Exertional Leg Pain

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Disclosure

- No relevant financial relationships with commercial entities

Learning Objectives

- Discuss common etiologies of exertional leg pain
- Discuss best available evidence for the diagnosis and treatment of common causes of exertional leg pain
- Provide a practical algorithmic approach to the assessment and management of exertional leg pain

Exertional Leg Pain

- Common
- 10-15% of all runners
- 60% leg pain syndromes [Bates]

- Common Etiologies
  - Medial Tibial Stress Syndrome (MTSS)
  - Stress Fractures - Tibia
  - CECS (Chronic Exertional Compartment Syndrome)
  - PAES (Popliteal Artery Entrapment Syndrome)
  - Nerve Entrapments – Peroneal nerve

Bates P. Shin splints a literature review. BJSM 1985; 19(3): 132-137.

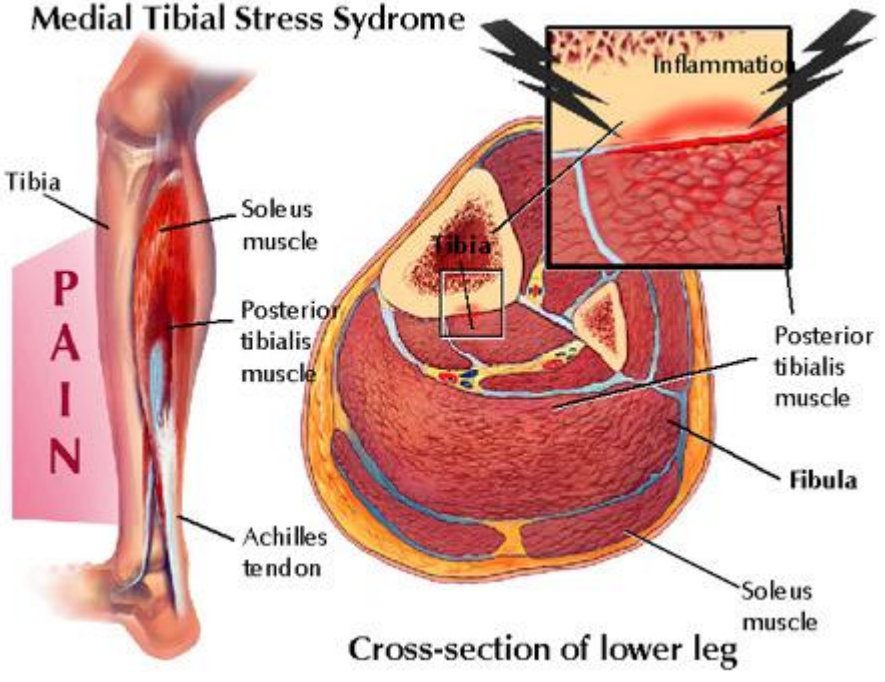
MTSS

- Overuse injury
- Diffuse pain along medial border of tibia
- Occurs with exercise REMITS with rest
- Stress reaction due to fascial traction at tibial attachment of soleus and deep crural fascia [Bouche]

Bouche, et al J Am Pod Med Assoc 2007; 97(1): 31-36.

MTSS

- Stress reaction at tibial attachment of soleus and deep crural fascia



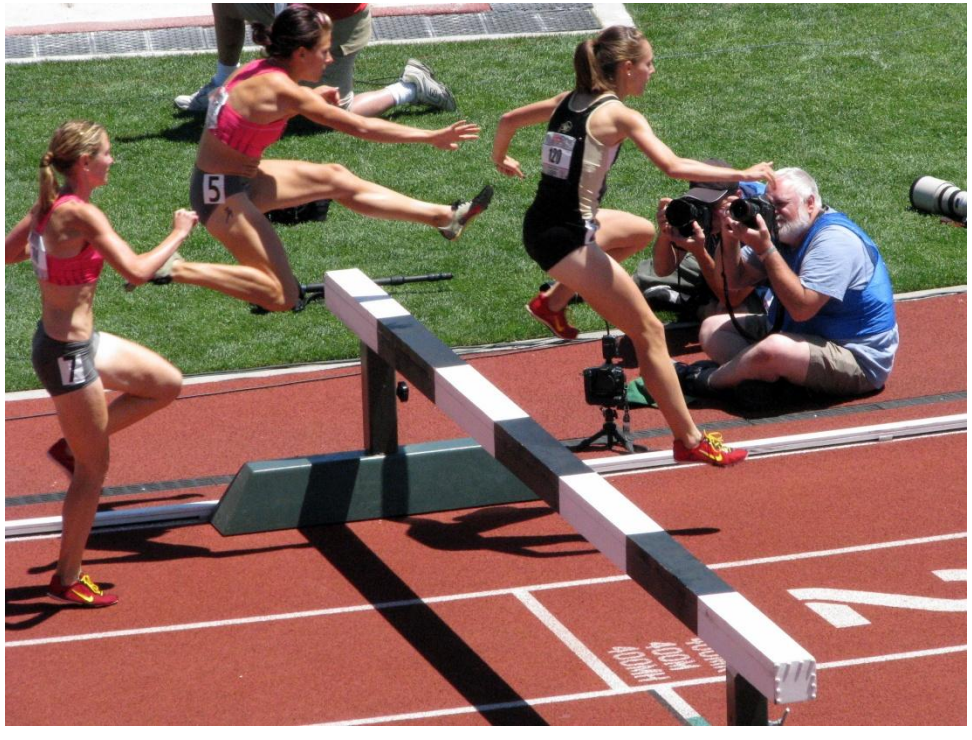
MTSS

- True incidence unknown
- Most common cause of exertional leg pain in athletes
- 6-16% of all running injuries [Thacker]
- 5-15% of injuries in runners or military recruits [Thacker]

Thacker et al, The prevention of shin splints in sports: a systematic review of the literature. MSSE 2002; 34(1): 32-40

MTSS Risk Factors

- Prev Hx of MTSS or stress fx
- Running < 5 yrs
- Need for orthotics [Hubbard]
- Female
- Excessive pronation [Moen]
- Calf tightness/weakness



