

Comparative study of histological changes in the deep branch of the lateral palmar nerve (DBLPaN) in horses with induced proximal suspensory desmitis (PSD)

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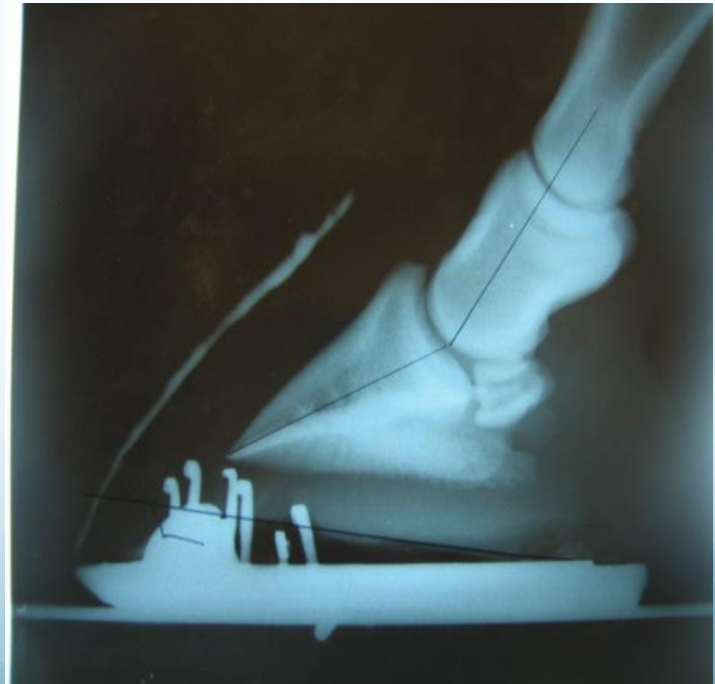
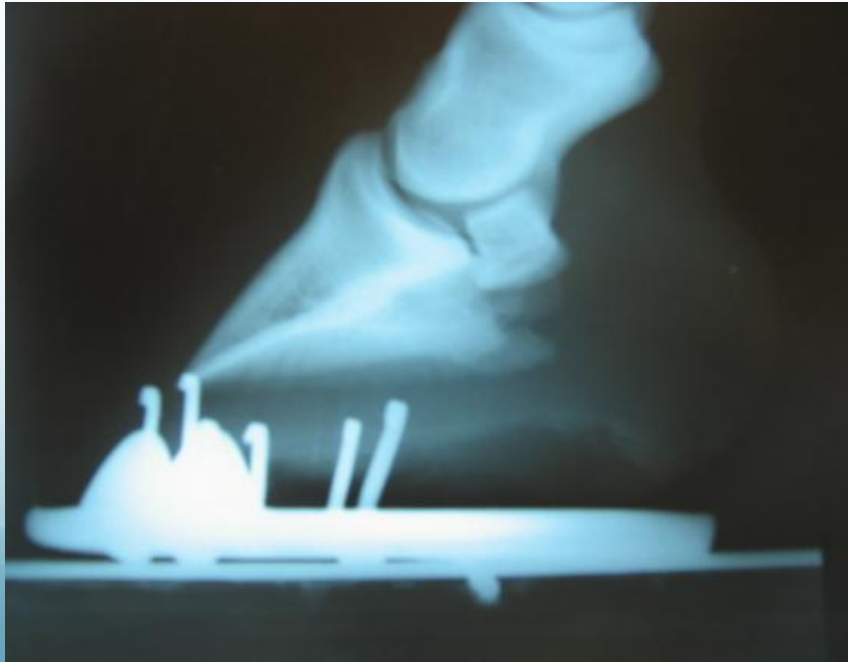
Introduction

- Proximal Suspensory desmitis (PSD) is a common cause of equine lameness in pelvic or thoracic limb in competition horses. Several medical treatments are recommended but when desmitis is chronic, lameness can be persistent and treatments ineffective .



Predisposing Conformation

- **Negative palmar angle** of distal phalanx, long pasterns



Why the Increase in Diagnosis?

- Increased awareness
 - Advances in techniques of local analgesia Hughes (2007)
Vet Surg 36:760
 - Advances in imaging techniques
MRI, US X-Rays
- Modern training demands
- Modern surfaces



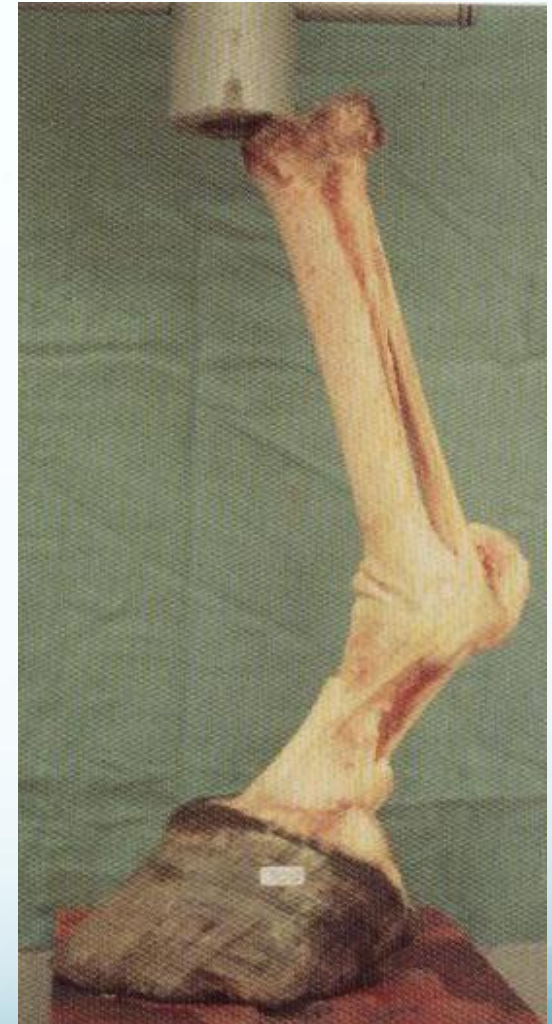
Introduction: Anatomy

- In the forelimb, the suspensory ligament originates in the distal row of carpal bones and at the proximal palmar aspect of the third metacarpal bone (Denoix 1994). The proximal part of the suspensory ligament is innervated by the deep branch of the lateral palmar nerve, which contains fibers from the ulnar and the median nerves.

