Medial Tibial Stress Syndrome: So much more than “Shin Splints”

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ATHLETICO PHYSICAL THERAPY

Disclosures

No conflict of interests

The views expressed in these slides and the today's discussion are ours. The views expressed are our own and not the views of our colleagues or employers.

Please use your own discretion when utilizing presented information in your clinical practice.

Learning Objectives

1. Understand the theories related to the cause and pathogenesis of MTSS.
2. Differentiate the intrinsic and extrinsic risk factors for developing MTSS.
3. Summarize the evidence-based preventative methods for MTSS.
4. Analyze evidence-based evaluation methods for diagnosis and differential diagnosis of MTSS.
5. Design appropriate treatment plans and return to activity guidelines for patients with MTSS.

Medial Tibial Stress Syndrome

Commonly referred to as exercise-induced/associated leg pain and *"shin splints"*

Inconsistent names and definitions

Pain at the posteromedial border of the tibia with pain on palpation of at least 5 cm (Moen, Tol, Weir, Steunebrink, & De Winter, 2009)

Differential diagnosis: Tibial stress fracture, acute/chronic exertional compartment syndrome (Galbraith & Lavalle, 2009)


“It happens every season. It’s no big deal.”
“I can practice through it, but can you tape my shins?”
“I’ll just ice my shins after practice.”

Prevalence

MTSS is a common overuse injury in sport

Incidence rates of 4%-19% in athletic populations (Moen, Tol, Weir, Steunebrink, & De Winter, 2009)

Among military personnel, dancers, and runners, MTSS is estimated to effect 4%-35%, with the highest prevalence in runners (Winters, Kostishak, McLeod, & Welch, 2014)

13.6%-30% of all runners are affected by MTSS (Lopes, Hespanhol Junior, Yeung, & Costa, 2012)

What is actually happening?

There is still controversy...

Conflicting results of studies, leading experts to have varied opinions (Franklyn & Oakes, 2015)

Is it a bony or soft tissue pathology??

Etiology

Strain on the tibia because of load (Galbraith & Lavalle, 2009)

MTSS is likely caused by a bony stress reaction of the tibial cortex → tibial bending and bone remodeling

- Remodeling results in an osteopenic bone, cannot withstand to the repetitive loads of training (Moen, Tol, Weir, Streunebrink, & DeWinter, 2009)
- Microfractures develop in the cortical bone of the tibia (Craig, 2009; Franklyn & Oakes, 2015)

Etiology

Traction issue from (Tib Post), Soleus, FHL?

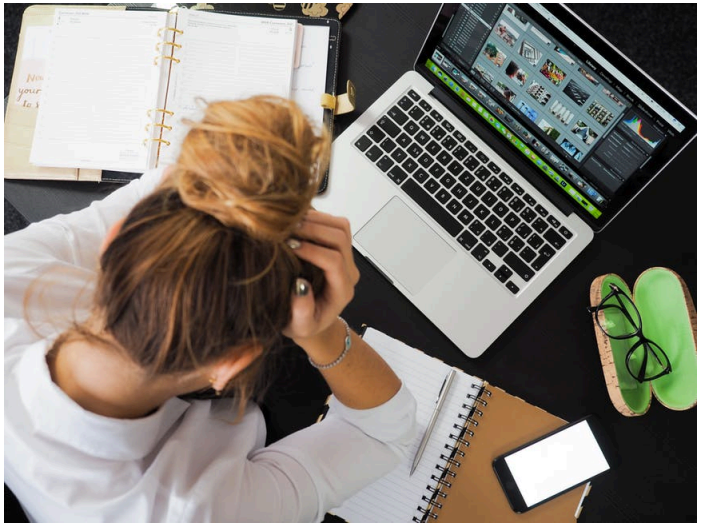
- There is minimal muscular attachment in distal, posteromedial border (Galbraith & Lavalle, 2009)

Need more histological studies to confirm theory → bone overload as a cause of MTSS remains a hypothesis (Moen et al., 2012)

Medial Tibial Stress *Syndrome*

"Group of signs and symptoms that occur together and characterize a particular abnormality or condition"

(Merriam-Webster, n. d.)



What are the risk factors associated with MTSS?

Risk Factors

With the cause relatively unknown(?), it makes it difficult to prevent.

Multiple proposed risk factors with varying levels of evidence to support.