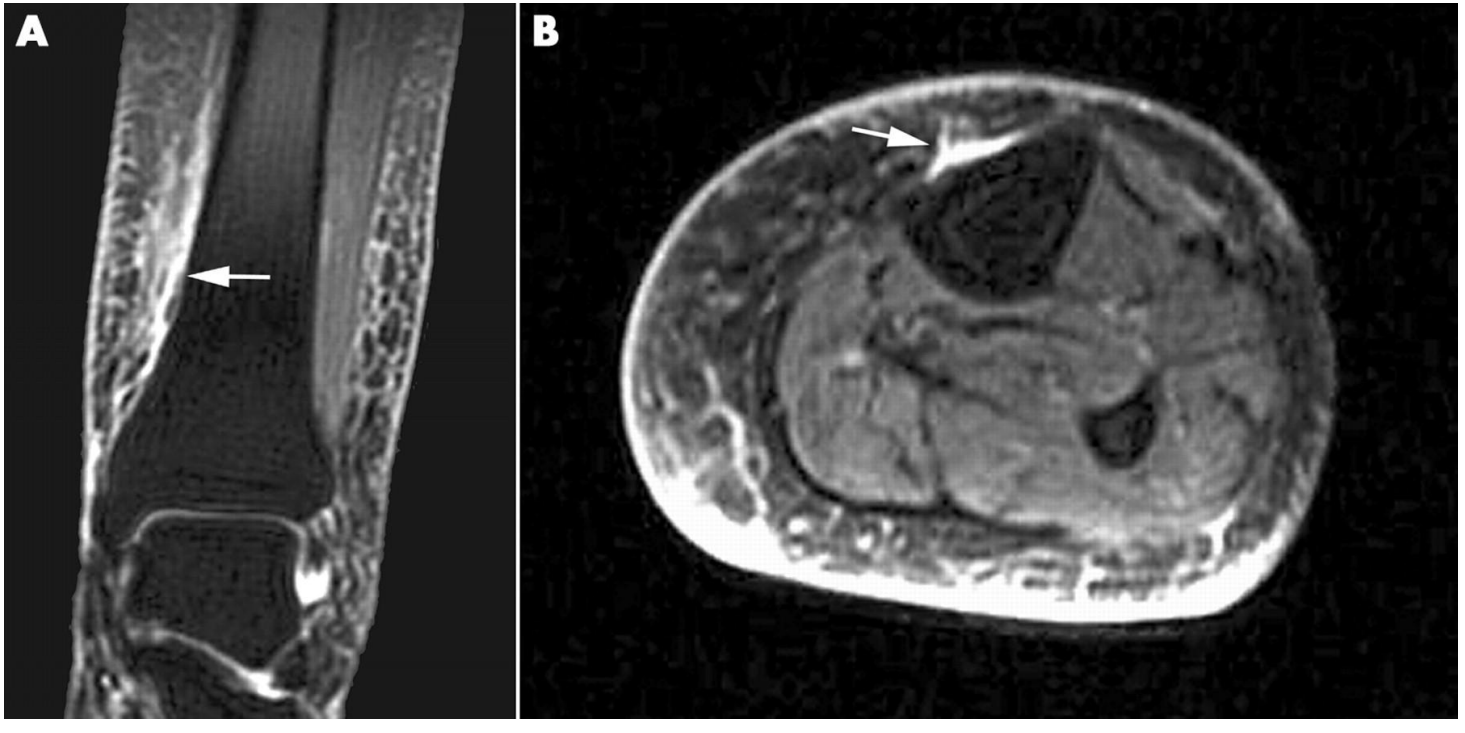
Hubbard, MSSE 2009; 41(3): 490-496.
Moen, et al. Sports Medicine 2009; 39(7): 523-546

MTSS

- Plain films: Normal
- Triple phase bone scans: Diffuse longitudinal uptake along the tibial periosteum

MTSS

- MRI has some utility in distinguishing MTSS from Stress Fx



MTSS - Treatment

- Acute
  - Ice and Rest [Beck]
  - Modalities – u/s, phonophoresis, e-stim
- Sub Acute
- Modify training
  - Decrease training by 50%, avoid hills and uneven surfaces
  - Cross training
- Appropriate footwear
- Orthotics (individuals with biomechanical problems)
- Correction of Intrinsic factors

Beck. Sports Med 1998; 26(4): 265-79.

MTSS

- Other Potential Treatments
- Low Energy ESWT may be effective [Rompe]
- Accupuncture [Callison]
- Refractory cases may require deep posterior fasciotomy (success rate 60-90%)

- Prevention – correction of intrinsic/extrinsic factors
- Systematic Review (199 articles reviewed, 4 compared interventions)
- Only intervention that worked was shock absorbing insoles [Craig]

Rompe, et al. AJSM 2010; 38(1): 125-132.
Craig. J Athl Training 2008; 43(3): 316-318.
Callison. J Chinese Med 2002; 70: 24-27.