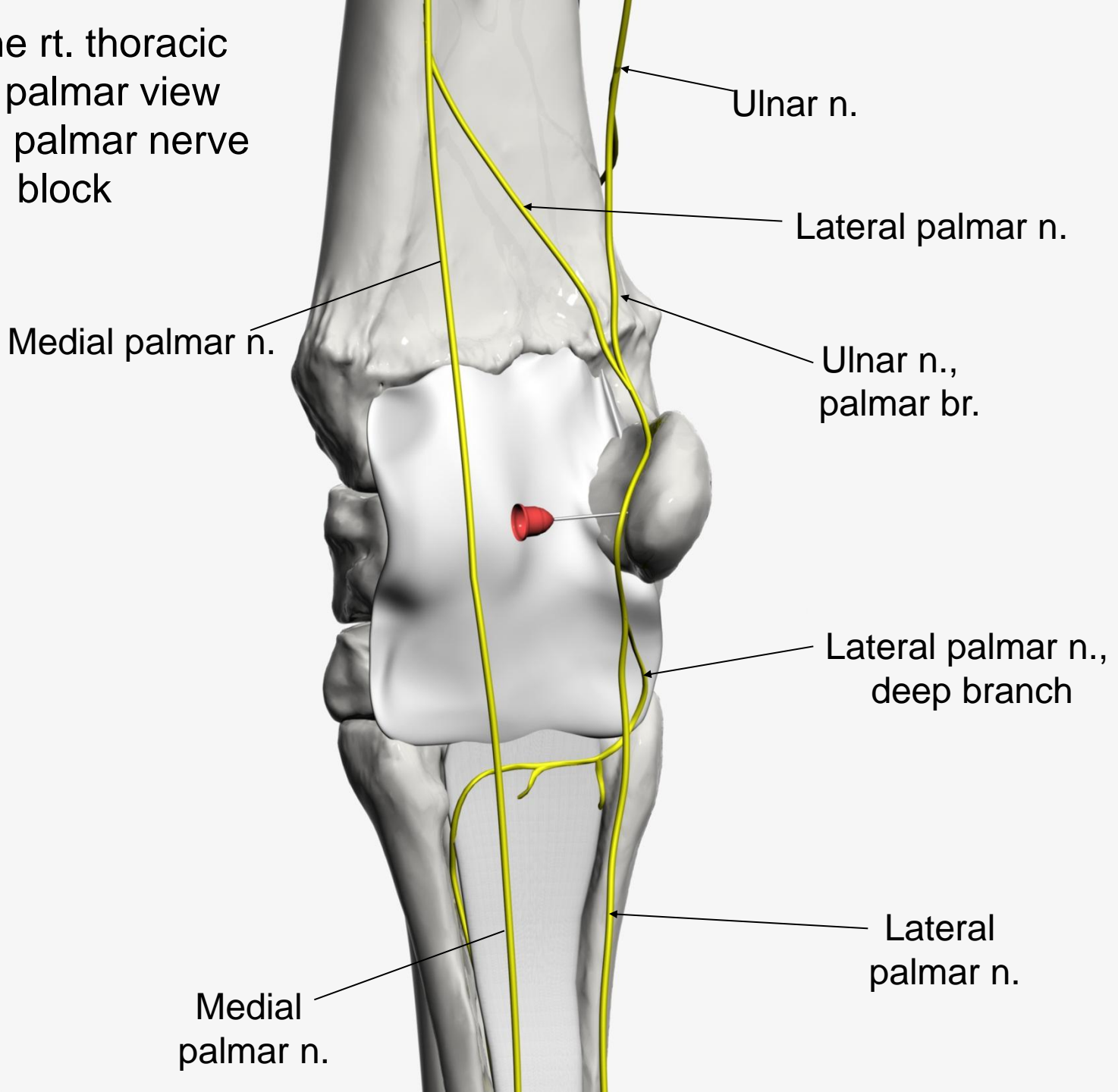


Function

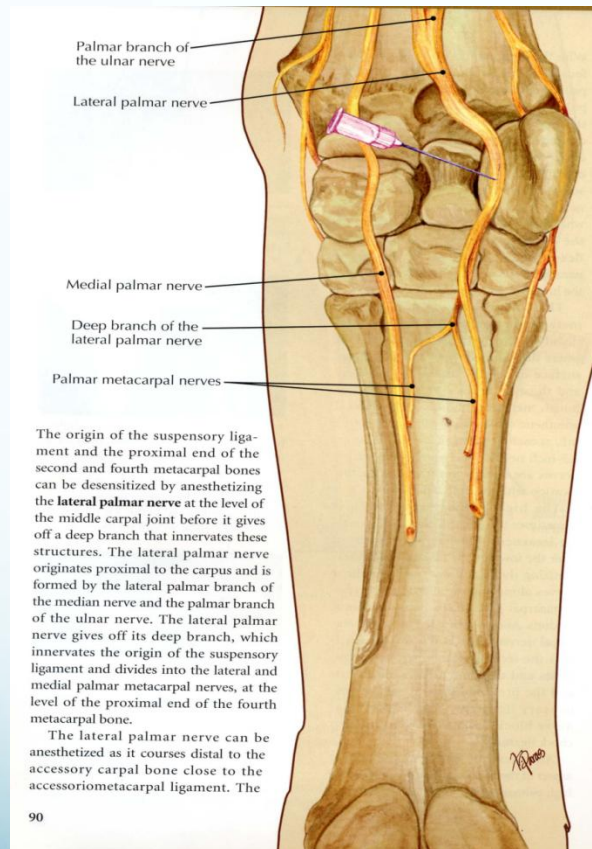
- Supports fetlock
 - Prevent hyperextension
- Limits bending of 3rd metatarsal/metacarpal bone
 - Prevents cannon bone fxs
- Elastic
 - Contributes to fetlock elevation
- Swing phase
 - Relaxed
- Stance phase
 - Tensed



Equine rt. thoracic limb, palmar view
Lateral palmar nerve block



Diagnostic Analgesia PSL Fore Limb



Introduction

- Previous studies reveal that horses chronically lame because of PSD in pelvic limbs have been treated with good results by neurectomy of the deep branch of the lateral plantar nerve (DBLPIN), suggesting that persistent lameness in horses with PSD of pelvic limbs may be caused by compression of the plantar metatarsal nerves, which innervate the proximal suspensory ligament. (Toth, *et al*)

Introduction

- Tóth *et al* examined the DBLPIN of horses determined to be lame of one or both pelvic limbs because of PSD and found histological changes suggestive of chronic compression of these nerves.



Introduction

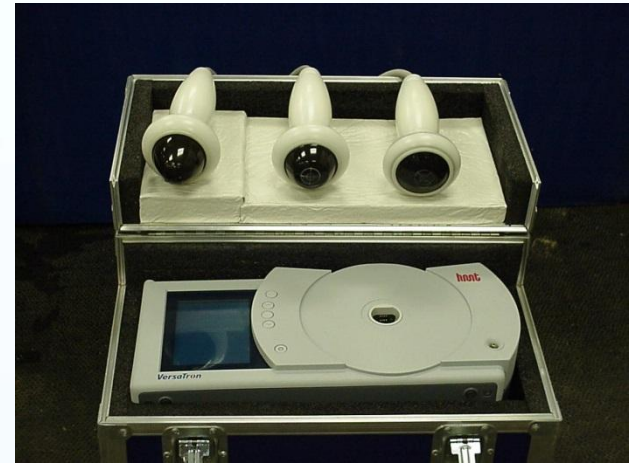
- In other study horses that were diagnosed with chronic PSD in thoracic limbs resolved by neurectomy of the deep branch of the lateral palmar nerve (DBLPaN) and suggested that chronic neural compression may also be a cause of chronic lameness of horses with PSD of a thoracic limb. (P Gay Gusco *et al* 2012)



Treatment

Confinement & Shockwave Therapy

- Confinement & shockwave therapy improves soundness for a short time
 - Rapid improvement from analgesic effect
 - Profound effect on collagen remodeling & turnover
- 41% of 44 horses became sound & remained so for 6 mo
 - Crowe OM, Dyson SJ, Wright IM, et al: *Equine Vet J* 36:313-316, 2004



Treatment

Other Treatments

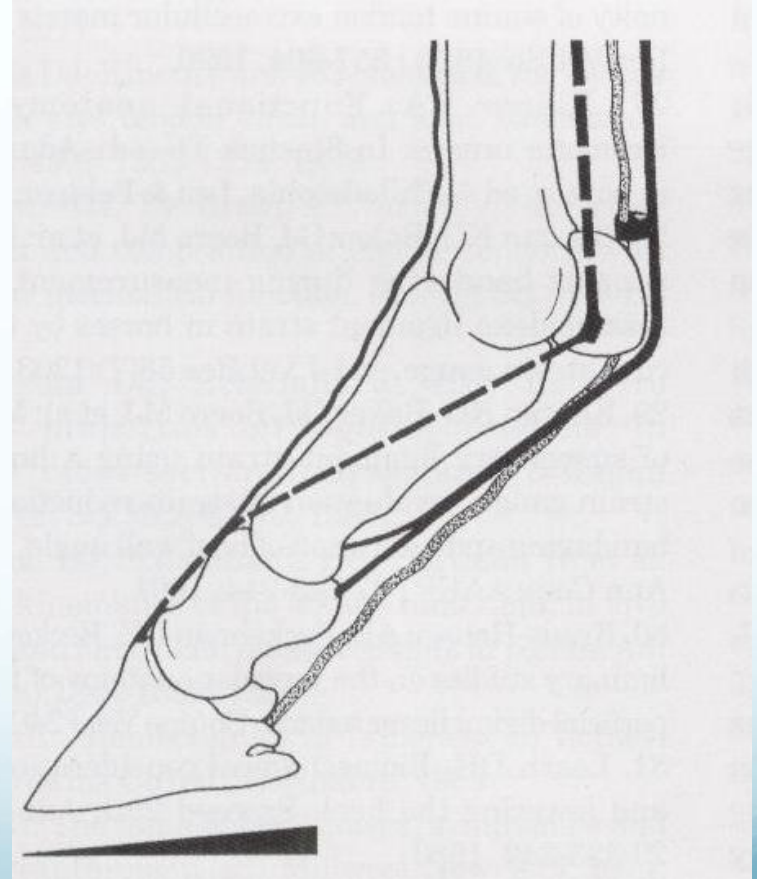
- Infiltration of a glucocorticoid around ligament
 - Triamcinolone
 - Betamethasone
- Injection of bone marrow aspirate, or platelet rich plasma
- Systemic or local administration of glucosaminoglycans



Treatment

Other Treatments

- Establish uniform weight distribution
 - Egg-bar shoes
- ***Do not*** elevate heels
 - Increases tension on SL



Objectives

- To determine if pathologic changes are present in the DBLPaN of horses affected with PSD that may explain the poor response to conservative therapy, compare to those controls.
- To determine how excision of a segment of the DBLPaN affects lameness of horses suffering from PSD of the thoracic limbs

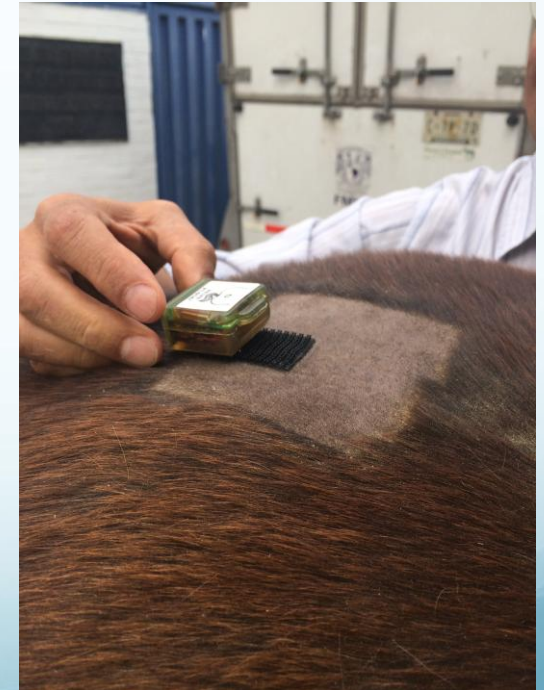
Methods

Adult mixed breed horses n= 8, clinically healthy, sound and with no evidence of PSD.



