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Equine regional anesthesia and joint injection

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Obsah

Regional anesthesia

Regional anesthesia is commonly performed in lameness investigation to localise the source of pain. Also is used to anesthetized horses undergoing surgery and allows to facilitate surgical procedures with the horse standing. Regional anesthesia can be also used to reduce chronic pain.

Perineural anesthesia is not as precise as intraarticular anesthesia in localizing the site of lameness, because it anesthetizes articular and nonarticular structures.

<u>The three commonly used local anesthetics:</u>

1. *Lidocaini hydrochloride 2 %*
    - induces anesthesia more slowly
    - provides shorter duration of anesthesia than mepivacaine and bupivacaine does
    - provides anesthesia for 30-45 minutes
    - can cause irritation of local tissues
2. *Mepivacaine hydrochloride 2 %*
    - is used more frequently tha lidocaine
    - longer lasting and less irritating than lidocaine
    - provides regional anesthesia for 90-120 minutes
3. *Bupivacaine hydrochloride 2 %*
    - provides longer duration of anesthesia (4-6 hours) than provided by lidocaine or mepivacaine

Pain usually relieved within 5 minutes after administering a local anesthetics in the distal part of the limb (because distally located nerves are smaller and

superficially located than proximaly located nerves), but when anesthetize the large nerves in the proximal portion of the limb, pain can relifed after 20 minutes or more.

The volume of local anesthetics used to anesthetize nerves, located in the distal part of the limb is less than volume used in the proximal part of the limb.

The needle has to be inserted without syringe detached because of the likelihood of it being bet or broken.

The needle is inserted over the digital nerve, subcutaneously and directed distally. Proximal direction of the needle could cause proximal diffusion of local anesthetics, which may increase the likelihood of anesthetizing structures not intended to be desensitized.

Skin preparation

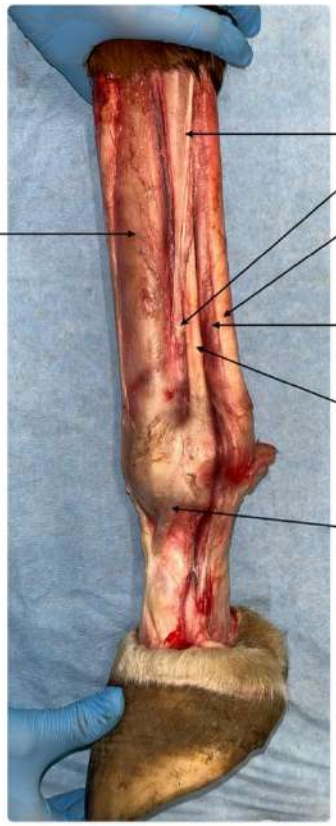
Clipping the site of injection is not necessary unless you need better visualisation of the landmarks.

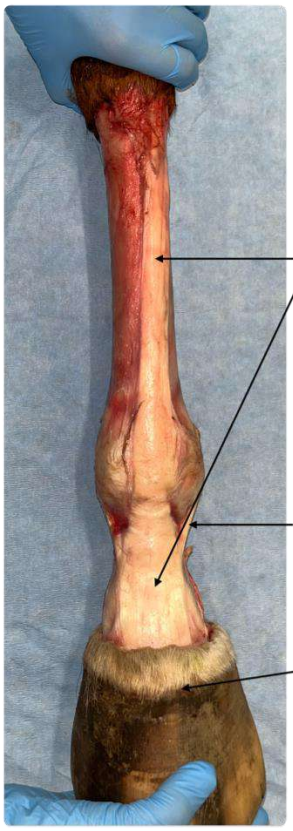
The skin preparation necessary for regional anesthesia is scrubbing the area with gauzes soaked in 70 % isopropyl alcohol until is clean. But if there is a risk of penetration synovial structures, the site hase to be prepared with an antiseptic soap.

Complications

Complications of regional anesthesia are rare, but include broken needle, subcutaneous infection, septic synovitis.

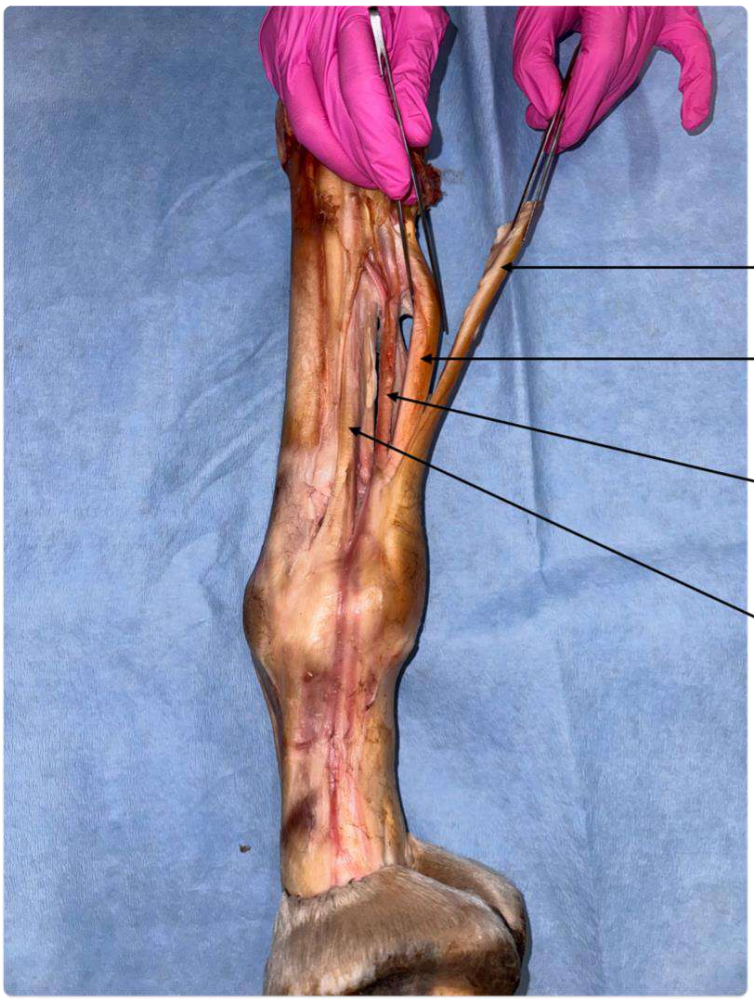
The most important factor for successful placement of a needle is a good knowledge of anatomy.


Bodcová kost (MTT IV, Splint bone)
Metatarsus (MTT III)
Šlacha povrchového ohybače prstu (SDFT = superficial digital flexor tendon)
Šlacha hlubokého ohybače prstu (DDFT = deep digital flexor tendon)
Mezikostní sval (SL = suspensory ligament)
Extenzorová větev SL (Extensor branch of SL)


Šlacha společného natahovače prstu (Common digital extensor tendon)
Laterální extenzorová větev SL (Lateral extensor branch of SL)
Korunkový okraj (Coronary band)


Kopytní chrupavka (Hoof cartilage)
Extenzorová větev SL (Extensor branch of SL)
Digitální (Digital) nerv (nerve) arterie (artery) véna (vein)


Kopytní chrupavka (Hoof cartilage)
Digitální (Digital) véna (vein) arterie (artery) nerv (nerve)
Proximální anulární vaz (Proximal digital annular ligament)


Šlacha povrchového ohybače prstu (SDFT = superficial digital flexor tendon)
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Digitální (Digital)
nerv (nerve)
arterie (artery)
véna (vein)
Mezikostní sval (SL = suspensory ligament)

Palmar digital nerve block

Volume of local anesthetics: 1,5 ml at each site.

Performed when the limb is held.

Anesthetized nerves: n. digitalis palmaris/n. digitalis plantaris

Sometimes is called as the „heel block“.