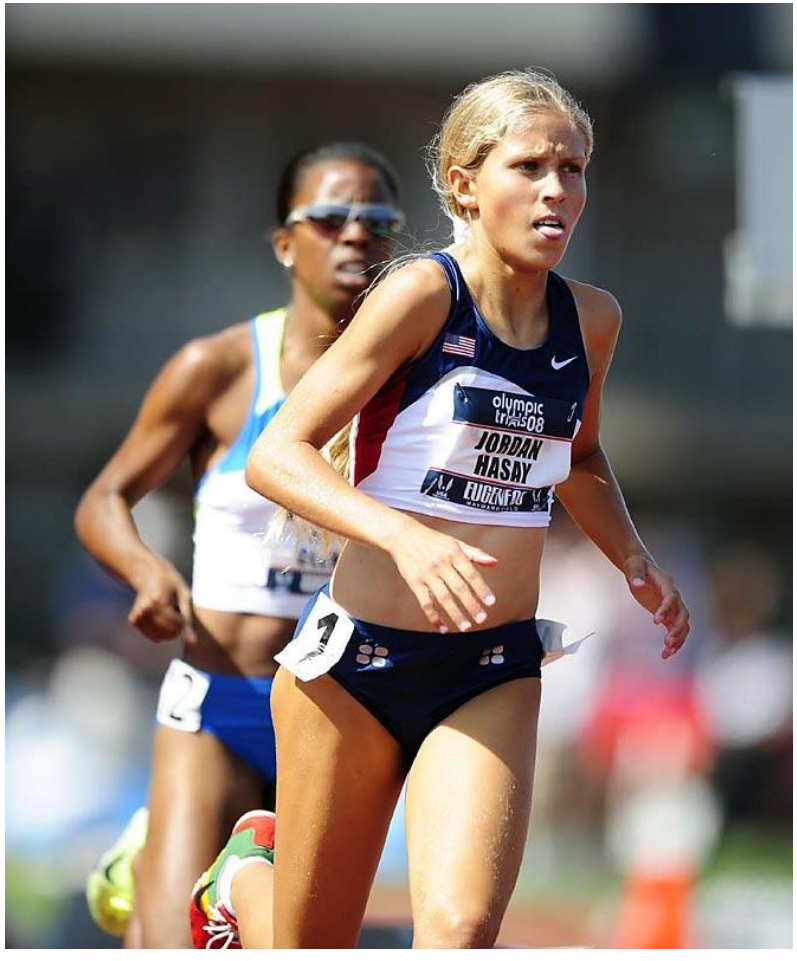
Tibial Stress Fracture

- Stress Fx
- 5-12% of all sports injuries [Matheson]
- 40-49% of athletes that get stress fx will be in tibia [Armstrong]
- F>M

Matheson, et al. Am J Sports Med 1987; 15(1): 46-58.
Armstrong, et al. Bone 2004; 35: 806-816.

Tibial Stress Fx – Risk Factors

- Risk factors:
  - Previous stress fx
  - Female
  - Younger age
  - Low bone mineral density
  - Menstrual irregularity
  - Poor nutritional status
  - Biomechanical abnormalities (pes cavus/inc hip ext rot)



Tibial Stress Fx – Risk Factors

- Increased running speed = increased bone loading
  - 2.5-3.5 inc 10%
  - 3.5-4.5 inc 7% - [Edwards]
- Stride Length
  - 10% reduction decreased prob stress fx 6% [Edwards]

Edwards. Clin biomech 2010; 25(4): 372-377.
Edwards. MSSE 2009; 41(12): 2177-2184.

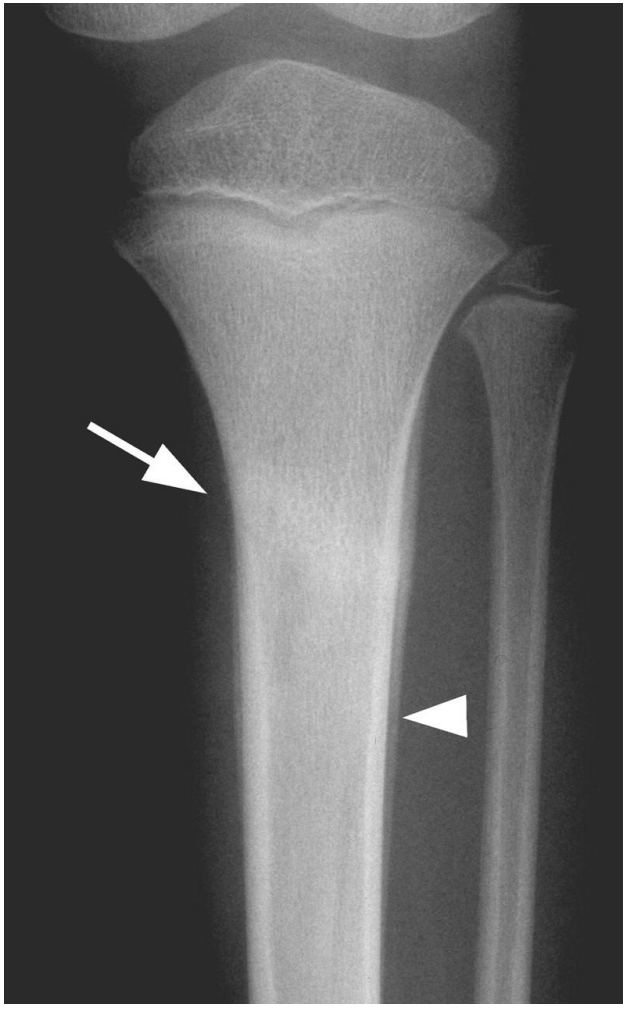
Tibial Stress Fx

- Most common site of stress fracture (50% of all stress fx)
- 5-12% military recruits [Armstrong]
- F>M approx 57% of stress fx occur in F [Taunton]
- Majority occur posteromedial aspect of the middle third of the shaft

Armstrong, et al. Bone 2004; 35: 806-816.
Taunton et al. BJSM 2002; 36: 95-101.

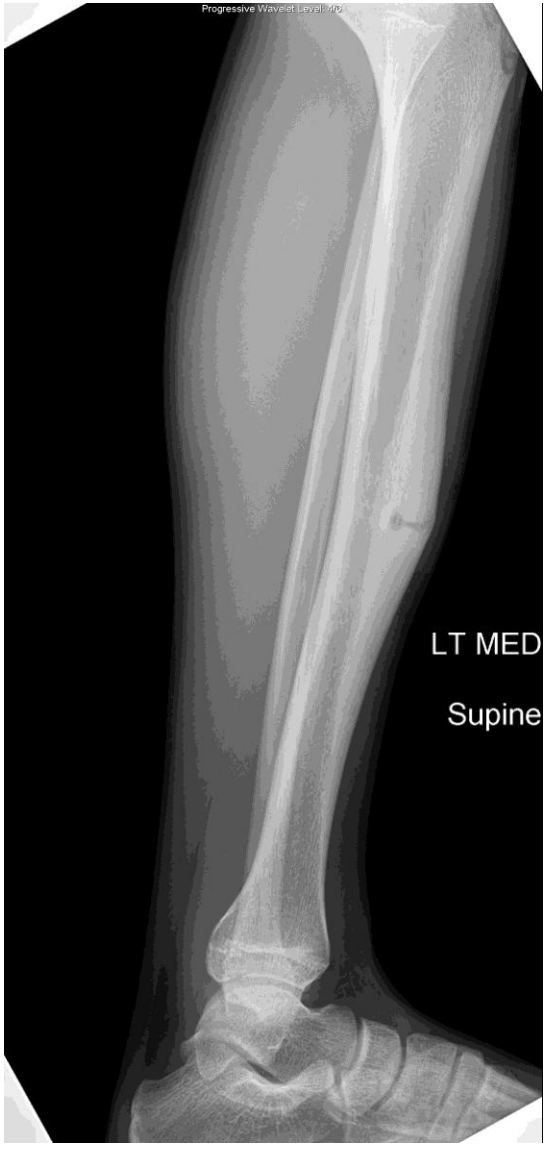
Tibial Stress Fx - Symptoms

- Insidious onset of leg pain
- Initially only with exertion – eventually at rest
- Focal location of pain