MATERIALS AND METHODS: PHASE 1

Using a body internal sensors system(BASELINE)



Trial: Straight line

Surface: Concrete

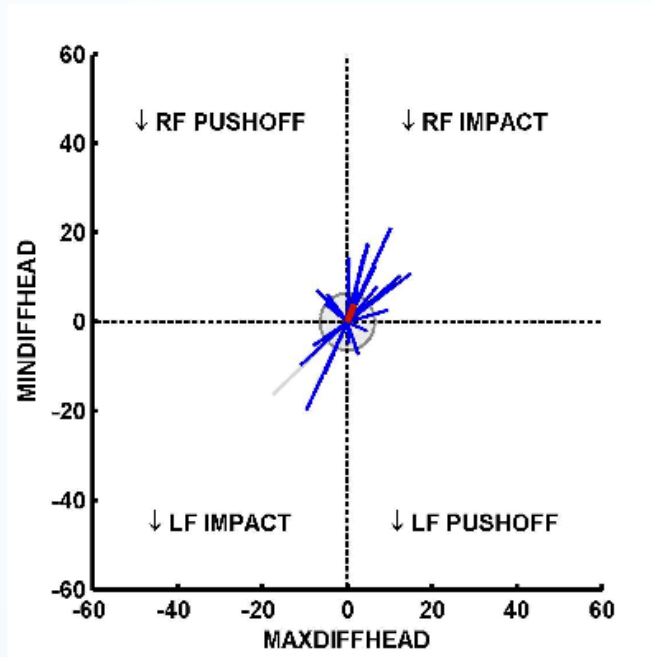
Blocks: _____

Analysis settings: *Delta = 0.1; Fore SD = 2.3;*

Stride Rate: 1.511

Strides Evaluated (front/hind): 24 / 25

Front Limb Evaluation



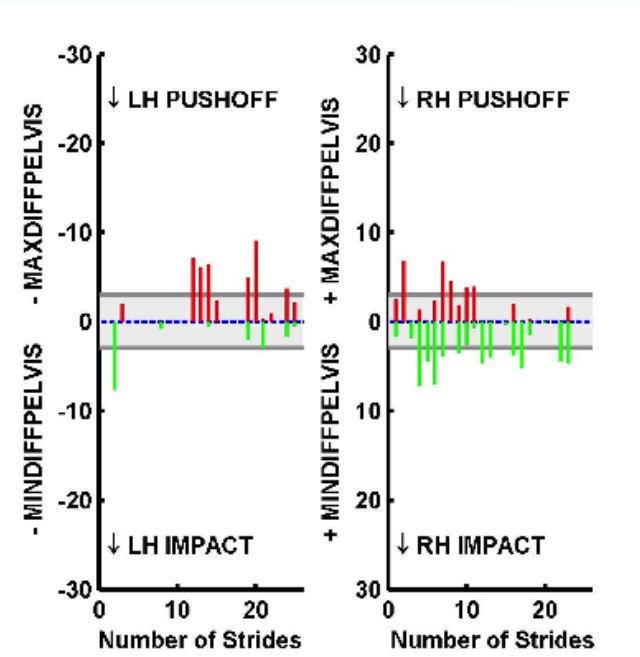
A1/A2: LF: 0.1713

Threshold = 0.50 RF: 0.4355

Head Diff (Mean/SD): Max: 1.611 / 6.98

Threshold = ±6mm Min: 3.907 / 9.88

Hind Limb Evaluation



A1/A2: LH: 0.0801

Threshold = 0.17 RH: 0.1288

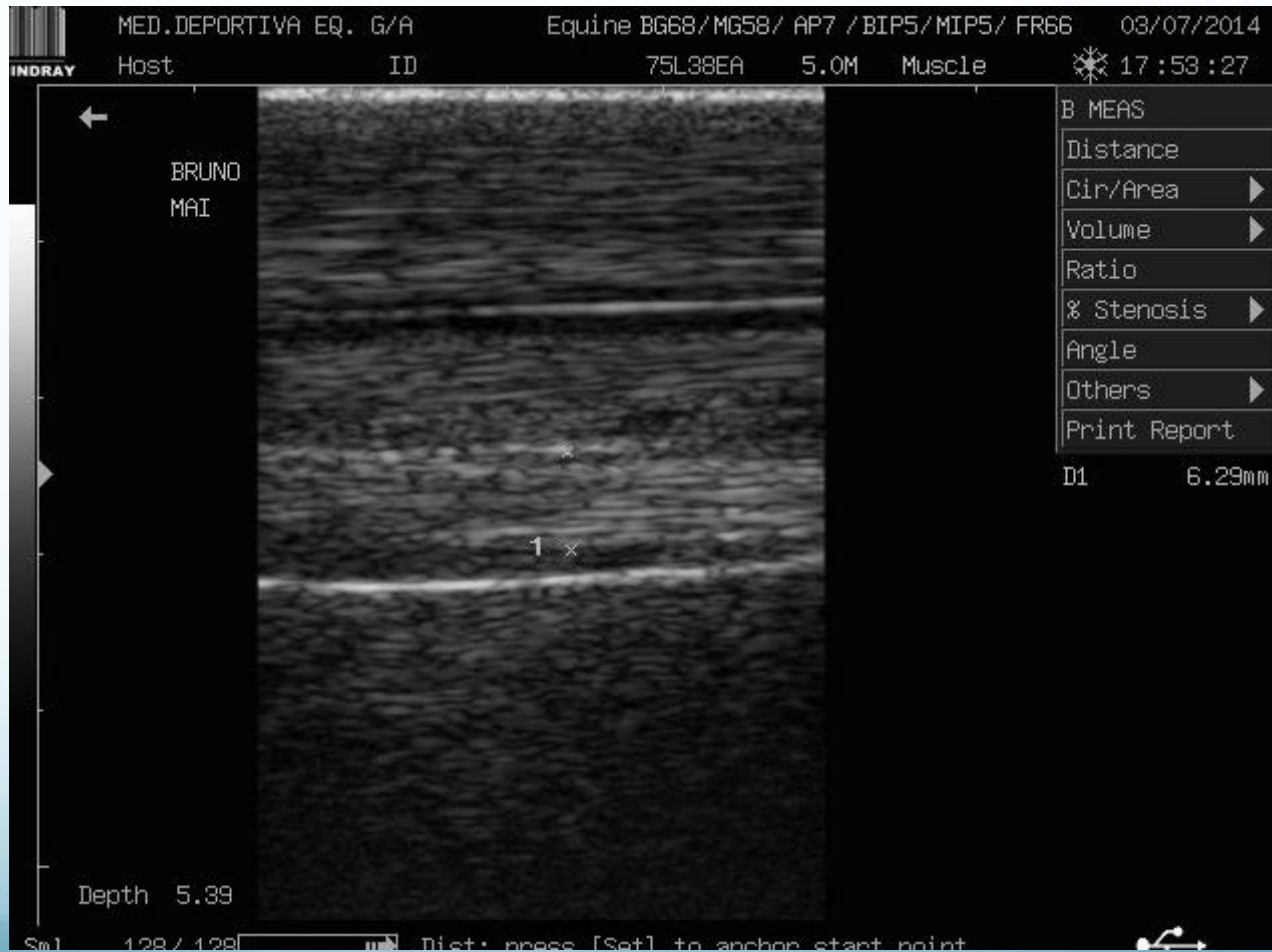
Pelvis Diff (Mean/SD): Max: -0.306 / 4.239

Threshold = ±3mm Min: 1.80 / 3.381

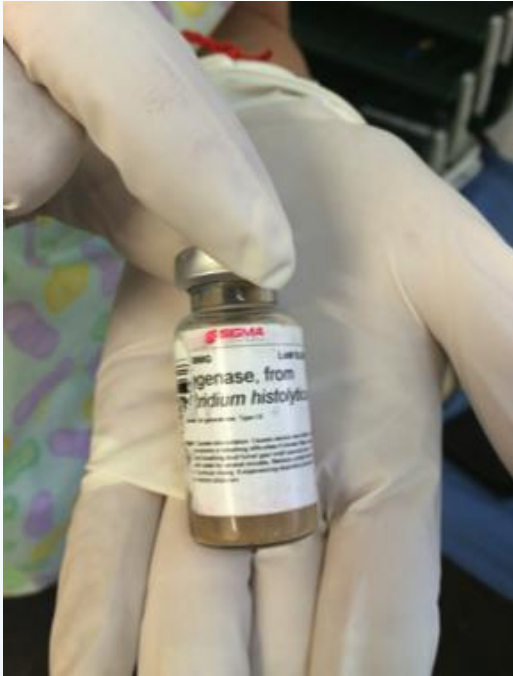
Evaluator Notes (before and/or after data collection)

There is "no" evidence of LF lameness
There is "no" evidence of RF lameness
There is "no" evidence of LH lameness
There is "no" evidence of RH lameness
prueba 1

METHODS.PHASE 2, ULTRASOUND.