Plisky, Rauh, Heiderscheit, Underdwood, & Tank, 2007
Medial Tibial Stress Syndrome in High School Cross-Country Runners: Incidence and Risk Factors

Followed 8 high school cross country teams

- 16 runners incurred 17 dx of MTSS
  - "Mild cases" 1-4 days loss of participation
- Patients with MTSS were 3 x as likely to report orthotic use, but not statistically significant
- Average Navicular Drop from 3.0 to 9.5 mm

Becker, Nakajima & Wu, 2018
Factors Contributing to Medial Tibial Stress Syndrome in Runners: A Prospective Study

24 NCAA D1 runners, prospective study

- Followed for 2 years, comparing ROM, strength, plantar pressure, and kinematics
- 7 (29%) developed MTSS, 2 had other injuries develop 5 months post MTSS dx
- Development of MTSS is multifactorial involving ROM, strength, mediolateral pressure balance, and running kinematics
  - Weaker hip abductors, tight iliotibial bands, and longer duration of rearfoot eversion

Hamstra-Wright, Huxel Bliven, & Bay, 2015
Risk Factors for Medial Tibial Stress Syndrome in Physically Active Individauls such as Runners and Military Personnel: A Systematic Review and Meta-Analysis

21 total studies

100 different risk factors

Proposed Risk Factors

- Increased BMI (MD= 0.79)
- Increased Navicular Drop (MD= 1.19 mm)
- Increased Ankle Plantarflexion ROM (MD= 5.94°)
- Increased Hip External Rotation (MD= 3.5°)

Newman, Witchalls, Waddington, & Adams, 2013
Risk Factors Associated with Medial Tibial Stress Syndrome in Runners: A Systematic Review and Meta-Analysis

10 articles

13 total variables pooled for analysis

Proposed Risk Factors

- Navicular Drop > 10 mm, 1.99 more times likely
- Orthotic use (Risk Ratio= 2.31)
- Increased Body Mass Index
- Fewer Years Running Experience
- Previous MTSS History (Risk Ratio= 3.74)
- Female Gender (Risk Ratio= 1.71)

Reinking, Austin, Richter, & Krieger, 2017
Medial Tibial Stress Syndrome in Active Individuals: A Systematic Review and Meta-analysis of Risk Factors

Over 18,000 articles found

Based on inclusion and exclusion criteria, 22 articles were evaluated

235 potential risk factors, only 27 could actually be identified

Proposed Risk Factors

- Female sex, increased weight
- Greater Navicular Drop
- Rearfoot eversion
- Fewer/More years running
- Previous running injury, but not MTSS
- Greater hip external rotation with the hip in flexion

Winkelmann, Anderson, Games, & Eberman, 2016
Risk Factors for Medial Tibial Stress Syndrome: An Evidence-Based Review Factors

Proposed Risk Factors

- Increased BMI
- Increased Navicular Drop
- Greater ankle plantarflexion range of motion
- Greater hip external rotation

Nussbaum, Bjornaraa, & Gatt, 2019
Identifying Factors that Contribute to Adolescent Bony Stress Injury in Secondary School Athletes: A Comparative Analysis with a Heathy Athletic Control Group

Data from National High School Stress Fracture Registry, 2 year period

Bony Stress Injury (BSI), majority to tibia/fibula

- More females (n=231) than males (n=115)
- 58% with BSI did not engage in weight training
- History of “shin splints”
- Less sleep, higher average stress rating
  - Females more frequently than males

Who is at most risk??

Female Sex

Increased BMI

Increased Navicular Drop

Increase Hip External Rotation

Previous History

Which are modifiable?

Understanding the risk factors can lead to preventative efforts

Prevention- Prediction

Shin Palpation Test	*Shin Oedema Test*
Palpate the distal two thirds of the posteromedial lower leg	Sustained palpation of the distal two thirds of the medial surface of the tibia, looking for pitting edema

(Newman, Adams, & Waddington, 2012)

Prevention- Prediction

Medial Tibial Stress Syndrome Score

(Winters, Moen, Zimmerman, Lindeboom, Weir, Backx, & Bakker, 2015)

Questions include:

- Limitation in sporting activities
- Pain while performing activities
- Pain with ADLs
- Pain at rest

Prevention

Altering Navicular Drop

(Newell, Simon, & Docherty, 2015)

Arch taping (Low-Dye and Navicular Sling Techniques) did not necessarily change navicular height but did affect plantar pressure

May look to get orthosis for long term use (Galbraith & Lavalle, 2009)