Tibial Stress Fx

- Radiographs – initially negative
- May be pos if sx > 2-3 weeks
- Triple phase bone scan + in all three phases
- Focal uptake
- MRI – highly sensitive and specific for stress fx [Gaeta]



Tibial Stress Fx

Table 1
Low-risk stress fracture treatment guide

Symptoms	Goal	Treatment suggestions
Any level of pain	Heal injury	Titrate activity to a pain-free level for 4–8 w depending on the grade of injury Braces/crutches Modify risk factors
Pain with no functional limitations	Continue participation	Titrate activity to a stable or decreasing level of pain Closely follow Modify risk factors
Pain with functional limitation	Continue participation	Decrease activity level to point at which pain level is decreasing and until a functional level of pain has been achieved, then titrate activity to stable or continued decrease level of pain Modify risk factors
Limiting pain intensifies despite functional activity modification (ie, unable to continue to perform at any reasonable functional level despite activity modification)	Heal injury	Complete rest Immobilization Surgery Modify risk factors

Diehl JJ, Best TB, Kaeding CC. Classification and Return-to-Play Considerations for Stress Fractures. Clinics in Sports Medicine. 2006; 25: 17-28.

Tibial Stress Fx - Treatment

- Pneumatic leg braces reduce healing time [Swenson]
- Capacitively coupled electric field (bone) stimulation may be indicated for severe injury or elite athletes [Beck]
- Low-level mechanical vibrations may be effective [Wood]

Swenson, et al. AJSM1997; 25: 322-328.
Beck. Sports Med 1998; 26: 265-279.
Wood, Meyering – research in progress

Tibial Stress Fractures

- Athletes with multiple stress fractures or who have delayed healing should have a DEXA scan
- Those with nutritional deficits should take calcium (1500mg/d) along with Vit D
- Vitamin D deficiency has been shown to be a factor in non-union [van Demark]
- Animal studies suggest that NSAIDS may decrease healing of stress fx [Wheeler]
- All high risk tibial stress fractures (dreaded black line) and non-unions or delayed healing (>6 mo) should be referred for orthopedic consultation

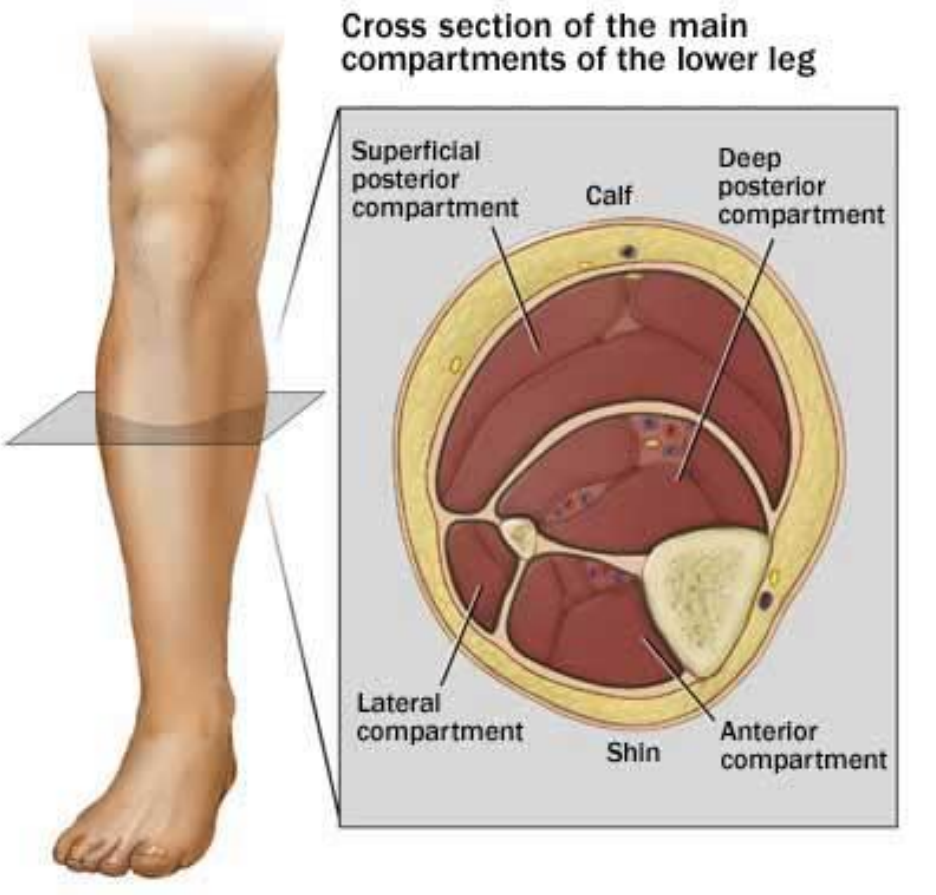
Wheeler, et al. BJSM 2005; 39: 65-69.
VanDemark. S D Med 2010; 63(3): 87-91.