COLLAGENASE type I INJECTION

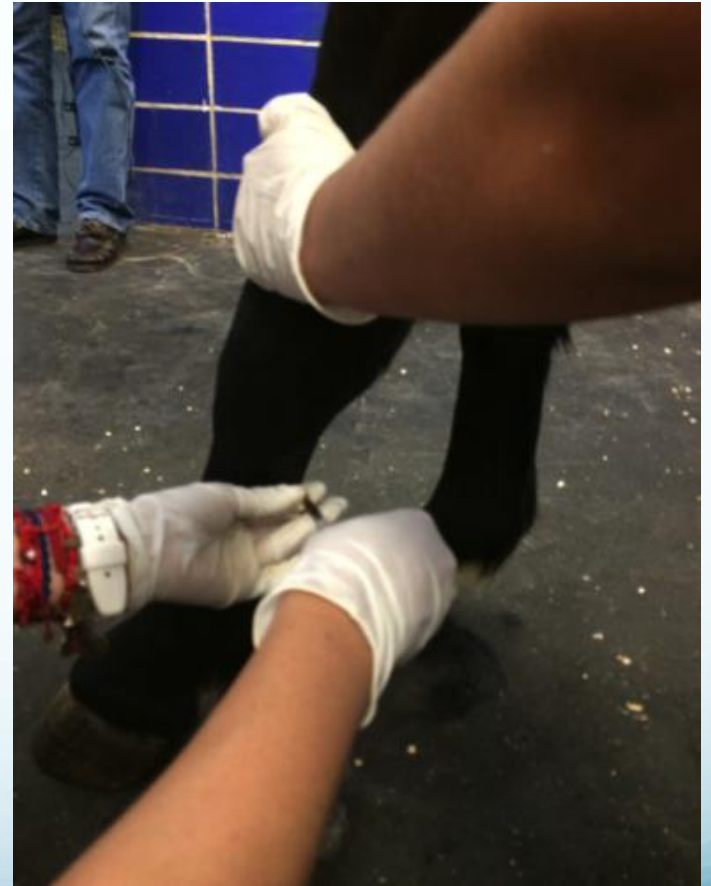


17,100 U/2 mL
Sterile water

2500 UI/ 0.3mL



US GUIDED



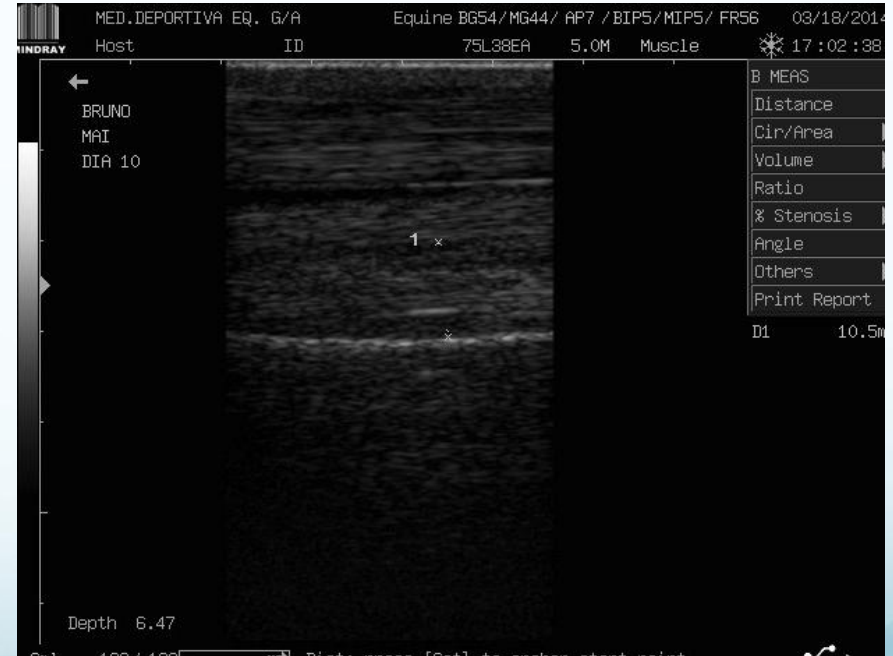
US



US



DAY ONE ,BEFORE INJECTION



DAYS 10,21,45 y 56 AFTER

Blocks:

Analysis settings: Delta = 0.1; Fore SD = 3.2;

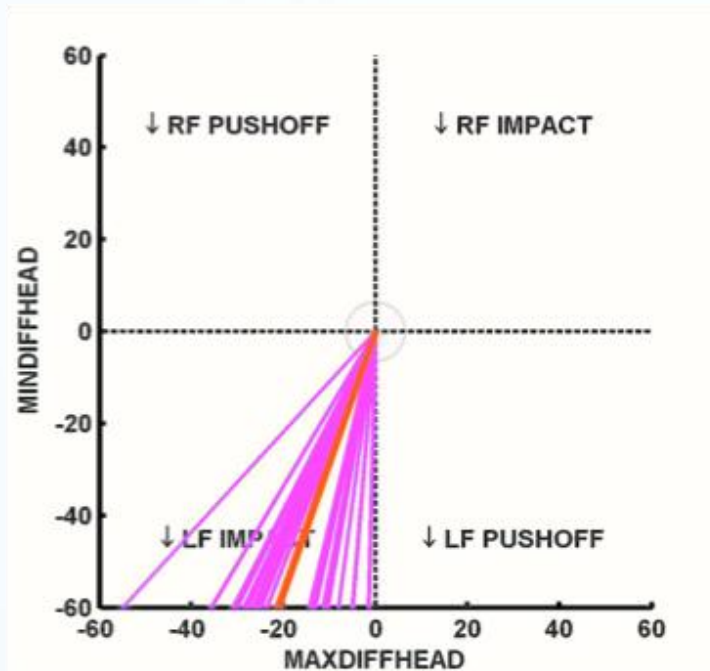
Stride Rate:

1.606

Strides Evaluated (front/hind):

29 / 28

Front Limb Evaluation



A1/A2:

LF: 4.4529

Threshold = 0.50

RF: 0.00

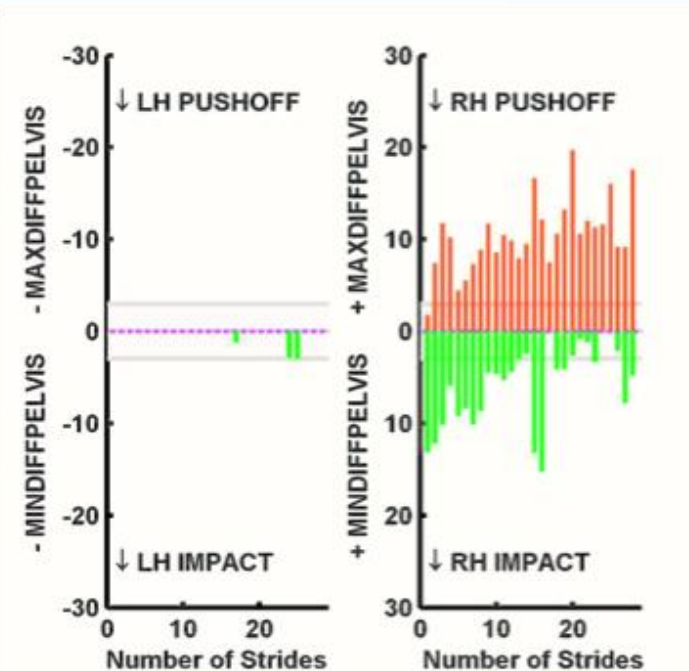
Head Diff (Mean/SD):

Max: -41.736 / 21.228

Threshold = ±6mm

Min: -118.389 / 22.662

Hind Limb Evaluation



A1/A2:

LH: 0.006

Threshold = 0.17

RH: 0.4045

Pelvis Diff (Mean/SD):

Max: 10.448 / 3.868

Threshold = ±3mm

Min: 5.428 / 4.719

Evaluator Notes (before and/or after data collection)

