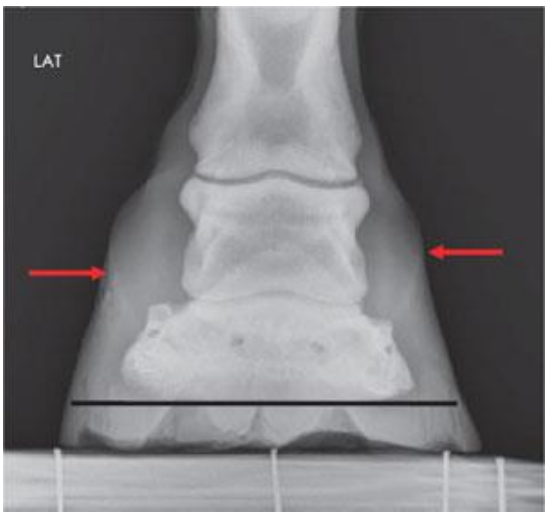


Fig. 31: Dorsal view of foot

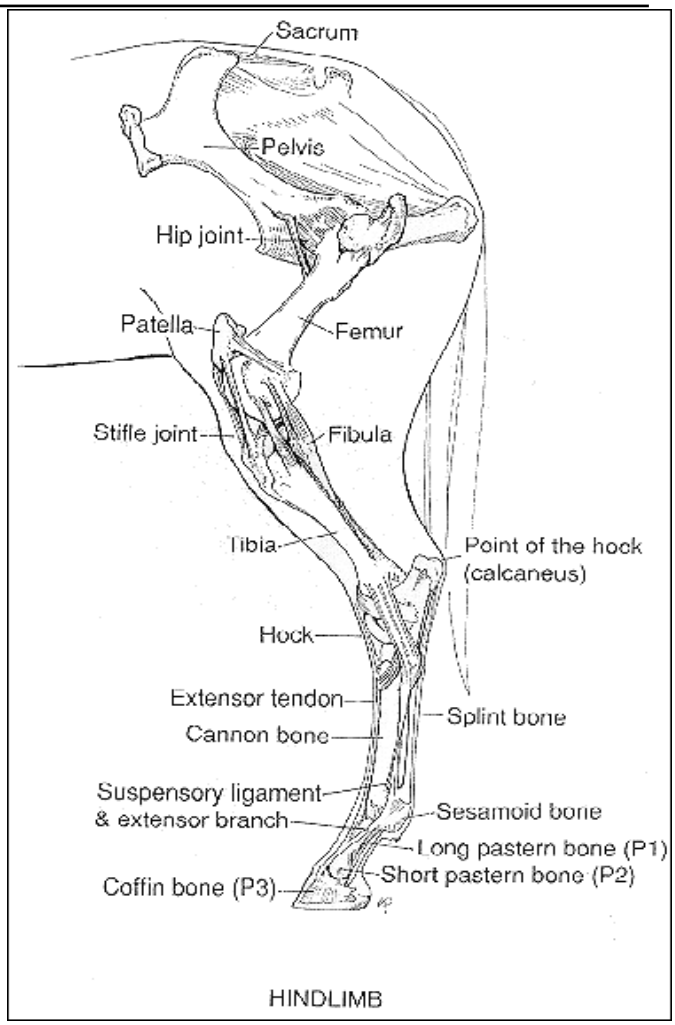


Fig.32: Diagram of Hind limb of horse.

Radiograph of the equine hind limb.