CECS

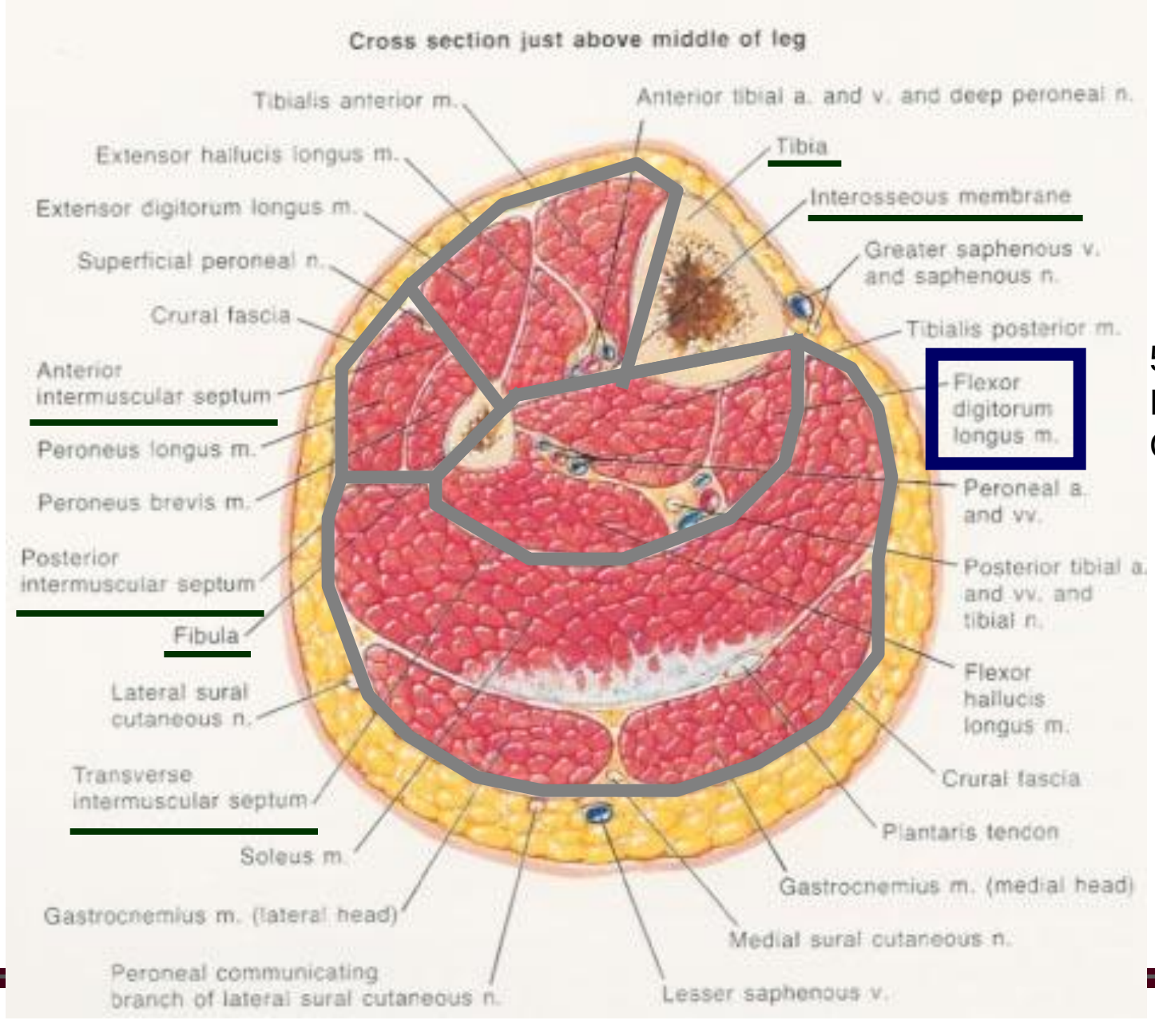
- Well defined and REPRODUCIBLE point in the run and increases if training persists.
- Same distance and intensity each time

CECS

- Reversible ischemia secondary to non-compliant fascial compartment
- 4 compartments
  - Ant (45%)
  - Lat (40%)
  - Deep post (10%)
  - Superficial post (5%)



Anatomy



5th compartmer
FDL – Fibular
Origin

CECS

- Anterior Compartment:
  - Weakness of dorsiflexion or toe extension and paresthesias over dorsum of foot
- Lateral Compartment:
  - Sensory changes over anterolat aspect of leg and weakness with ankle eversion
- Deep Posterior:
  - Paresthesias plantar aspect of foot, weakness of toe flexion and ankle inversion
- Superficial Posterior:
  - Sensory changes dorsolateral foot, plantar flexion weakness

CECS

- If CECS is suspected, must examine after exercise that initiates the symptoms
- Neurovascular status should be documented

CECS

- Hallmark diagnostic tool is compartment testing

CECS

- CPT should be performed at REST and after REPRODUCTION of symptoms
- 1 and 5 minutes post exercise
- Confirmatory
- > 15mm Hg at rest
- >30 mm Hg 1 min post
- >20 mm Hg 5 min post

[Pedowitz]

- Should check with local orthopedists to find local standard

Pedowitz, et al. AJSM 1990; 18: 35-40.

CECS

- Triple Phase Bone Scan
  - Decreased radionuclide in area of increased pressure during uptake phase
- MRI
  - Evolving and promising tool
  - Detects fascial thickening, fatty infiltration, decreased T1 signal with fibrosis, and muscle atrophy [van den Brand]

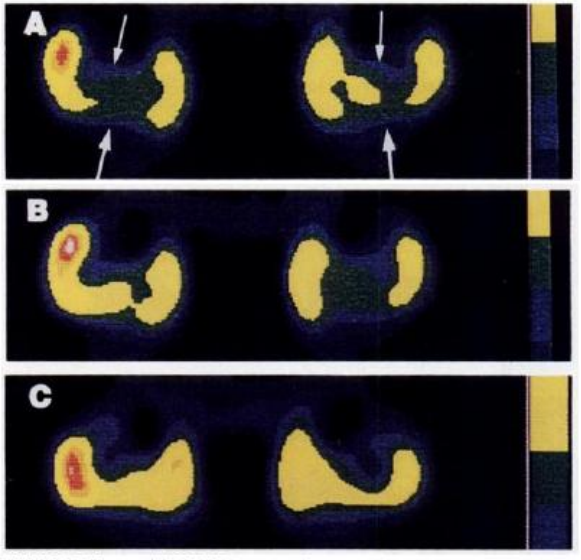
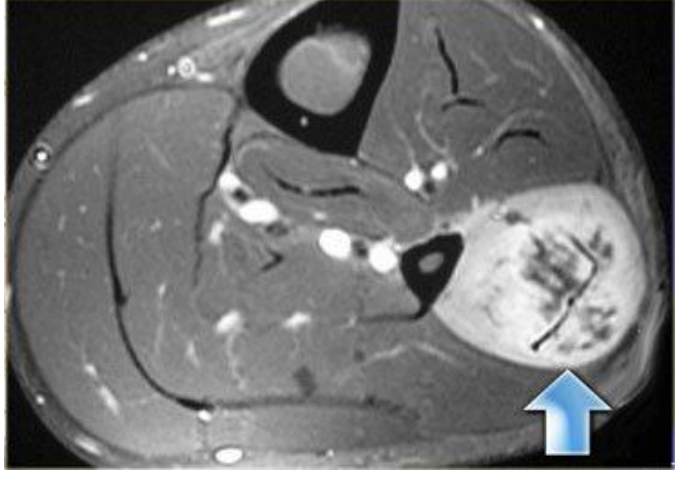