There is "strong" evidence of "moderate/severe" LF lameness

There is "no" evidence of RF lameness

There is "no" evidence of LH lameness

There is "strong" evidence of "moderate" RH lameness

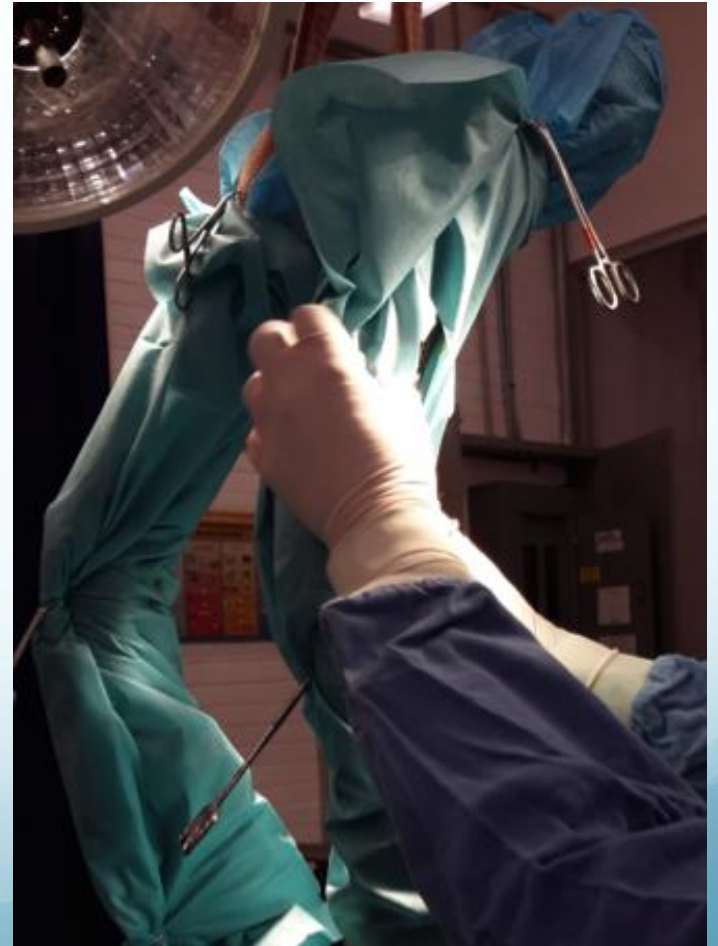
Consider LF as primary

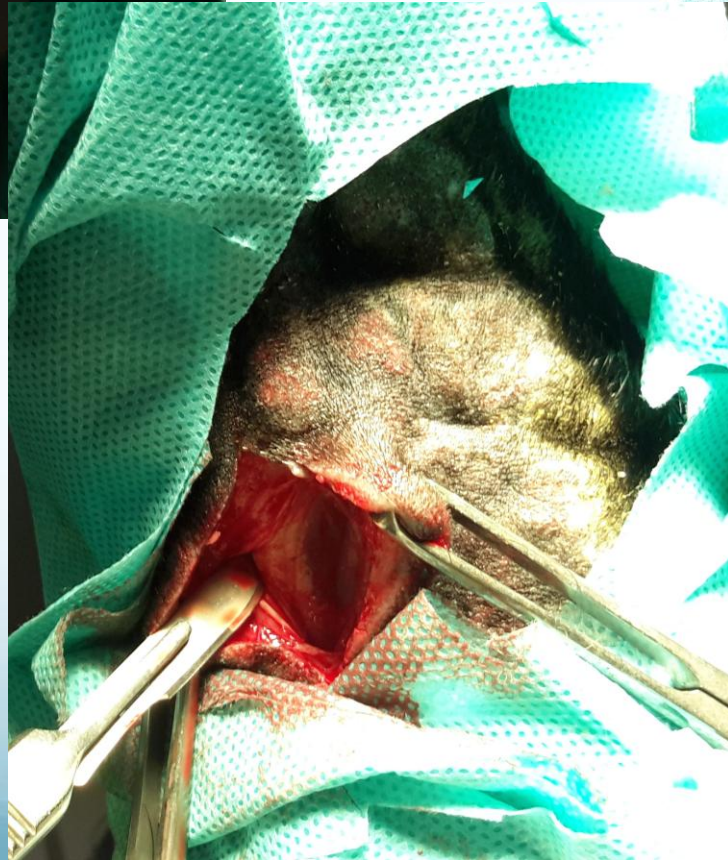
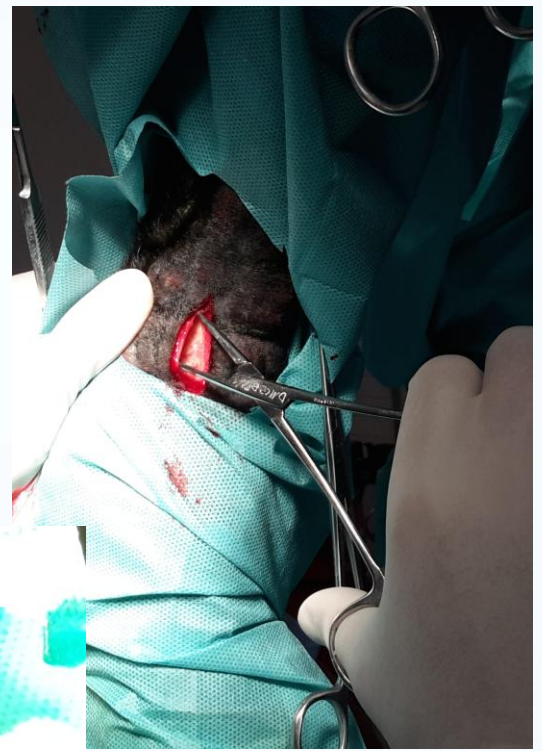
5dias post inyeccion

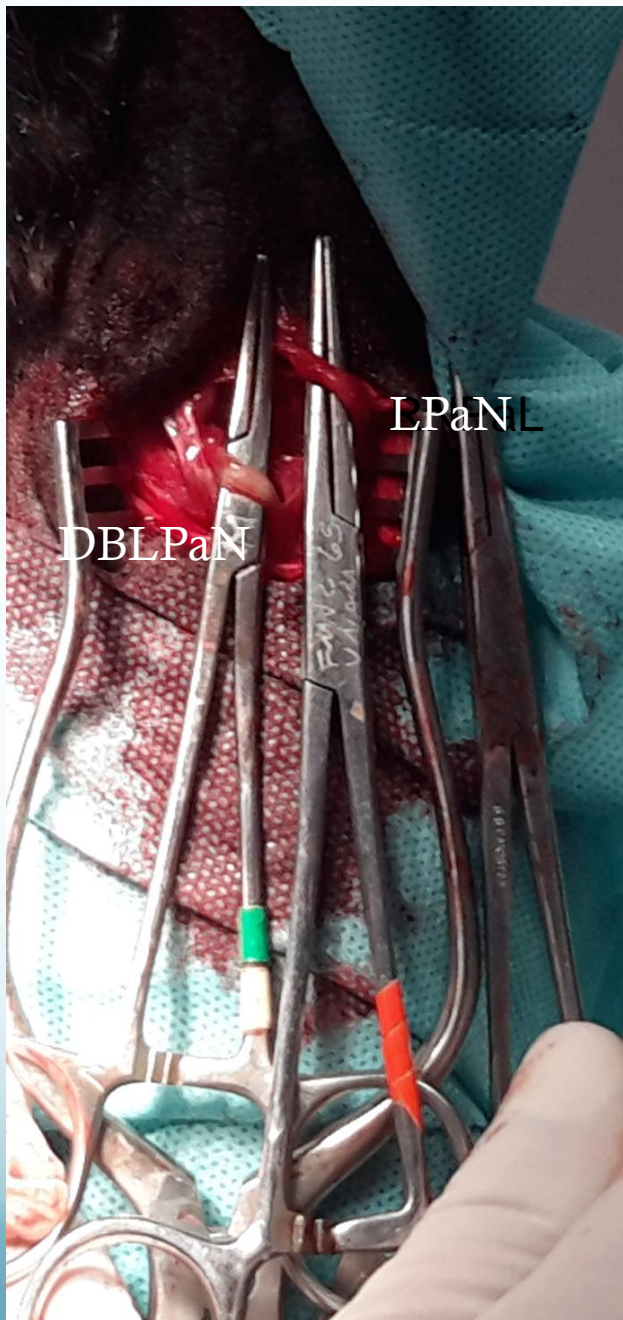
PHASE 3: Neurectomy, Induction



Preparation of the site







DBLPaN





Lab

- Resected nerve segments were submitted for histologic evaluation
 - Hematoxylin and eosin
 - Masson Trichrome
 - Alcian blue
 - Luxol fast-blue



SKIN STAPLES WERE REMOVED 14 DAYS AFTER

Results: Values obtained with body internal sensors

Vector Sum (amplitude) of lameness (mm)
mean + s.d.

Test condition	
Time zero (baseline)	5.1 <u>+</u> 0.643
8 weeks afetr PSD induction	91.3 <u>+</u> 11.4 *
2 weeks after neurectomy of the DBPaLN	6.6 <u>+</u> 0.82

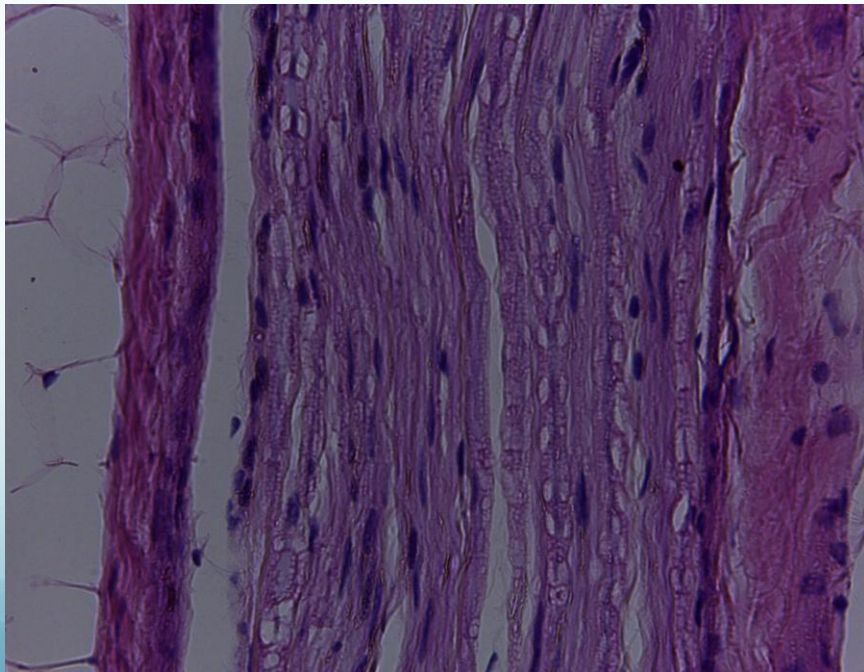
* Means significantly different (threshold 8.5 mm)

Results

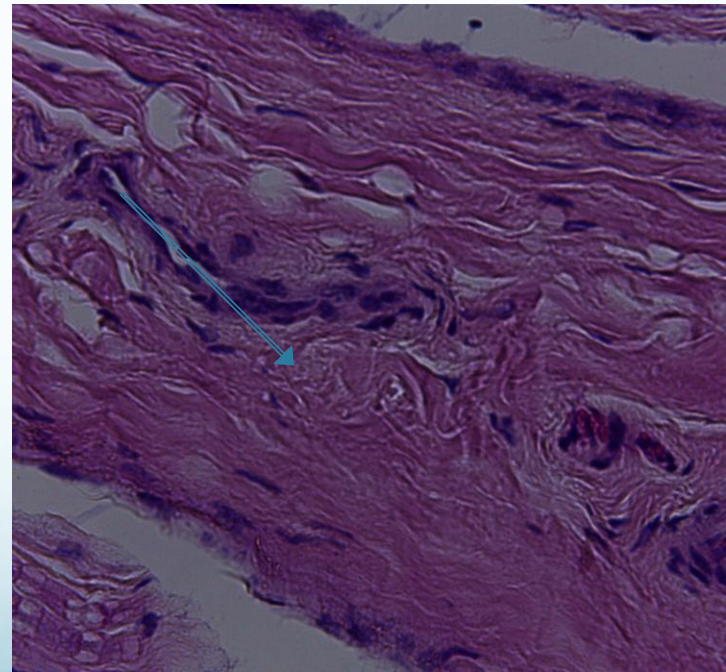
- Values would tell that collagenase created a lameness caused by proximal suspensory desmitis and the neurectomy of the DBLPaN was successful in resolving the lameness.....