Desensitized structures:

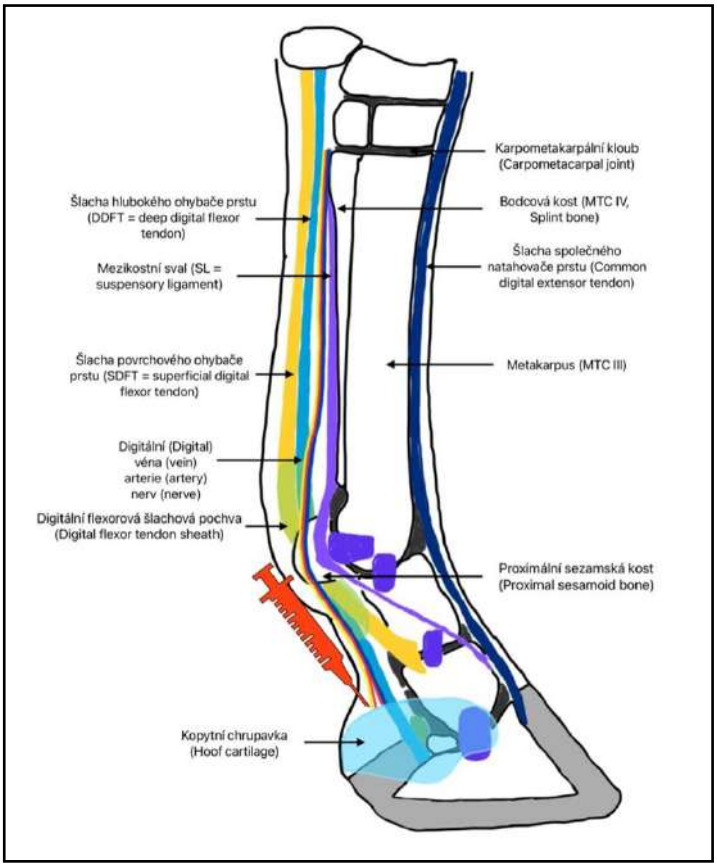
- the sole, the soft tissue of the heel
- the navicular apparatus
- the coffin joint
- the distal part of the deep digital flexor tendon
- the distal sesamoidian ligaments

Injection technique:

The needle is inserted directly over the palmar side of the neurovascular bundle, over the foot cartilage.

The neurovascular bundle is palpable about 1 cm above the cartilage of the foot.

The needle is inserted in a distal direction.



Neurovascular bundle is palpable at each site of the limb, 1 cm over the foot cartilage.

The needle is inserted from lateral and medial site in a distal direction, over the foot cartilage.

Abaxial sesamoid nerve block

Volume of local anesthetics: <2 ml at each site.

Performed when the limb is held.

Anesthetized nerves: n. digitalis palmaris

The abaxial sesamoid nerve block is used for localizing pain, caused lamenes. If the lameness after the palmar digital nerves block has not improved.

<u>Desensitized structures:</u>

- the foot
- middle phalanx and distopalmar aspects of the proximal phalanx
- proximal interphalangeal joint
- distal portion of the superficial and deep flexor tendons

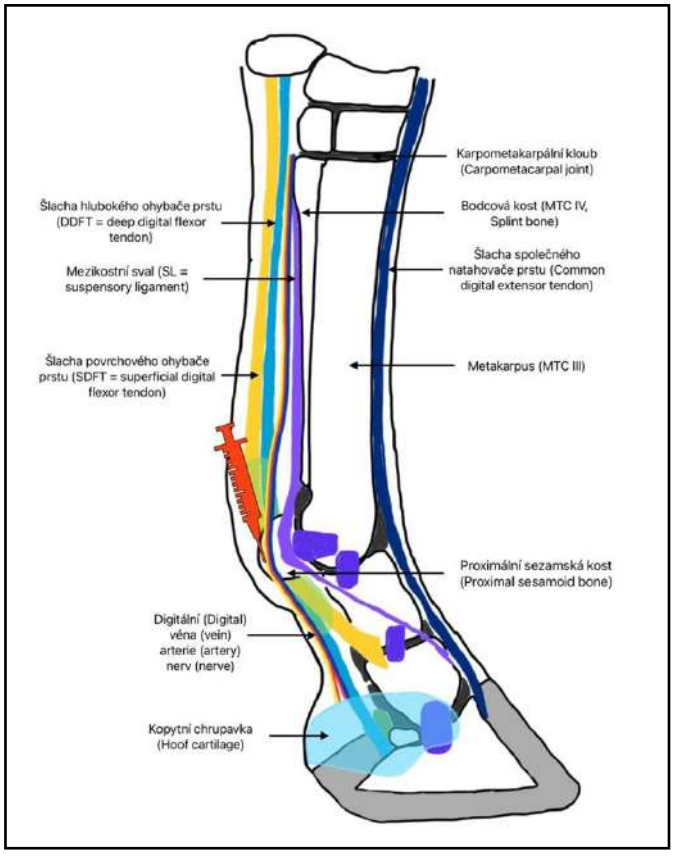
<u>Injection technique:</u>

The neurovascular bundle can be palpated over the abaxial border of both proximal sesamoid bones.

The neurovascular bundle contain the palmar digital nerve.

The needle is directed distally.

The needle is inserted at the base of the proximal sesamoid bones, on the lateral and medial site.



Neurovascular bundle are anesthetized along the abaxial border of both proximal sesamoid bones.

The needle is directed distally, at the base of proximal sesamoid bones.

Low palmar nerve block

Volume of local anesthetics: 1–2 ml at each site.

Performed when the horse is bearing weight on the limb.

Anesthetized nerves: n. palmaris lateralis/medialis, n. palmaris metacarpalis lateralis/medialis

Also known as „low four-point block“. Is performer after a negative response to the abaxial sesamoid nerve block.

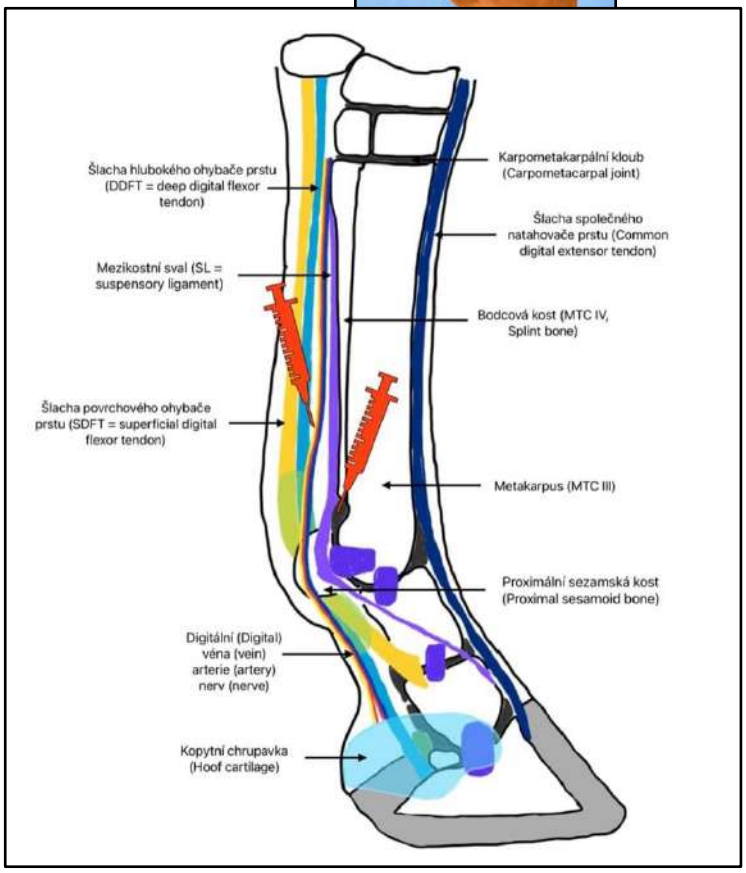
Desesitized structures:

- all the structures below this region are desensitized

Injection technique:

To anesthetize the palmar nerve, the needle is inserted between the deep digital flexor tendon and the suspensory ligament, 1 cm proximal to the distal ends of the the second or fourt metacarpal bone.

To anesthetize the palmar metacarpal nerve, the needle is inserted under the distal end of the second and fourth metacarpal bone.



The lateral and medial palmar nerve is located very deep between the deep digital flexor tendon and suspensory ligament.

The lateral and medial palmar metacarpal nerve is located supperficialy under the distal end of the second and fourth metacarpal bone.

The palmar nerve – the needle is inserted 1 cm proximal to the distal end of the second or fourth metacarpal bone.

The palmar metacarpal nerve – the needle is inserted to the ends of the second or fourth metacarpal bone.

Low plantar nerve block

Volume of local anesthetics: 2-4 ml at each site.

Performed when the horse is bearing weight or with the limb held.