FIGURE 5. Transaxial SPECT images of calves clinically involved by posterior CECS. (A) Decreased ^{201}Tl perfusion in both superficial (large arrows) and deep (small arrows) posterior compartments is observed on the stress image. (B) Redistribution is observed in the right superficial and anterior compartments on the delayed image. (C) Thallium-201distribution in the bilateral superficial compartments is improved on the stress image after



Jimenez. Phys Sports Med 1999; 27(12):
Van den Brand, et al. AJSM 2005; 33: 699-704

CECS

- Conservative Treatment
- Massage may be effective for ant comp synd [Blackmail]
- May be satisfactory for those willing to decrease activity

- Surgery (Fasciotomy)
- Symptoms > 3 months
- High level athletes

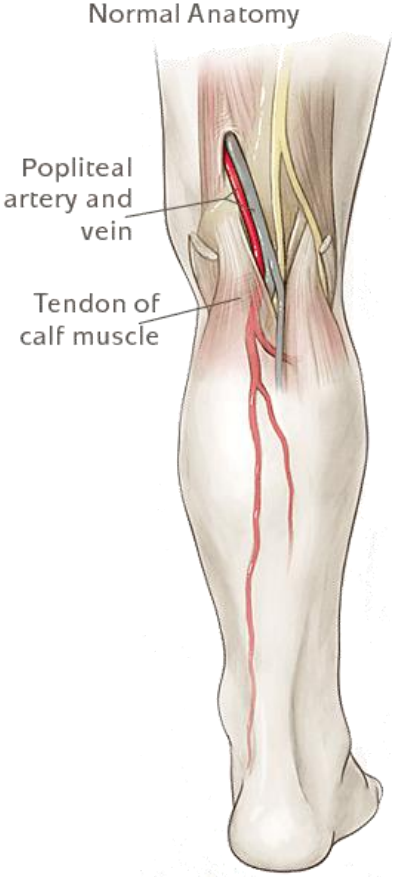
- Early weight bearing as tolerated following surgery improves outcomes [Fraiport][Kaeding]

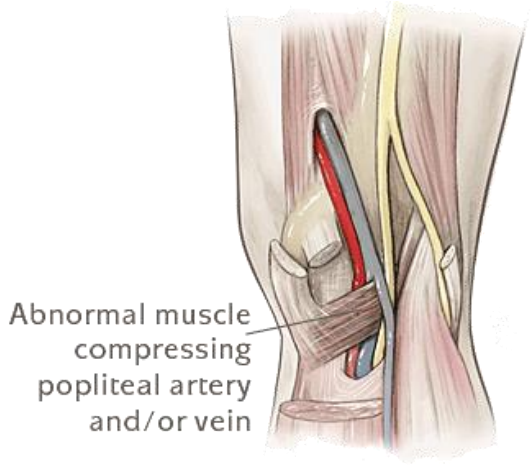
Blackmail, et al. CJSM 1998; 8: 14-17.
Fraiport, et al. Am Acad Orthop Surg 2003; 11: 268-276.

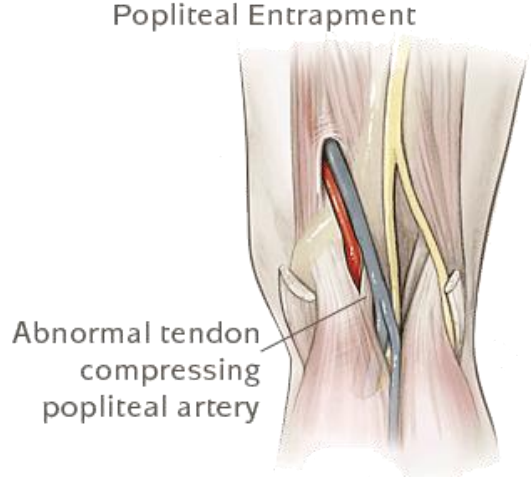
PAES

- Abnormal course of the popliteal artery within the popliteal fossa
- Congenital abnormality

- Deep ache are cramping involving foot or leg with high intensity running activity







PAES

- Predominantly
- Males < 30
- High intensity exercise
- Excessive dorsiflexion/plantar flexion

- Classically unilateral, but some studies report up to 80% cases may be bilateral [Levien]

Levien, et al. J Vasc Surg 1999; 30: 587-598.

PAES

- Examine bilateral pulses
- Reexamine with dorsiflexion and plantarflexion with knee in extension (places tension on the gastroc leading to compression of the pop art.)
- Dynamic changes in pulses = high suspicion for PAES

- MRI/MRA screening tool – decreased flow with provocation

PAES

- Arteriography should be performed after exercise (or in positions of provocation) [Baltopoulous]
- Dynamic MRI in the future?
- Preferred MGMT = surgery

Baltopoulos, et al. CJSM 2004; 14: 8-12.

Dynamic Nerve Entrapment

- Running motion produces complex, forceful, repetitive, lower limb movements that can compress, stretch or dislocate nerves as they travel through compartments and tunnels.