Histopathologic findings

- Expansion of the subperineum by a poorly cellular myxomatous matrix & nerves, Renault body formation & nerves.



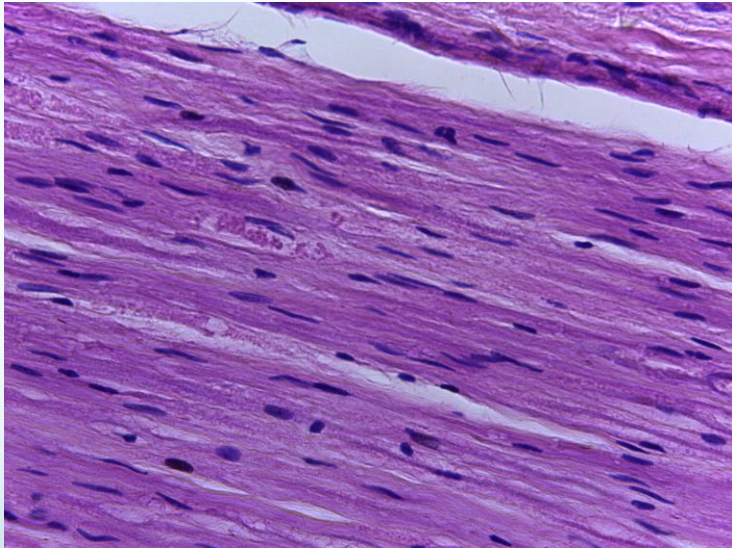
Normal



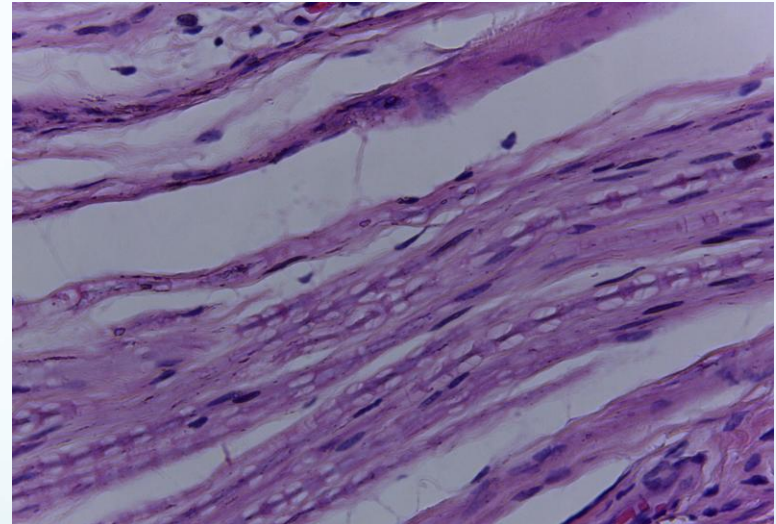
Treated

Histopathologic findings

- Axonal swelling and necrosis with myelin degeneration
8 nerves

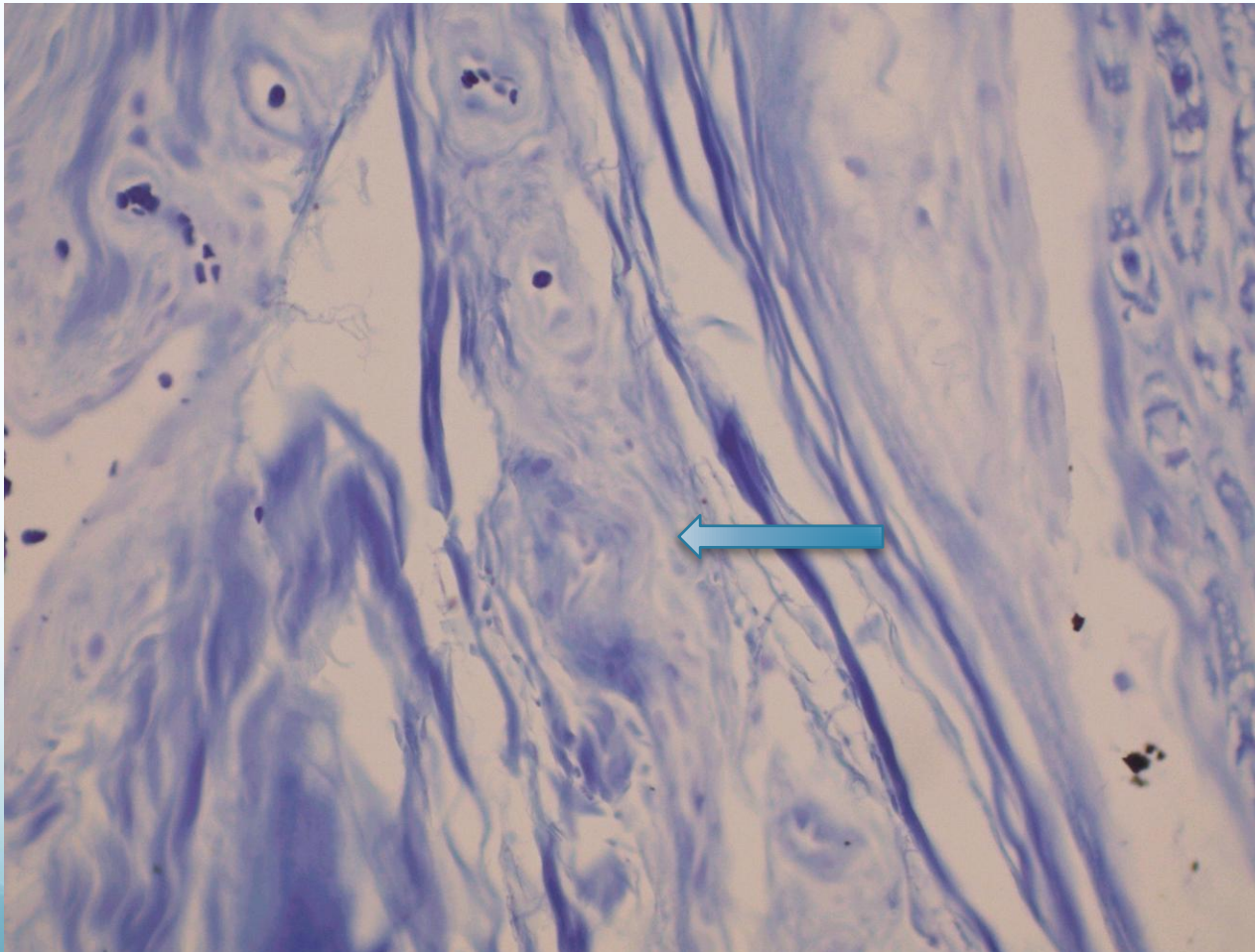


Normal



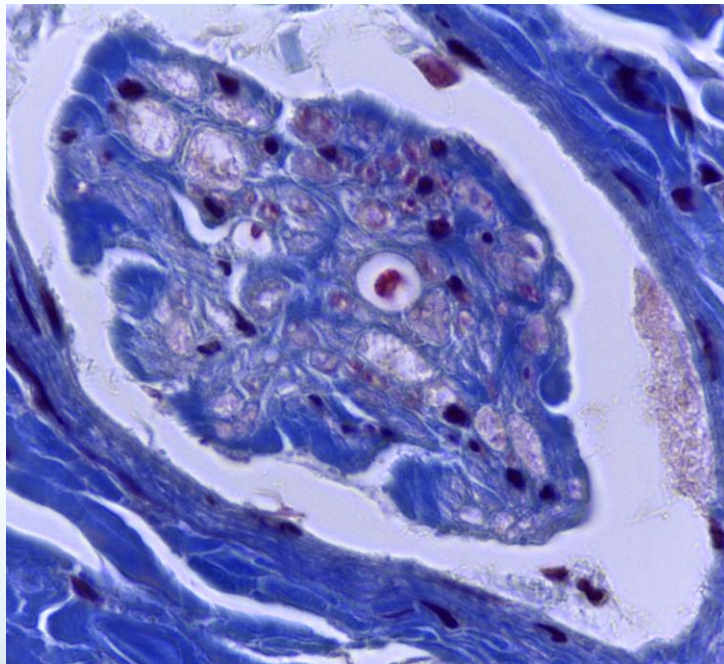
Treated

LFB, TREATED 40 X

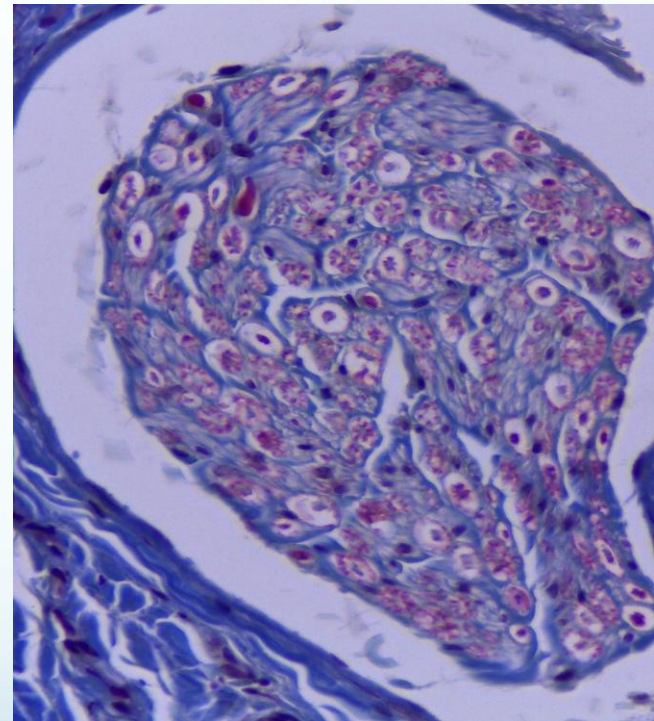


RENAUT BODY 40X

CROSS SECTION DBLPaN MT 100 X

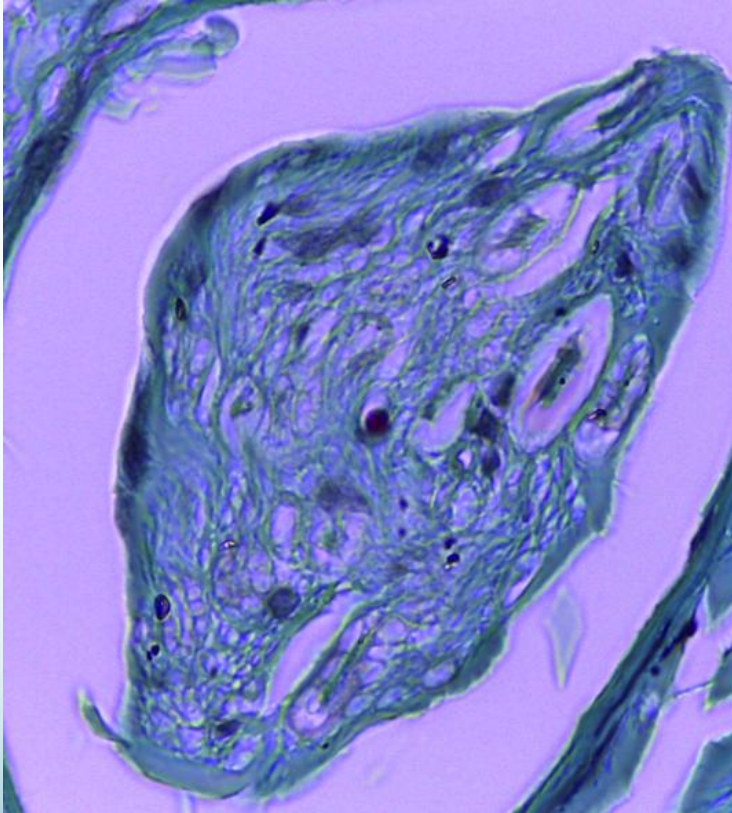


TREATED

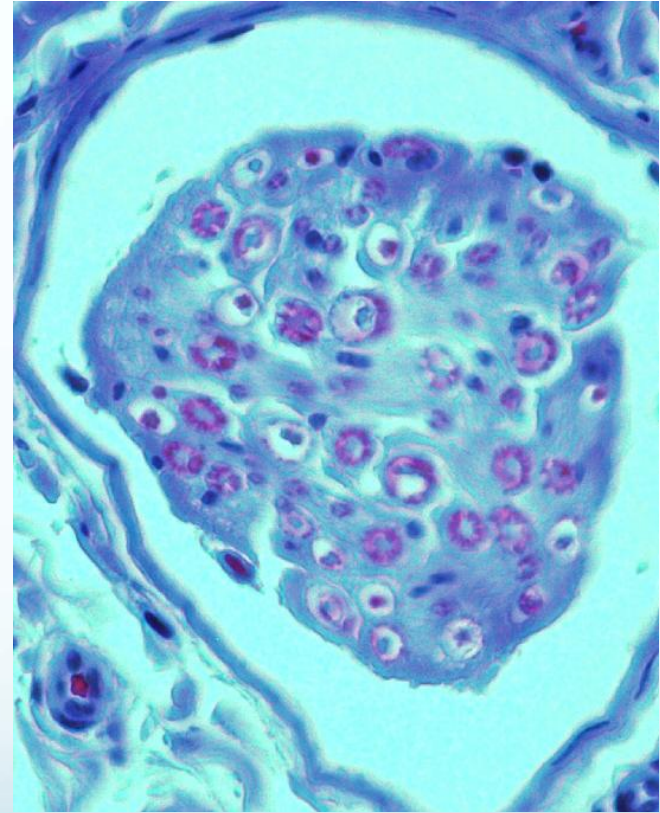


CONTROL

CROSS SECTION DBLPaN MT 100 X



TREATED



CONTROL

Discussion

- Persistence of thoracic limb lameness in horses with PSD may be caused by compression of the DBPaLN, which innervates the proximal aspect of the