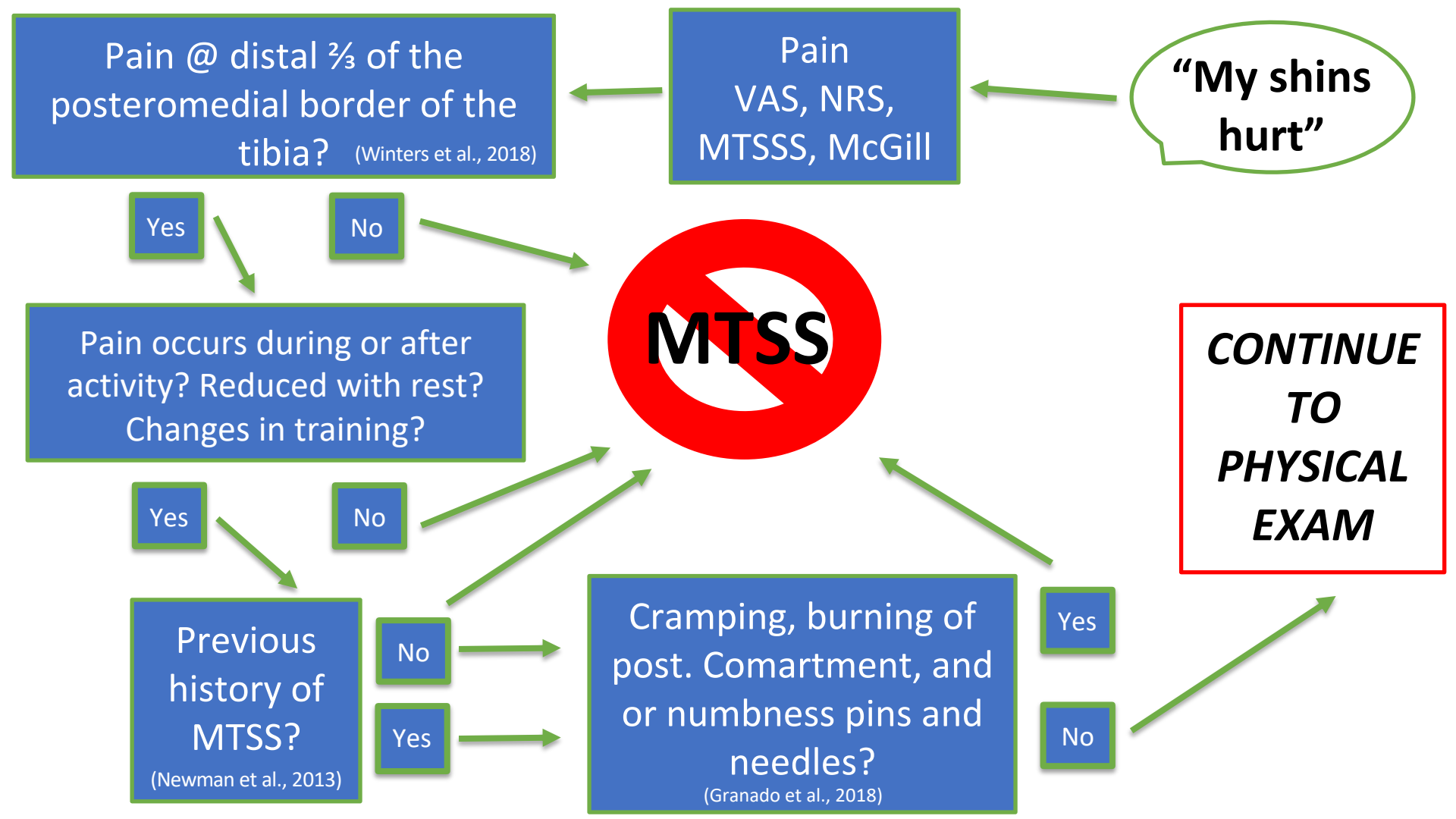
How do I evaluate MTSS?