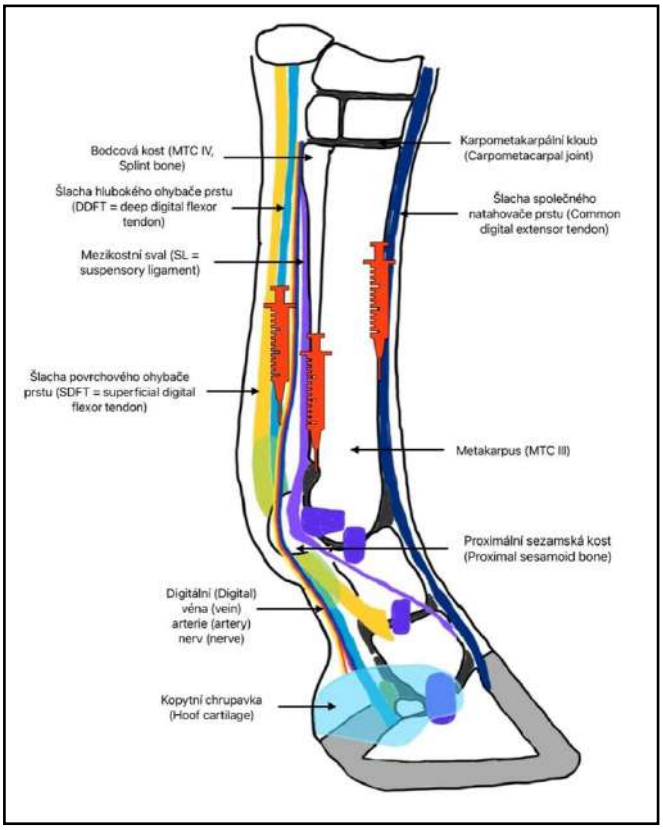
Anesthetized nerves: n. plantaris lateralis/medialis, n. plantaris metatarsalis lateralis/medialis

Also known as „low six-point block“. The low six-point block is performer in the hindlimb.

One difference between the forelimb and the hindlimb is that there is a lateral and medial dorsal metatarsal nerve on either side of the long digital extenson tendon, to completely desensitize the fetlock region.

Desensitized structures:

- all the structures below this region are desensitized



Injection technique:

N. plantaris and n. plantaris metatarsalis in the distal metatarsus are anesthetized in a similar way as the nerves in the forelimb.

Anesthesia of the dorsal metatarsal nerves is performed by injecting 2-3 ml of local anesthetic lateral and medial to the long digital extensor tendon.

The lateral and medial plantar nerve is located very deep between the deep digital flexor tendon and suspensory ligament.

The lateral and medial plantar metatarsal nerve is located supperficialy under the distal end of the second and fourth metacarpal bone.

The lateral and medial dorsal metatarsal nerve is located on either side of the long digital extenson tendon,

The plantar nerve – the needle is inserted 1 cm proximal to the distal end of the second or fourth metacarpal bone.

The plantar metatarsal nerve – the needle is inserted to the ends of the second or fourth metacarpal bone.

The dorsal metatarsal nerve – the needle is inserted on either side of the long digital extensor tendon.

High palmar nerve block

Volume of local anesthetics: 2-3 at each site.

Performed when the horse is bearing weight on the limb (the palmar nerve) or with the limb held (the palmar metacarpal nerve).

Anesthetized nerves: n. palmaris medialis/lateralis, n. palmaris metacarpalis medialis/lateralis.

Also known as „high four-point block“. This nerve block is very similar to the low palmar nerve block. The same nerves are anesthetized, but in the proximal part of the metacarpus, under the carpometacarpal joint.

<u>Desesitized structures:</u>

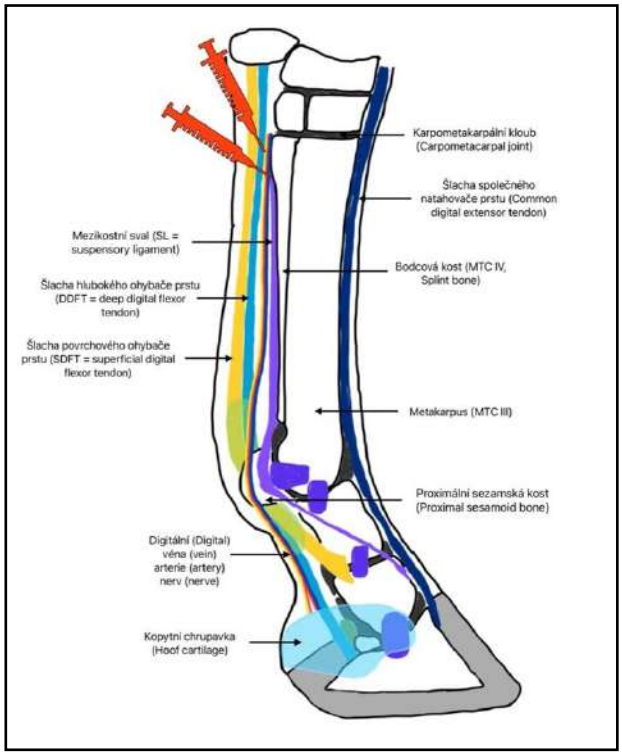
- All structures innervated by the nerves distal to the block.

<u>Injection technique:</u>

To anesthetize the palmar nerve, the needle is inserted to the dorsal surface of the deep digital flexor tendon, little distal to the level of the carpometacarpal joint.

To anesthetize the palmar metacarpal nerve, the needle is inserted between third metacarpal bone and the second or fourth metacarpal bone.

It is importent to aspirate before anesthetic solution is deposited, to be sure that the needle is not inside the carpometacarpal joint.



The lateral and medial palmar nerve lie between the deep digital flexor tendon and suspensory ligament.
The lateral and medial palmar metacarpal nerve run parallel and axial to the second and fourth metacarpal bone.

The needles in place.

Joint injection

Also known as arthrocentesis. It Is a procedure where is administer drugs into the synovial structures or collect synovial fluid for examination.

Deposit of local anesthetics into synovial structures is commonly used to specifically identify the region causing pain in the lame limb. Intrasynovial injection of medications (e.g. corticosteroids, antibiotics, sodium hyaluronate) are also used to treat joint, tendon sheath and bursal conditions.

The three commonly used local anesthetics:

1. *Lidocaini hydrochloride 2 %*
    - induces anesthesia more slowly
    - provides shorter duration of anesthesia than mepivacaine and bupivacaine does
    - provides anesthesia for 30-45 minutes
    - can cause irritation of local tissues
2. *Mepivacaine hydrochloride 2 %*
    - is used more frequently tha lidocaine
    - longer lasting and less irritating than lidocaine
    - provides regional anesthesia for 90-120 minutes
3. *Bupivacaine hydrochloride 2 %*
    - provides longer duration of anesthesia (4-6 hours) than provided by lidocaine or mepivacaine

Intraarticular anesthesia is more precise than regional anesthesia in diagnostics of lameness. The regional anesthesia may not adequately localize

the source of pain responsible for lameness. Regional nerve block desensitizes extraarticular structure as well, such as ligaments, tendons, tendon sheaths, extraarticular bone.

Skin preparation

Many clinicians clip the hair over the injection site, but this has been shown to be unnecessary if an adequate sterile preparation of the site is performed. The injection site should be scrub with an antiseptic soap and then wiped with 70 % isopropyl alcohol.

To begin the procedure, palpated the injection area to identify the landmarks. The needle should be inserted without the syringe attached. When the needle must be redirected, it should be done without being withdrawn back throught the skin. After the needle is in correct position, the syringe is attached.

The depth of needle penetration varies with the joint. The carpal, tibiotarsal and fetlock joints, the needle is inserted superficially. The coffin and pastern joints, the needle is inserted deeper.

Complications

The two most common complications are a broken needle and a postinjection reaction. A needle should not be inserted through inflamed tissue into a joint, but many joints have an alternative approach to avoid the site of inflammation.

Coffin joint

P2 – P3, distal interphalangeal joint

Volume of local anesthetics: 4-6 ml to each site.