Fig 33*: *Hip joint and femur

Stifle

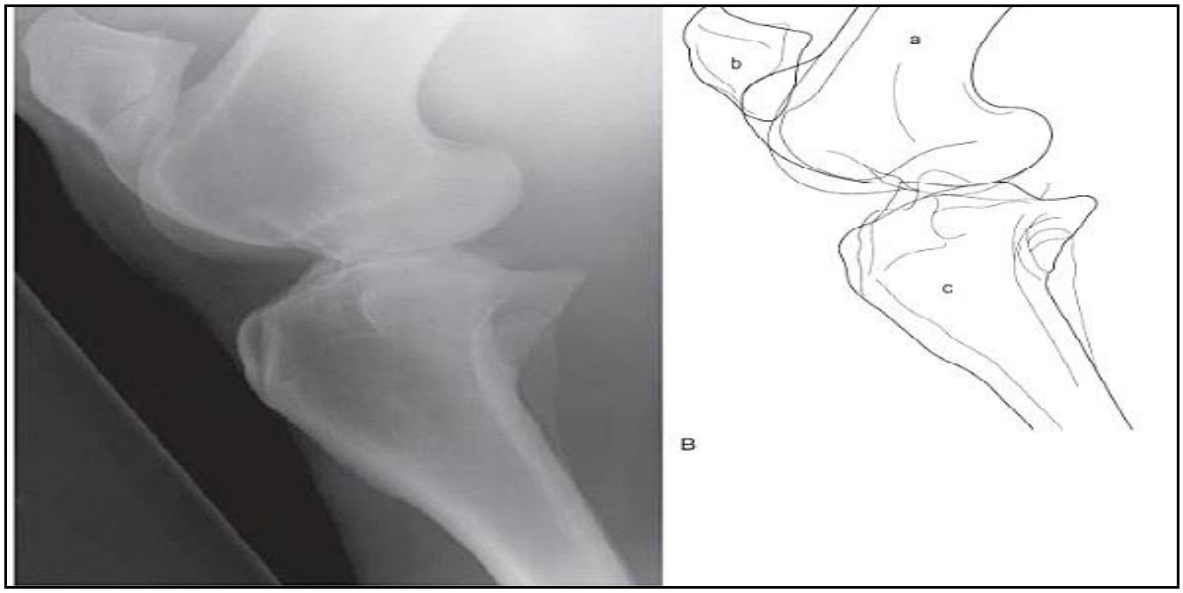


Fig. 34: Lateral radiograph of the stifle a- femur, b- patella, c-tibia

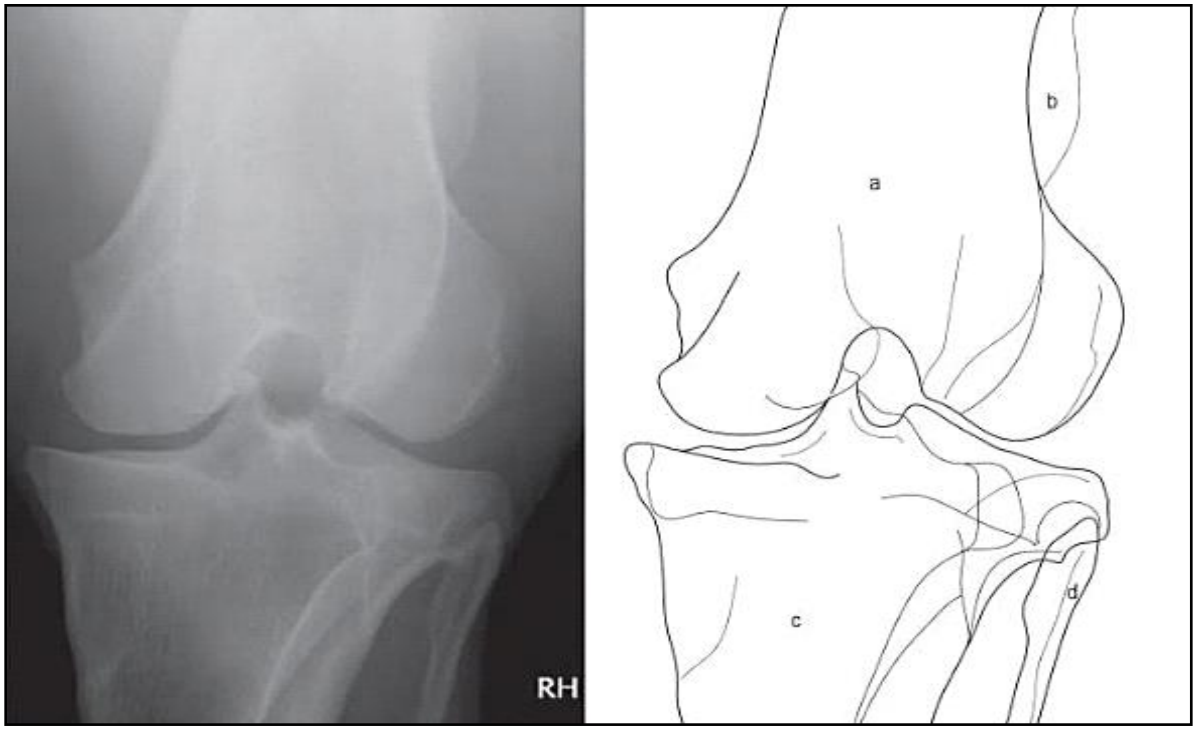


Fig. 35: Caudo-cranial radiograph of the stifle a- femur- : patella- c: tibia

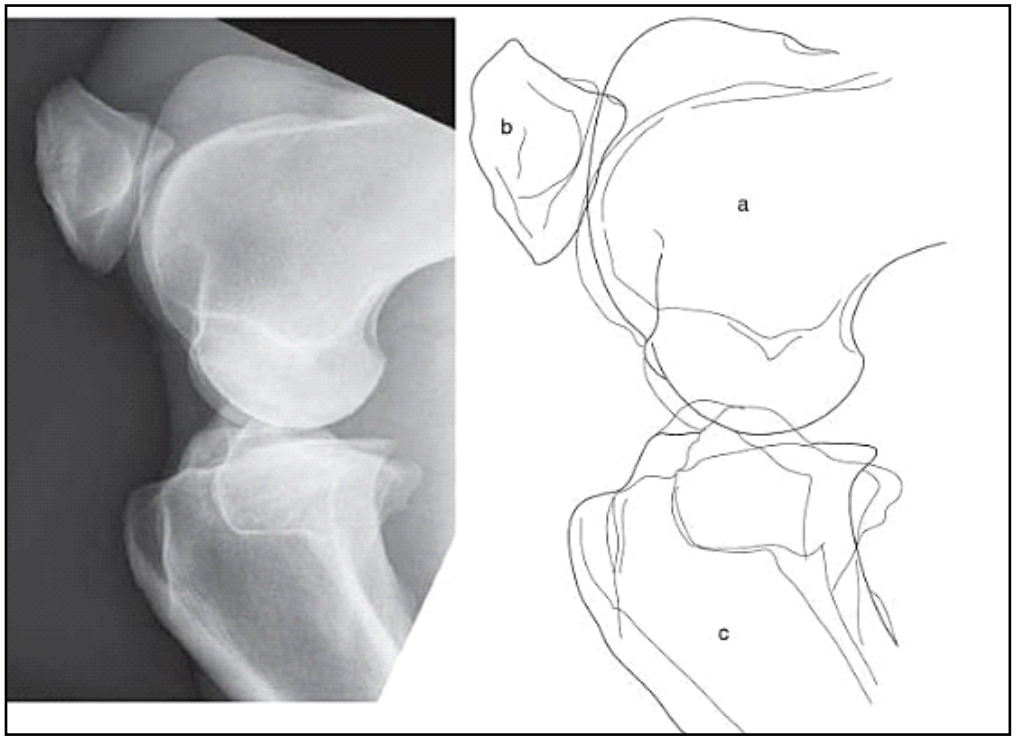


Fig. 36: Flexed lateral radiograph of the stifle a- femur- : patella- c: tibia