- Numbness or tingling or pain brought on by activity

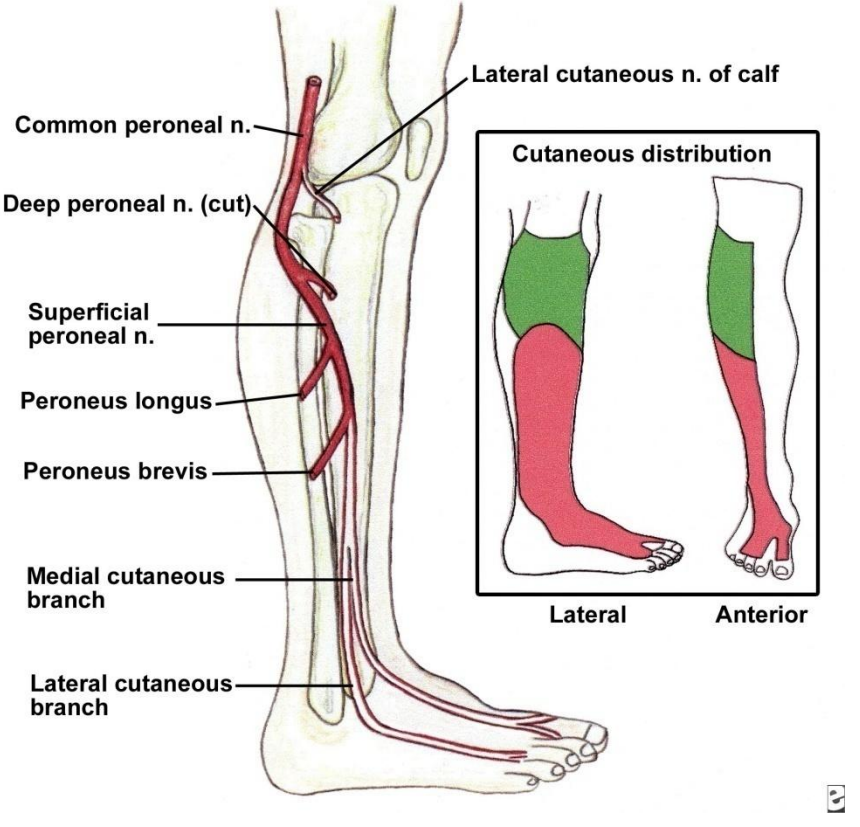
- Common peroneal nerve is the most commonly injured lower extremity nerve
- Superficial location lateral to surgical neck of the fibula

Dynamic Nerve Entrapment

- Common peroneal n.
  - Lateral leg/foot
- Sup. Peroneal n
  - Lateral calf/dorsum foot

Dynamic Nerve Entrapment

- TTP at area of nerve compression
- Compression/percussion yields paresthesia = principle sign
- Comm Peroneal – Fibular neck – radiates distally
- Sup Peroneal – 7-12cm above lateral malleolus



Dynamic Nerve Entrapment

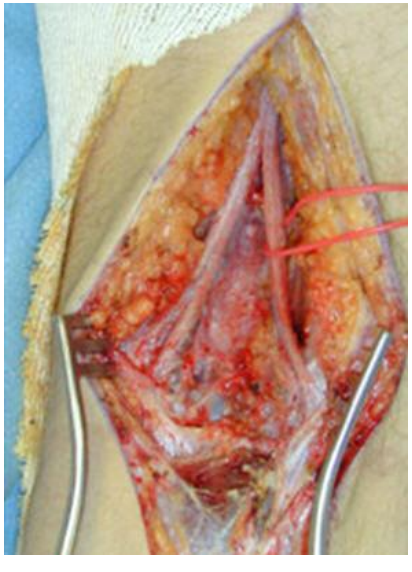
- EMG
  - conducted before and after exercise.
- Diagnostic nerve block
- Inject area:
  - Tinel's sign strongest
  - Maximum tenderness
  - ? U/S guided
- MRI
  - May be helpful [Moore]
  - Neurogenic edema

Moore, et al. Am J. Neuroradiol 2001; 22: 786-794.