The coffin joint aproaches:

- dorsal parallel approach
- dorsal perpendicular approach
- dorsolateral approach
- lateral approach

Coffin joint

- dorsal parallel approach

Volume of local anesthetics: 4-6 ml

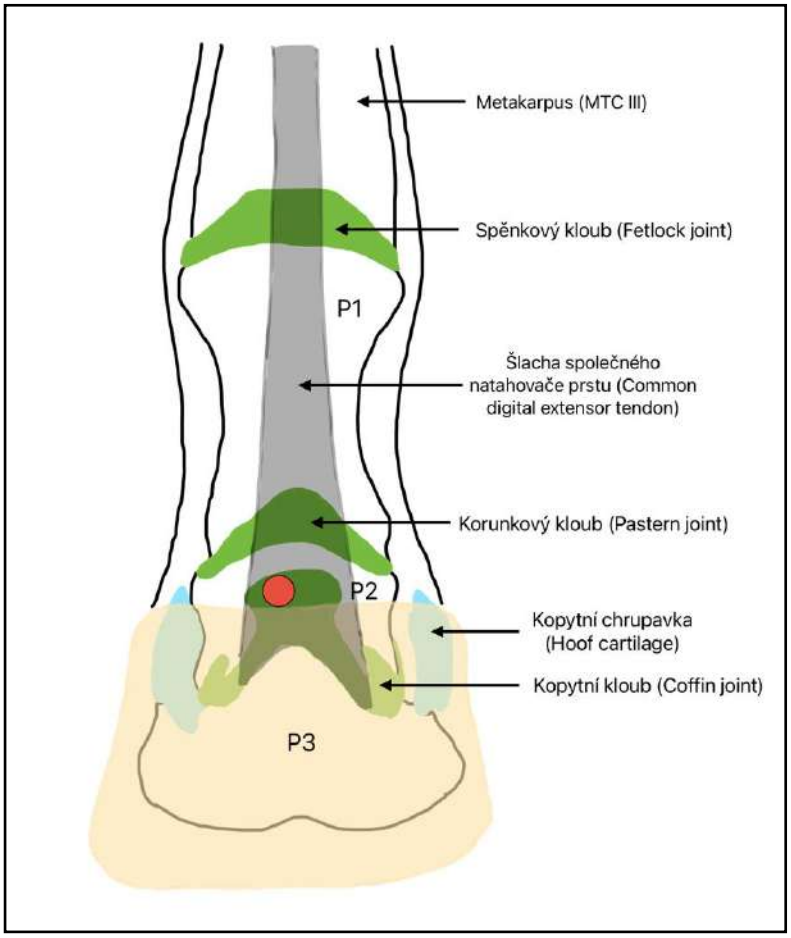
Limb in weight-bearing position.

The dorsal parallel approach is easier to perform.

Injection technique:

The needle is inserted 1 cm proximal to the coronary band, above the edge of the hoof wall and the dorsal midline of the foot.

The needle is directed parallel to the ground and the depth of penetration is less than 1,2 cm.



The injection site is 1 cm above the coronary band on the dorsal midline of the foot

Insert the needle parallel to the ground.

Coffin joint

- dorsal perpendicular approach

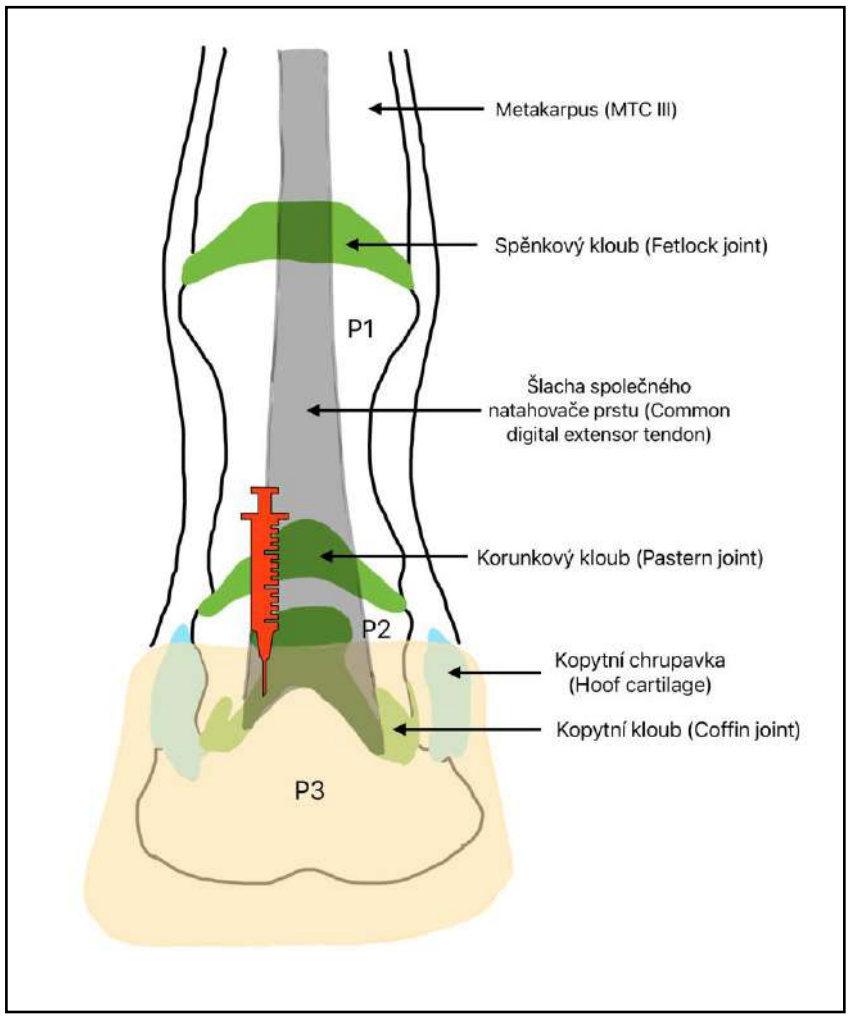
Volume of local anesthetics: 4-6 ml

Limb in weight-bearing position.

Injection technique:

The needle is inserted perpendicular to the weight bearing surface of the foot.

At the 1 cm proximal to the coronary band, above the edge of the hoof wall and 2 cm lateral or medial from the midline of the proximal interphalangeal joint.



The injection site is 1 cm above the coronary band on the dorsal midline of the foot.

Insert the needle perpendicular to the weight bearing surface of the foot.

Coffin joint

- dorsolateral approach

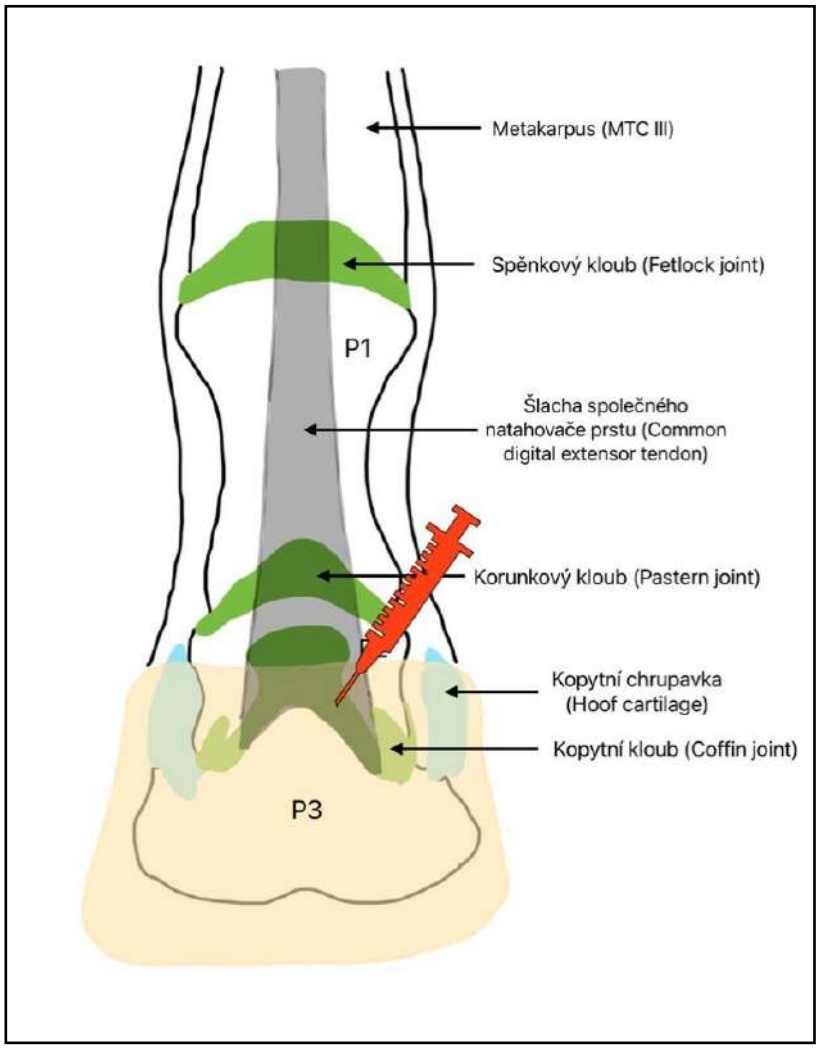
Volume of local anesthetics: 4-6 ml

Limb in weight-bearing position.