Hock joint

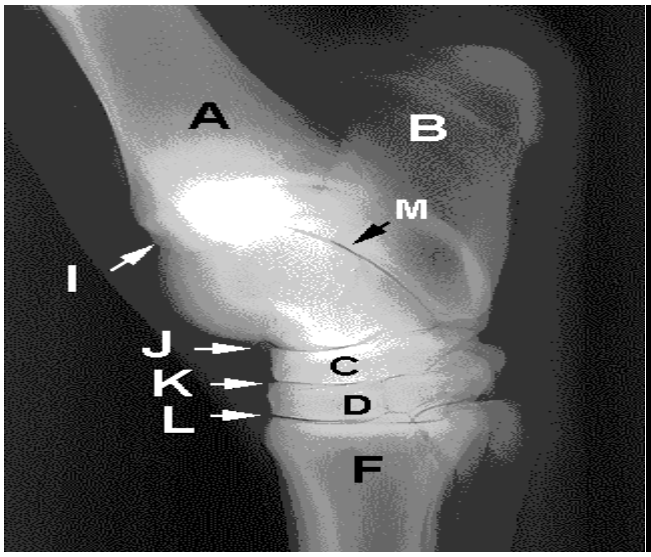


Fig. 37: Lateral view

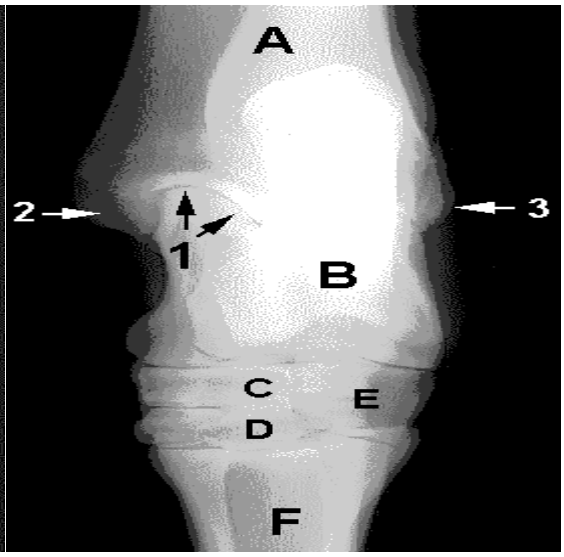


Fig. 38: Dorso-plantar view

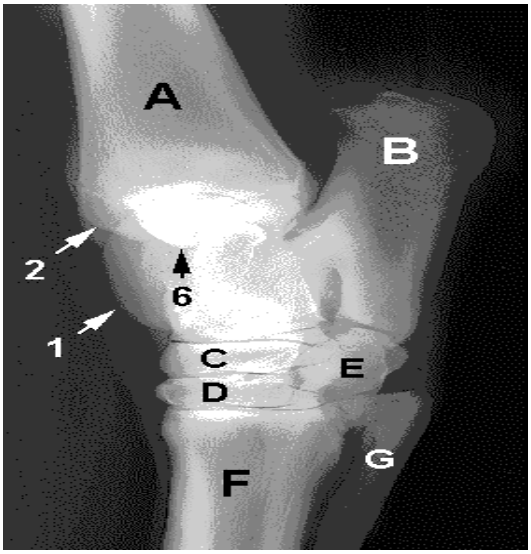


Fig. 39: Dorsolateral to Plantaro-medial oblique view (DLPM-O)

A- Tibia. B- Calcaneus. C- Central tarsal bone. D-Third tarsal bone. E- Fourth tarsal bone F- Third metatarsal bone. G-Fourth metatarsal bone. H- Second metatarsal bone. I- Tarsocrural joint. J-Talocalcaneal joint. K-Centrodistal joint. L-Tarsometarsal joint. M-Talocalcaneal joint. N-Second metatarsal bone. 1- Medial trochlear tali. 2- Medial malleolus. 3-Lateral malleolus. 4-Lateral trochlear tali. 5-Sustentaculum tali. 6-Distal intermediate ridge of tibi joint.