suspensory ligament and be the cause of pain causing lameness rather than pain originating within the proximal aspect of the suspensory ligament.

Discussion

- Excision of the DBLPaN enabled horses with PSD to return to the exercise.....
 - Interruption of sensory innervation to a painful suspensory ligament ?
 - Removal of a painful segment of an entrapped nerve?

Discussion

- Future directions
 - Evaluate the importance of neurogenic atrophy of SL after DBLPaN resection – potential for failure (Pauwels et al)

Conclusions

- All nerves (DBLPaN) resected from PSL with induced desmitis had evidence of entrapment neuropathy....
- Chronic lameness in horses affected with PSD can be caused by compression neuropathy in forelimbs.

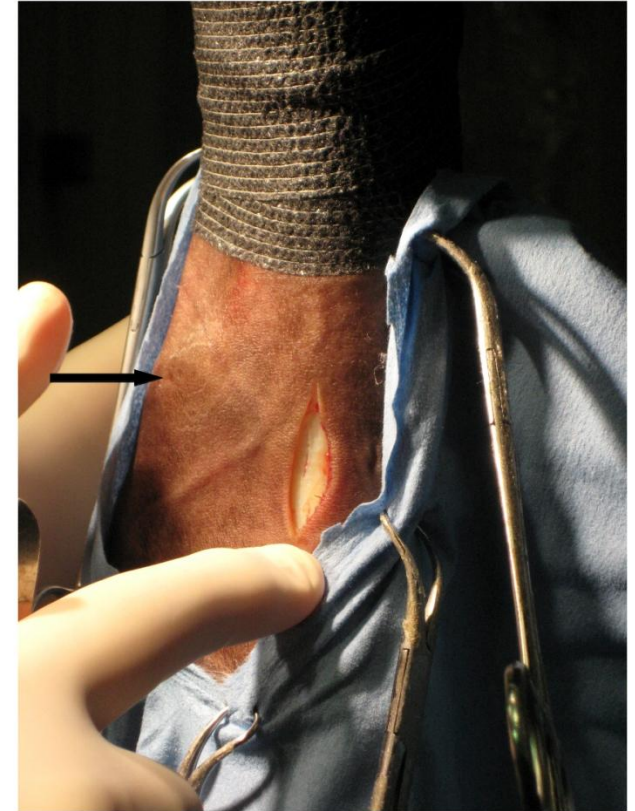
***The protocol was approved by the FMVZ-UNAM Institutional Animal Care and Use Committee.