Injection technique:

Insert the needle 1 cm above the coronary band and 2,5 cm lateral or medial from the midline of the foot.

The needle is inserted from a vertical position and directed distally and medially to the midline at 45 ° angle.



The injection site is 1 cm above the coronary band, 2 cm lateral or medial from the midline of the foot.

Insert the needle distally and medially to the midline of the foot at 45 ° angle.

Coffin joint

- lateral approach

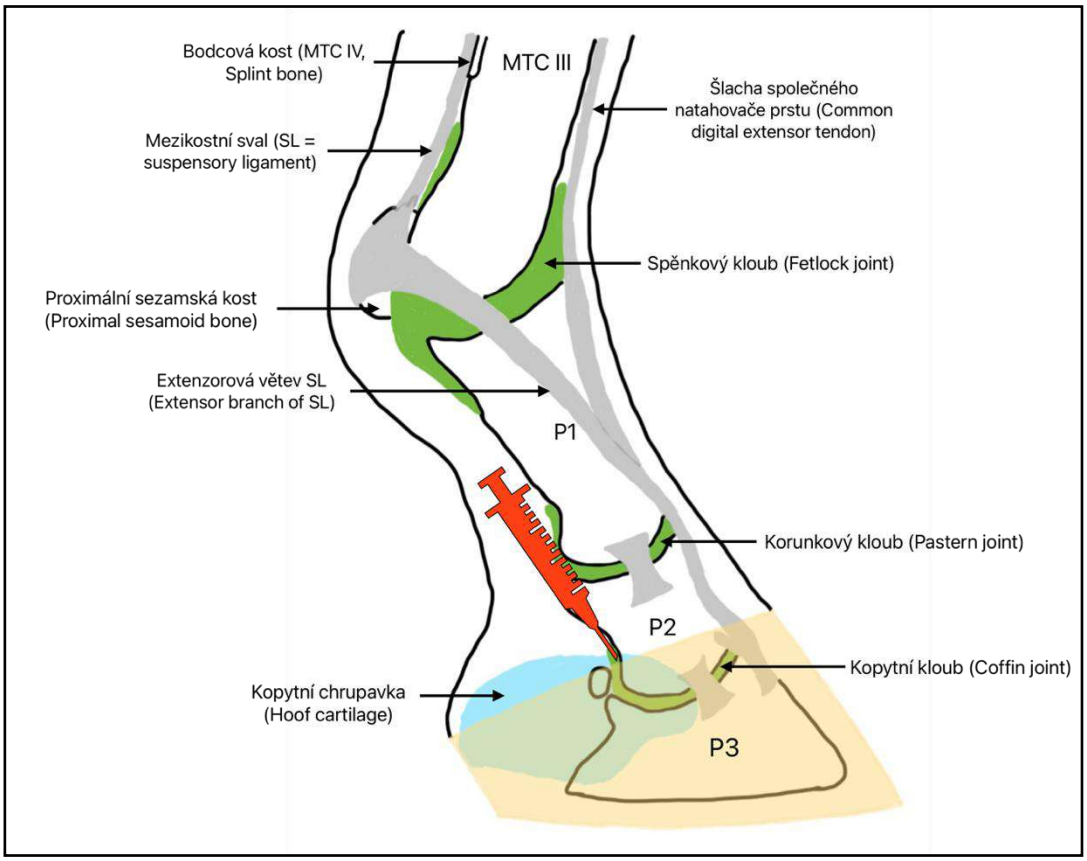
Volume of local anesthetics: 4-6 ml at each site.

Limb in weight-bearing or a flexed position.

Injection technique:

Insert the needle distally above a depression along the proximal edge of the collateral cartilage, between the dorsal and palmar/plantar border of the second phalanx.

The needle is directed at a 45 ° angle toward the medial weight-bearing hoof surface.



The injection site is above the proximal edge of the collateral cartilage of the foot. Between the dorsal and palmar/plantar border of the second phalanx.

Insert the needle at 45 ° angle toward the medial weight-bearing hoof surface.

Pastern joint

P1 – P2, the proximal interphalangeal joint.

Volume of local anesthetics: 8–10 ml at each site.

The coffin joint aproaches:

- dorsolateral approach
- palmar/plantar approach

Pastern joint

- dorsolateral approach

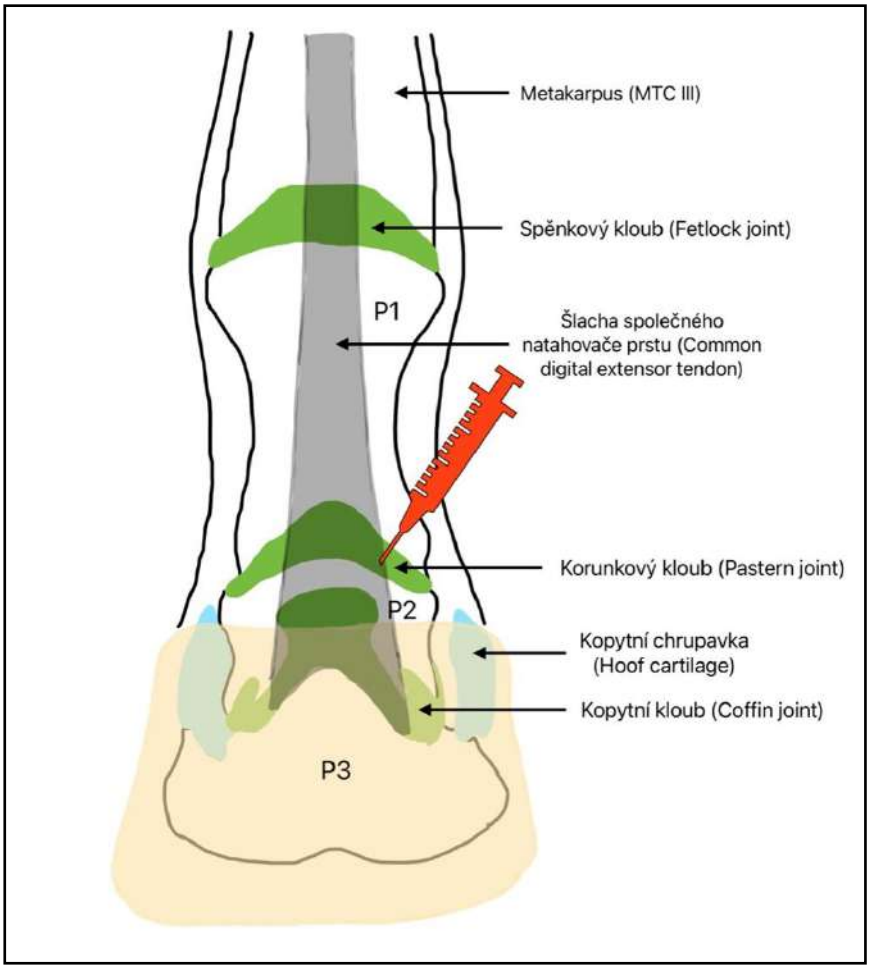
Volume of local anesthetics: 8-10 ml at each site.

Limb in weight-bearing position.

Injection technique:

The condylar eminences of the distolateral aspect of the first phalanx are identified and a needle is inserted under the edge of the common digital extensor tendon

The needle is directed medially and parallel to the ground.



The injection site is under the edge of the common digital extensor tendon. 1,2 cm distal to the level of the lateral or medial eminence on the distal end of the first phalanx.

Insert the needle medially and parallel to the ground.