Radiography by contrast media

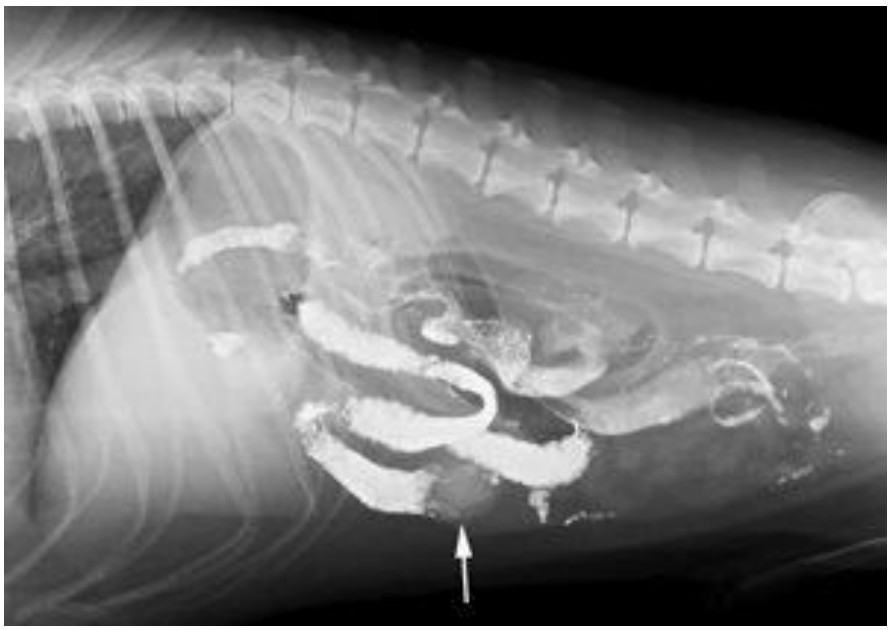


Fig 40: Enterography by barium sulfate (positive contrast)

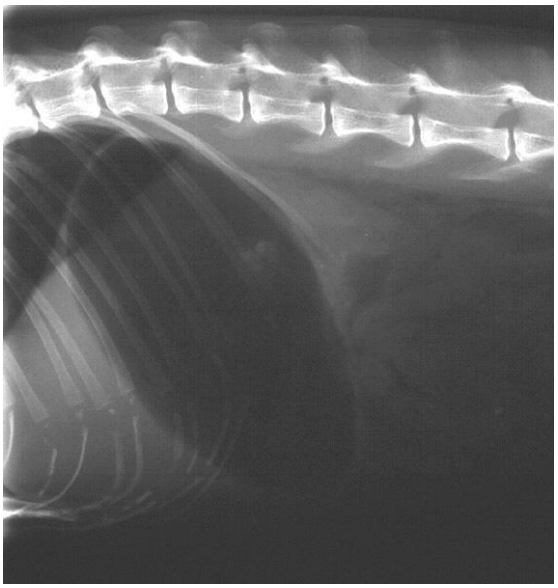


Fig 40: Gastrography (negative contrast)

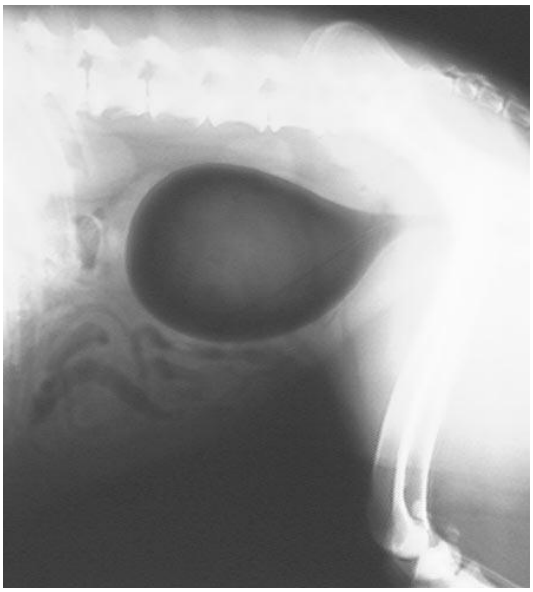


Fig 41: Cystography (negative contrast)

Fig 42: Nephrography (excretory positive contrast)

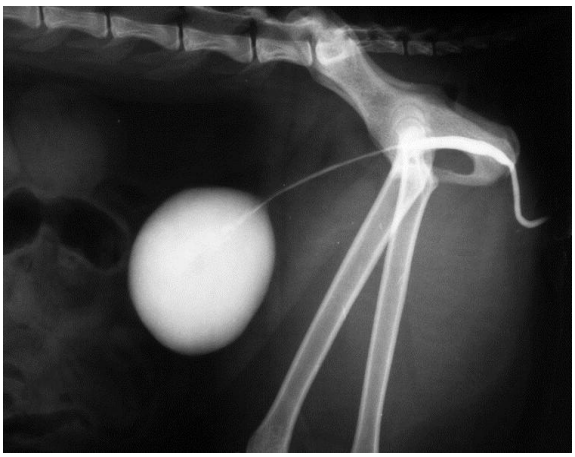


Fig 43:Cystography (excretory positive contrast)

Fig 44: Intravenous pyelogram (excretory positive contrast)

Fig 45: cholecystography (excretory positive contrast)

Radiographic artifacts

Artifact is an unwanted finding on a radiograph, interferes with interpretation and **May *occur:***

- During exposure.
- During processing.
- During film handling (loading, processing, unloading or storing)
- **Exposure artifacts resulted from:**
- Poor patient preparation.
- Motion.
- Double exposure.
- Poor film screen contact.
- Incorrect technique.
- **Processing artifacts:**
- Dirty deposits:

- Areas of increased or reduced density.
- Some sludge that may not washed off and dried.