Dynamic Nerve Entrapment

- Conservative management:
- Activity modification, massage, iontophoresis

- Surgery may be needed if no improvement after 3-4 months



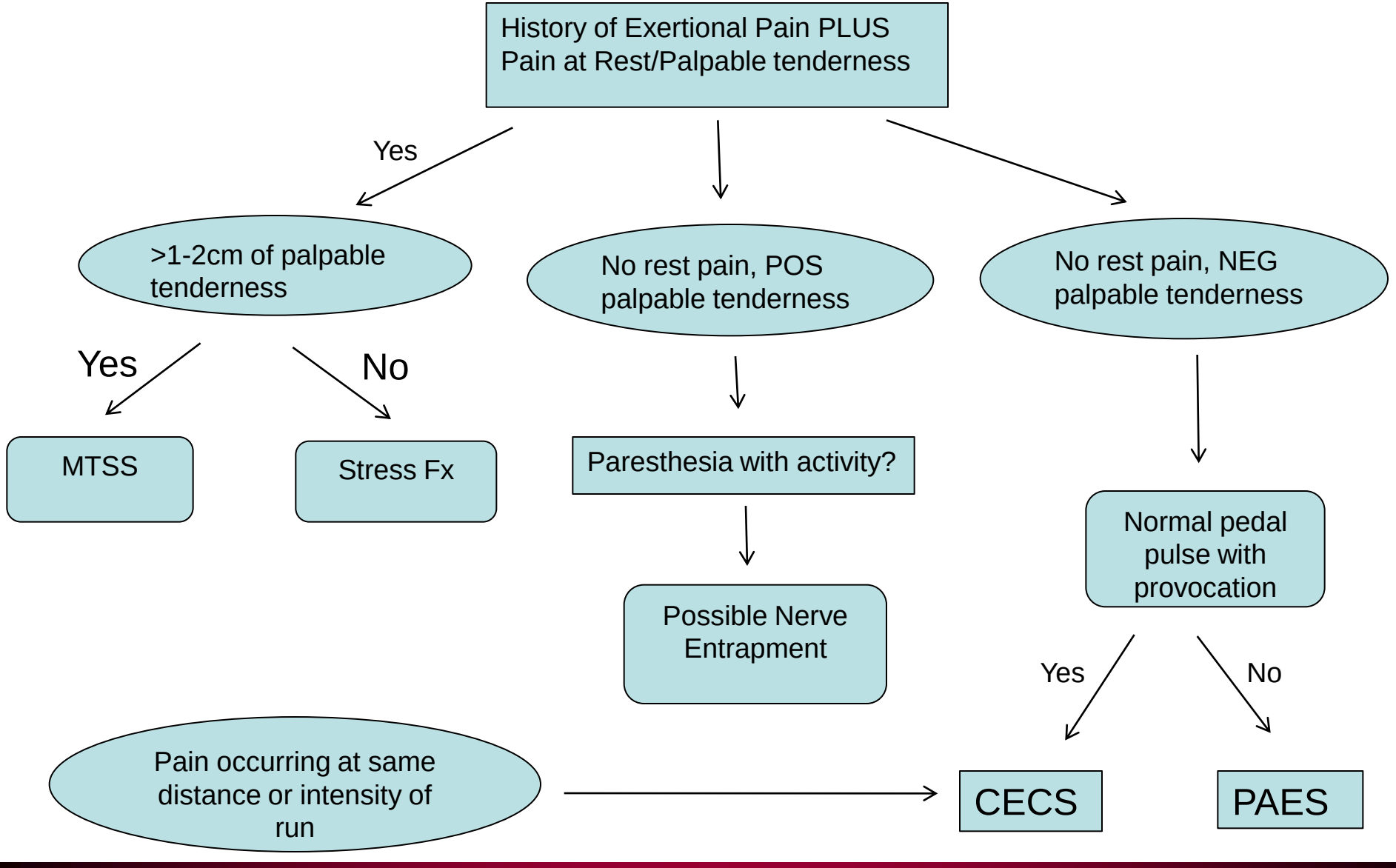
Summary

- Exertional leg pain is common
- MTSS most common etiology
- MTSS and Tibial Stress Fx exist on continuum

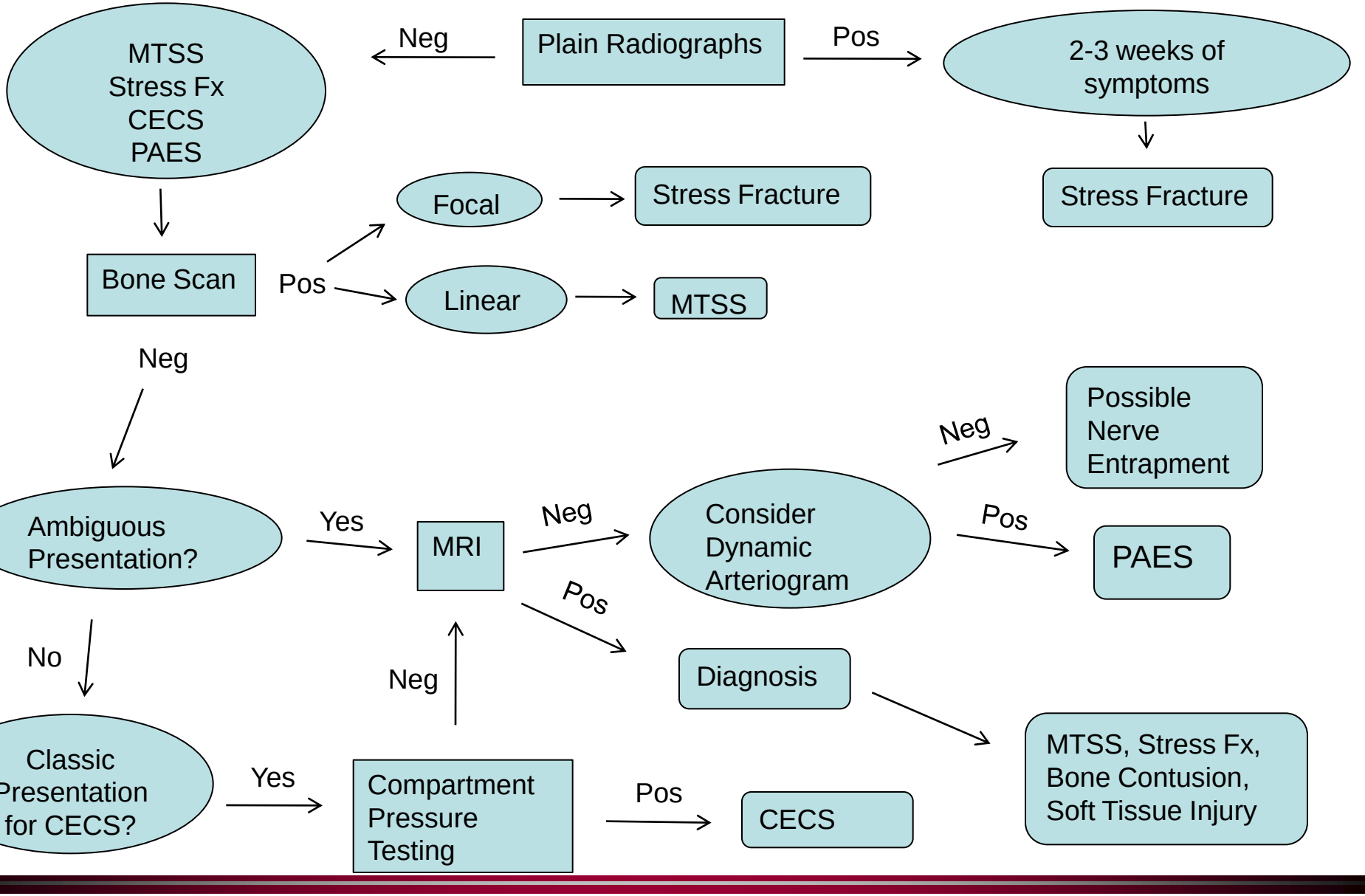
- Diffuse tibial pain with activity = MTSS
- Focal tibial pain at rest = Stress Fx
- Reproducible pain at same distance/intensity = CECS
- Pain with certain distance and abnormal pulses = PAES
- Pain with numbness/tingling or neurodist = DNE

Algorithms: Exertional leg pain

History and Physical Algorithm



Diagnostic Studies Algorithm



Questions