Pastern joint

- palmar/plantar approach

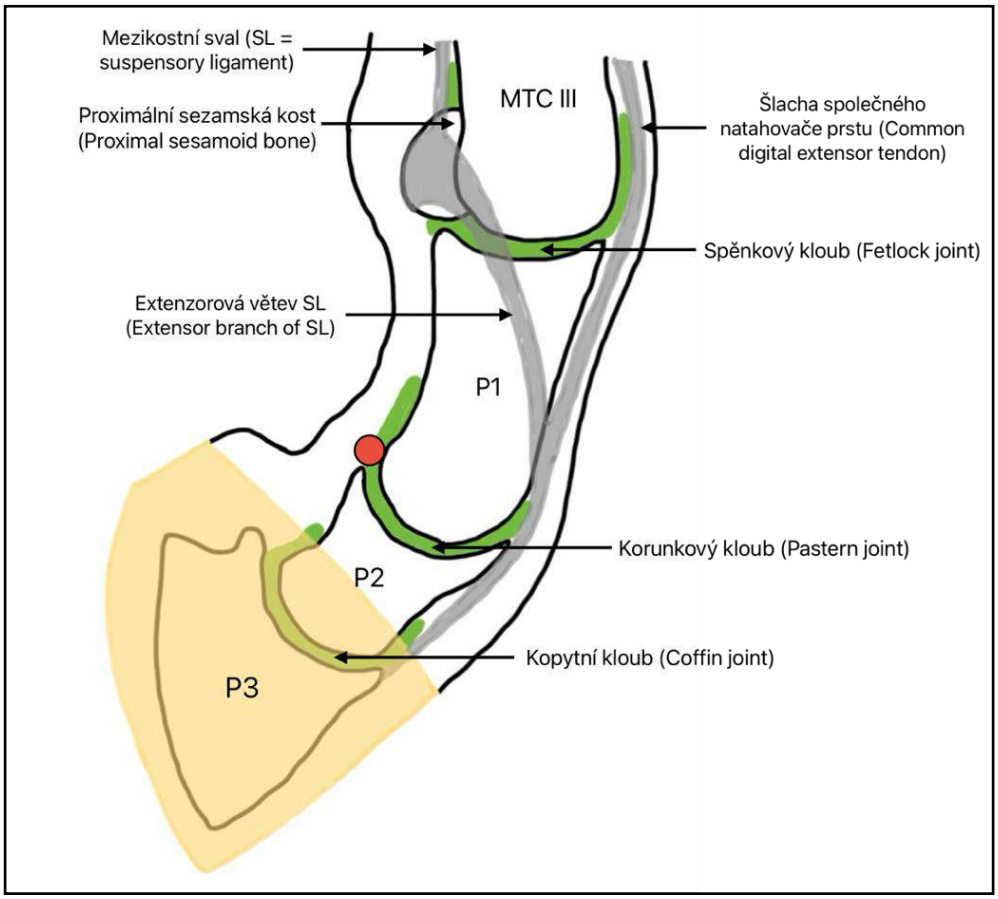
Volume of local anesthetics: 8-10 ml at each site.

Limb in a flexed position.

Injection technique:

The needle is inserted perpendicular to the limb into the V-depression, the needle is directed along the palmar/plantar aspect of the bone.

The V-depression is formed by the palmar aspect of firt phalanx dorsally, the distal eminence of firt phalanx distally and the lateral brach of the superficial digital flexor tendon.



The injection site is at the palmar/plantar aspect of the bone, where is the V-depression formed.

The needle is directed along the palmar/plantar aspect of the bone.

Fetlock joint

MCIII/MTIII – P1, metacarpophalangeal/metatarsophalangeal joint.
Volume of local anesthetics: 8-12 ml to each site.

The coffin joint aproaches:

- palmar/plantar approach
- dorsal approach
- lateral approach
- distal approach

Fetlock joint

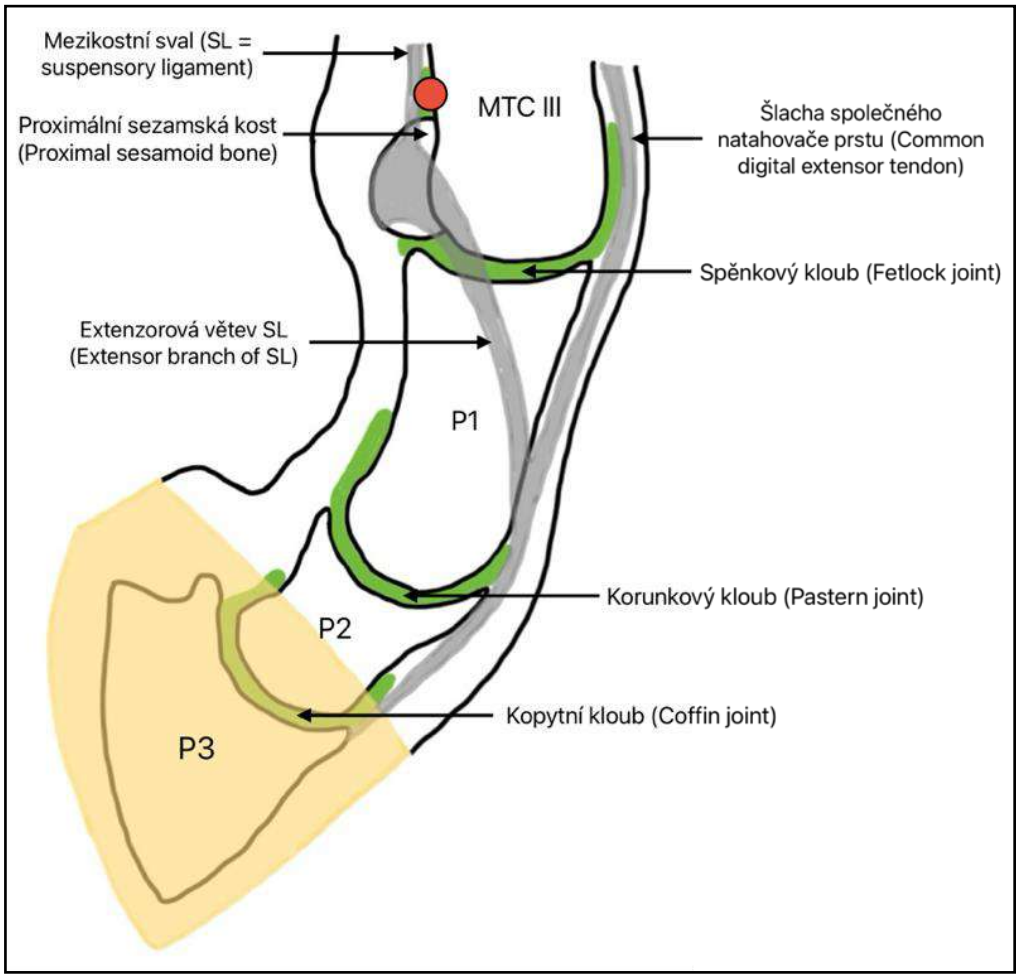
- palmar/plantar approach

Volume of local anesthetics: 8-12 ml at each site.

Limb in a flexed position.

Injection technique:

The needle is inserted into the lateral aspect of the palmar/plantar pouches of the fetlock join. The border consist of the distal ends of the third metacarpal/matatarsal bone proximally, proximal sesamoid bone distally, the third metacarpal/metatarsal bone dorsally, the lateral branch of the suspensory ligament.



The injection site is between the distal ends of the third metacarpal/matatarsal bone proximally, proximal sesamoid bone distally, the third metacarpal/metatarsal bone dorsally, the lateral branch of the suspensory ligament.

The needle in place.

Fetlock joint

- lateral approach

Volume of local anesthetics: 8-12 ml at each site.