- Chemical Fog:

Unusual density on a film occurs during development, due to improper or inadequate chemicals.

- Leaves a dull haze on the film.
- May seen in two different colors.

- Water stain from hard water.
- Hypo Retention:

- Yellowish stain that appears on finished radiograph.
- Due to inadequate washing.
- Remaining thiosulfate from fixer solution.

C. Handling and storage artifacts:

- Light or radiation Fog:

- Safe light is too close or wrong wattage.
- Film left in x-ray room during exposure.

- Kink Marks:

- Improper handling or storage.
- Appears as a fingernail mark.

Review questions

a- Using the following radiograph: Complete the following sentences:

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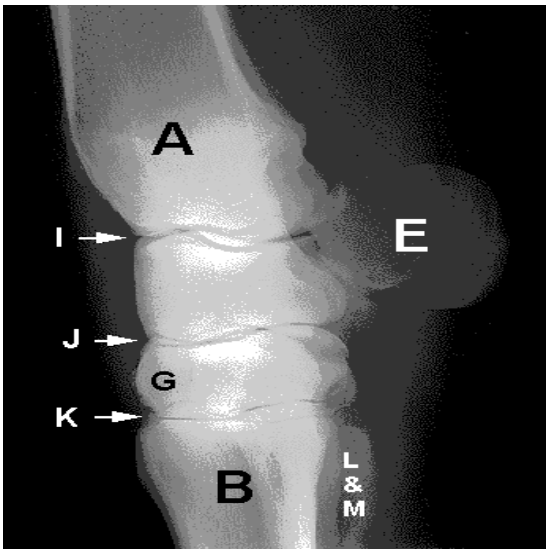

A is representing:……
B is representing:……
E is representing:……
G is representing:……
I is representing:……
J is representing:……
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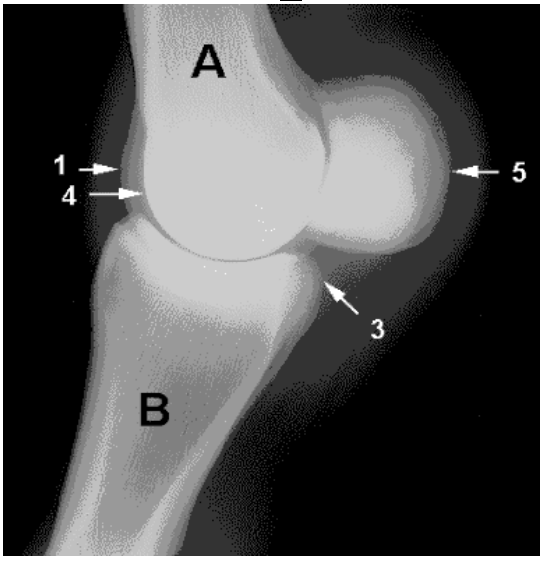

A is representing:……
B is representing:……

b- Name the following radiographic artifacts:

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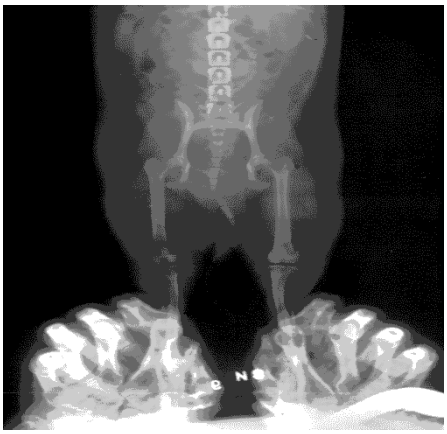
2-……



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