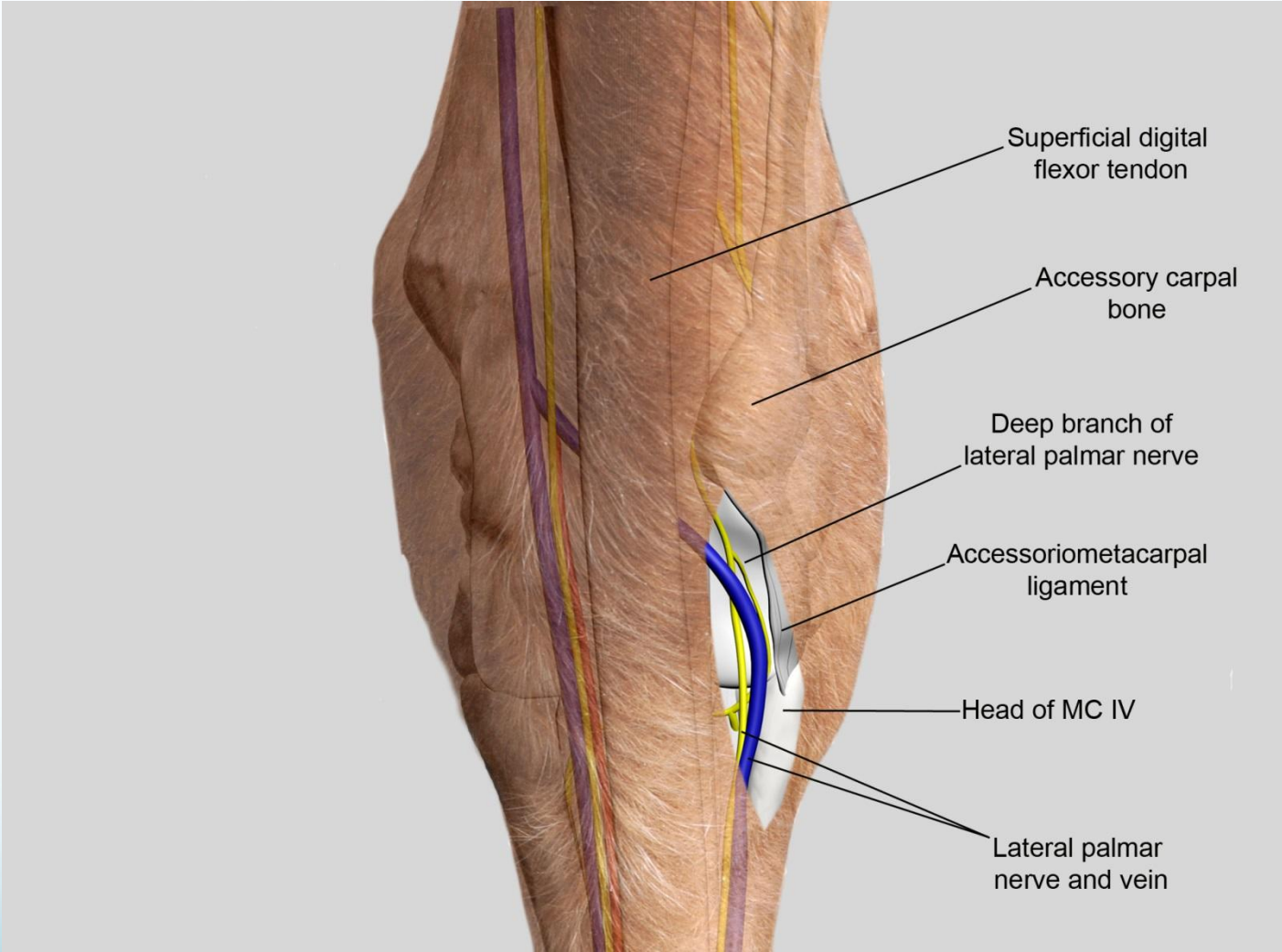
THANKS!!

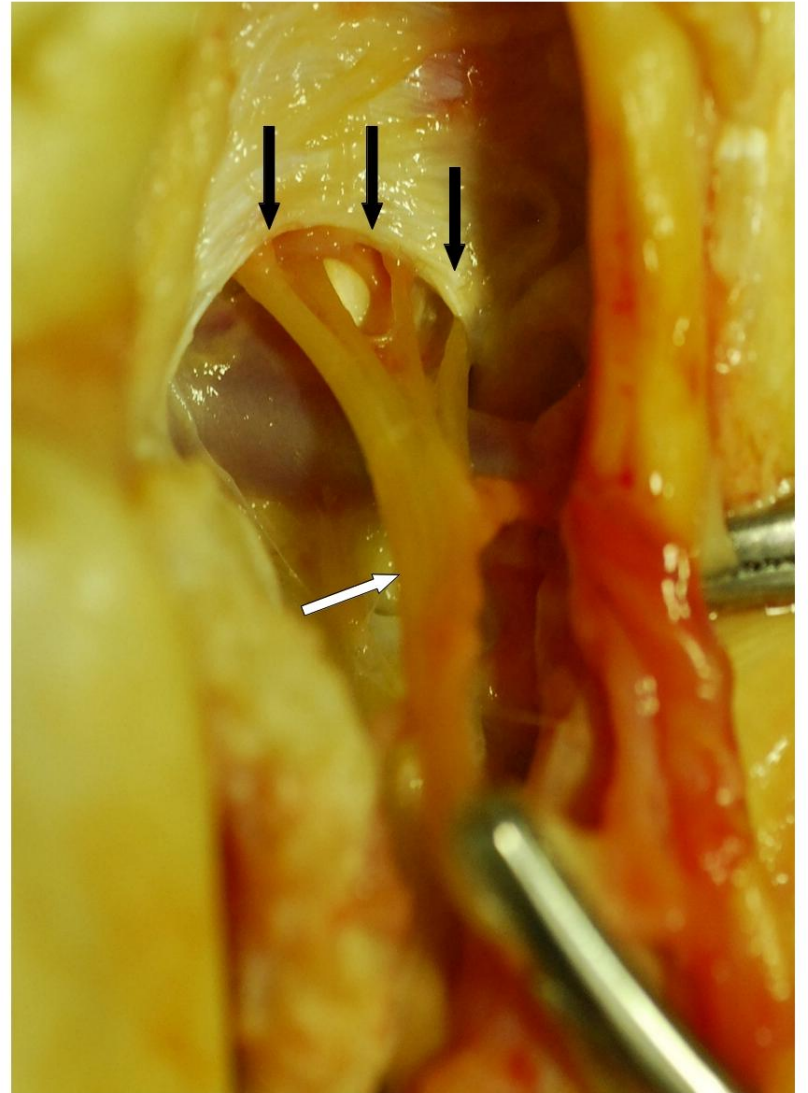
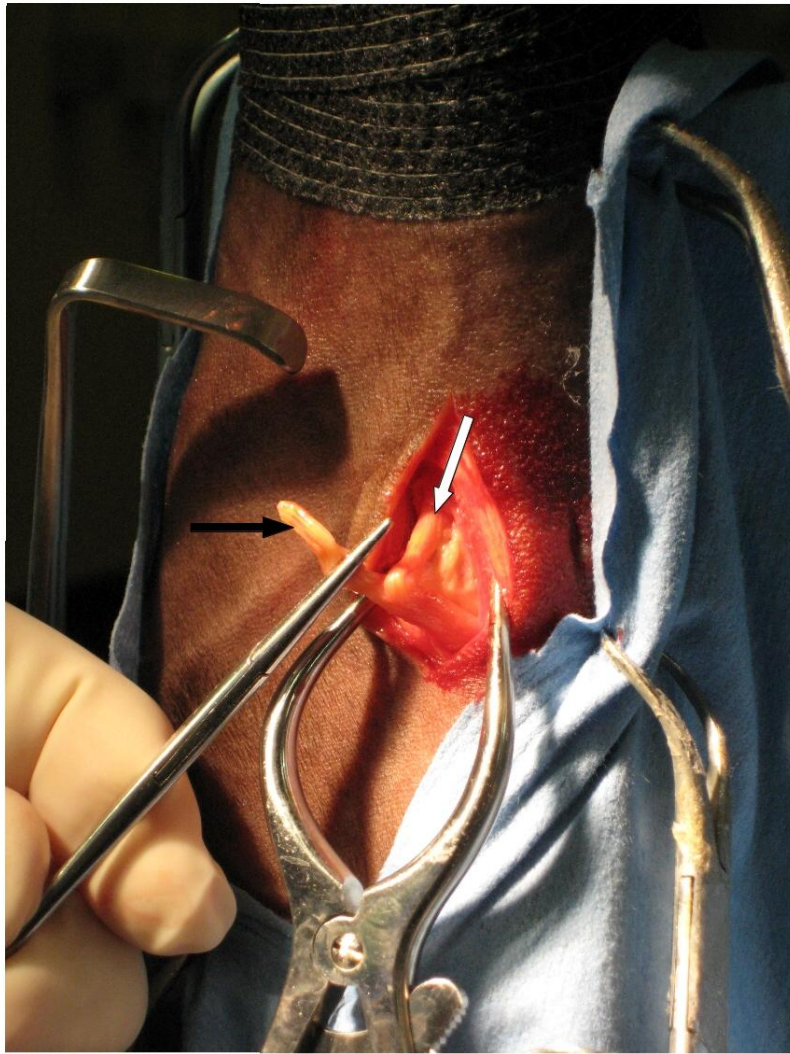
Fore Limb Suspensory

- Lameness of horses caused by chronic PSD can be resolved by neurectomy of the DBLPaN when horses are refractory to more conservative therapy*



*Gay Guasco P, Kelly G, Schumacher J, Henry RW.
Vet Surg 42:296-301, 2013





DISCUSSION

- Why does excision of DBLPIN resolves lameness in the majority of horses
 - By interrupting sensory innervation to painful suspensory ligament?
 - By removing a painful segment of entrapped nerve?

DISCUSSION

- Should neurectomy be performed on both pelvic limbs even if horse is lame on only 1 limb?
 - Unilaterally affected horses sometime become lame on non-operated limb

Factors that Predispose to PSD

- Immaturity & poor conditioning
 - Strength is related to **size & number** of collagen fibrils
 - Increase in response to increase in physical demands
 - PSD occurs when physical demands surpass body's ability to adapt