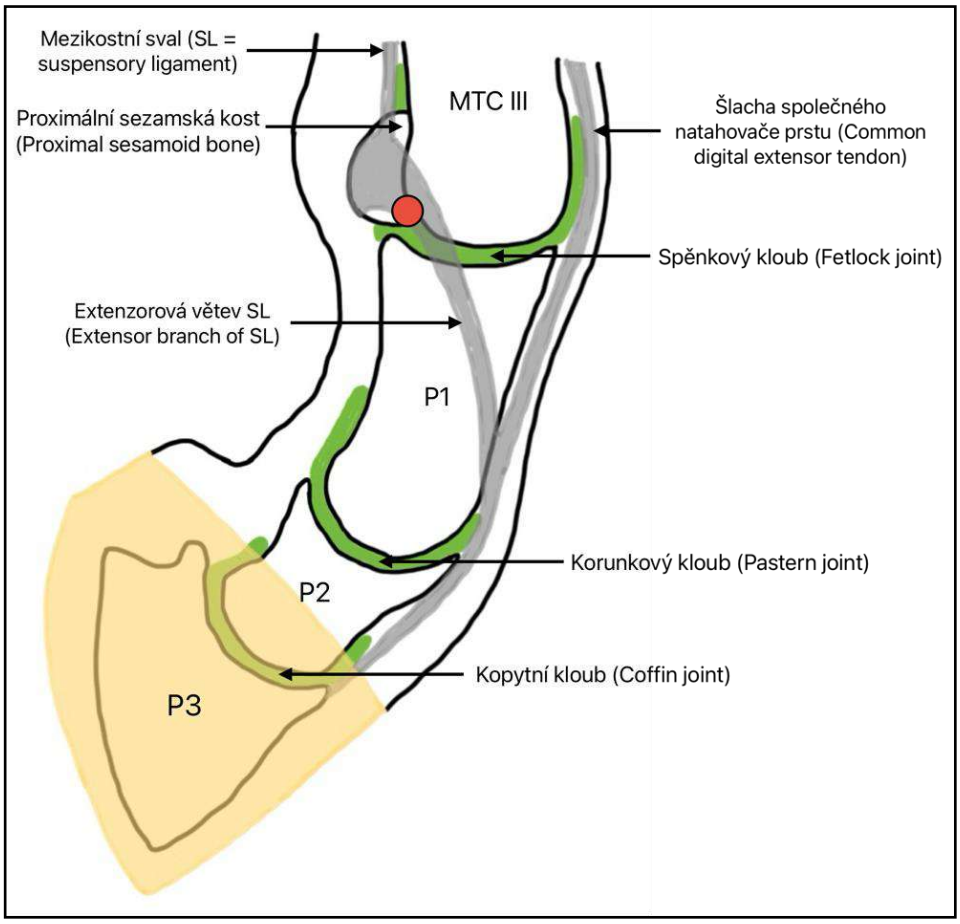
Limb in a flexed position.

Is the best approach to get a hemorrhage – free synovial fluid sample.

Injection technique:

Also known as a collateral sesamoidean approach.

Insert the needle through the lateral collateral sesamoidean ligament, between the articular surfaces of the proximal sesamoid bones and the articular surface of the third metacarpal/metatarsal bone.



The injection site is between the articular surface of the third metacarpal/metatarsal bone and the articular surface of the proximal sesamoid bones.

The needle in place.

Fetlock joint

- distal approach

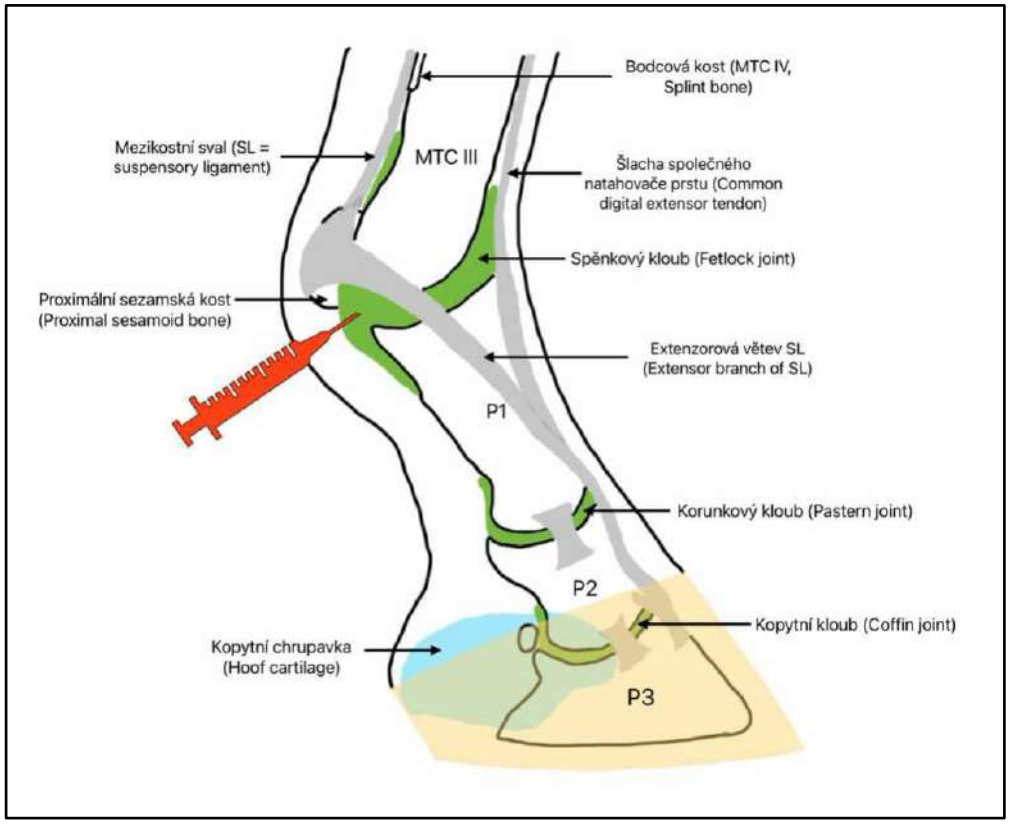
Volume of local anesthetics: 8-12 ml at each site.

Limb in weight-bearing position.

Injection technique:

The distal approach is performed in the palpable depression by the distal aspect of the proximal sesamoid bone. The borders of the injection site are the distal aspect of the proximal sesamoid bone and colateral sesamoidean ligament proximally.

The needle is inserted in the depression and directed slightly dorsally and proximally until the joint is entered.



The injection site is bordered by the distal aspect of the proximal sesamoid bone and colateral sesamoidean ligament proximally.

The needle is inserted in the depression and directed slightly dorsally and proximally until the joint is entered.

Fetlock joint

- dorsal approach

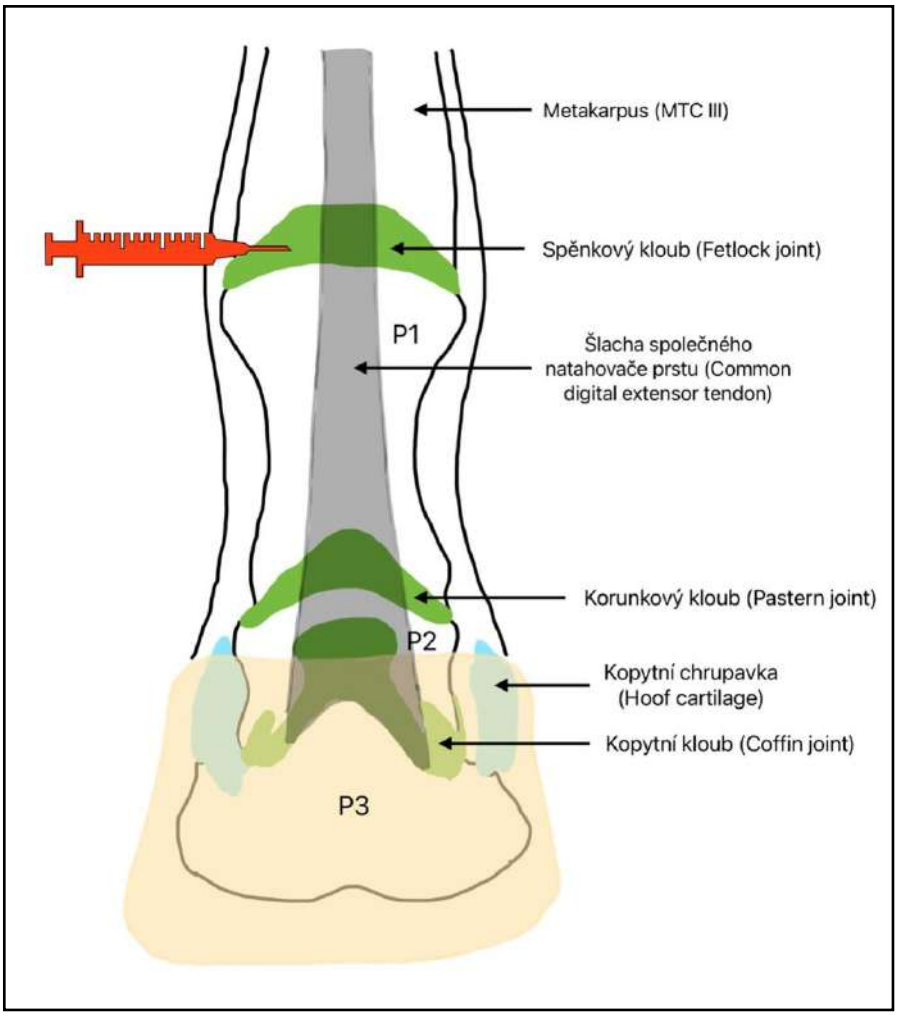
Volume of local anesthetics: 8-12 ml at each site.

Limb in weight-bearing position.

Injection technique:

The needle is inserted above the palpable joint space and the needle is directed medially and parallel to the frontal plane of the joint.

The needle is inserted under the lateral or medial edge of the common digital extensor tendon



The injection site is above the palpable joint space at the dorsal site of the fetlock joint, under the lateral or medial edge of the common digital extensor tendon.

The needle in place.

The digital synovial sheath

It is a very thin-walled synovial cavity in the fetlock region, extends from the distal part of third metacarpal/metatarsal bone to the proximal to the navicular bursa.

This synovial structure contains the superficial and deep digital flexor tendons in the part where pass around the palmar/plantar aspect of the metacarpophalangeal joint.

The digital synovial sheath is proximaly bordered by the palmar annular ligament, in the middle is bordered by the proximal digital annular ligament and distally by the distal digital annular ligament.

There are three approaches for entering sheth's pouches, proximal, distal and axial sesamoidean approach. The sheath may be injected from palmarolateral or palmaromedial sites distal to the annular ligament. Also the sheath can be entered on the palmar/plantar aspect of the pastern joint between the proximal and distal digital annular ligaments.

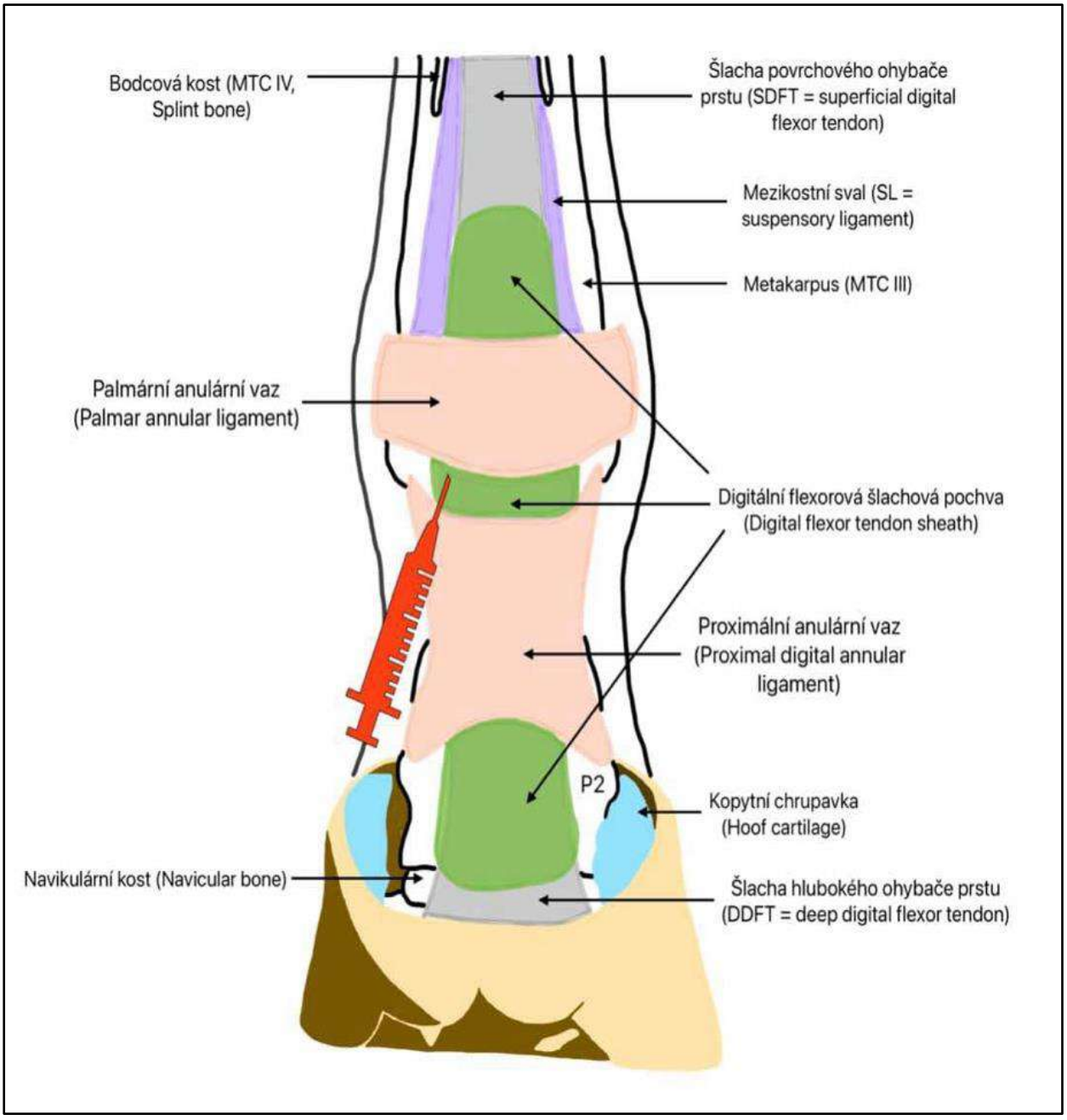
Analgesia of the digital tendon sheath is most commonly performed only in the presence of synovial distension of the sheath. A volume of local anaesthetis is 10 ml.

<u>Injection technique:</u>

The axial sesamoidean approach is performed between the annular and proximal digital annular ligaments, the needle is inserted in a distal to proximal direction at approximately a 45° angle to the sagittal plane.

The distal approach is located between the proximal and distal digital annular ligaments and between the branches of the superficial digital flexor tendon and

where the deep digital flexor tendon lies close to the skin. The needle is inserted from lateral to medial direction, under the skin. The distal approach is performed when th effusion is presented.



Distal approach to the digital flexor tendon sheath.

The injection site of the distal approach is performed between the annular and proximal digital annular ligaments

The axial sesamoidean approach – the needle is inserted in a distal to proximal direction at approximately a 45° angle to the sagittal plane.

The distal approach is located between the proximal and distal digital annular ligaments and between the branches of the superficial digital flexor tendon and where the deep digital flexor tendon lies close to the skin.

The needle is inserted from lateral to medial direction, under the skin.

References

AUER, Jörg A. a STICK, John A. *Equine surgery*. 4th ed. St. Louis, Missouri: Elsevier Saunders, c2012. ISBN 978-1-4377-0867-7.

BAXTER, Gary M. (ed.). *Manual of equine lameness*. Chichester: Wiley-Blackwell, 2011. ISBN 978-0-8138-1546-6.

DENOIX, Jean-Marie. *Essentials in clinical anatomy of the equine locomotor system*. Boca Raton: CRC Press, [2019]. ISBN 978-1-4987-5441-5.

DENOIX, Jean-Marie. *The equine distal limb: atlas of clinical anatomy and comparative imaging*. London: Manson Publishing/The Veterinary Press, [2000]. ISBN 1-84076-001-X.

MOYER, William; SCHUMACHER, John a SCHUMACHER, Jim. *A guide to joint injection and regional anesthesia*. 2011. ISBN 978-0-615-42033-2.

TAYLOR, F. G. R.; BRAZIL, Tim J. a HILLYER, M. H. (ed.). *Diagnostic techniques in equine medicine: a textbook for students and practitioners describing diagnostic techniques applicable to the adult horse*. 2nd ed. Edinburgh: Saunders, 2010. ISBN 978-0-7020-2792-5.