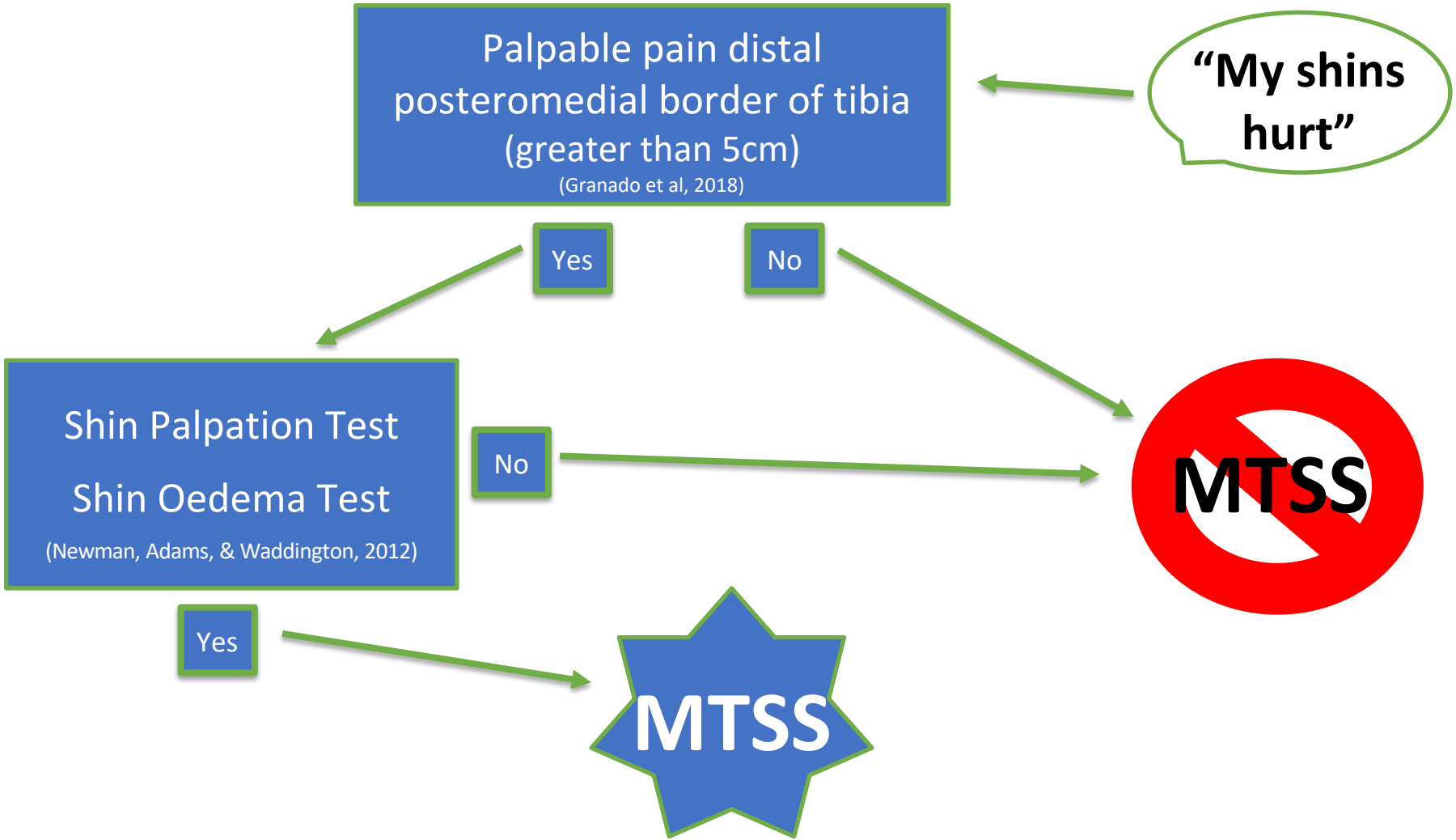
Evaluation of MTSS

Multifactorial in nature

MTSS can be diagnosed with almost perfect reliability in clinical practice (Winters et al., 2018)

Must rule out other differential diagnoses of exertional compartment syndrome and stress fracture


"My shins hurt"
Pain
VAS, NRS, MTSSS, McGill
Pain @ distal ⅔ of the posteromedial border of the tibia? (Winters et al., 2018)
Yes
No
Pain occurs during or after activity? Reduced with rest? Changes in training?
Yes
No
Previous history of MTSS? (Newman et al., 2013)
No
Yes
Cramping, burning of post. Comartment, and or numbness pins and needles? (Granado et al., 2018)
Yes
No
MTSS
CONTINUE TO PHYSICAL EXAM


Palpable pain distal posteromedial border of tibia (greater than 5cm)
(Granado et al, 2018)
"My shins hurt"
Yes
No
Shin Palpation Test
Shin Oedema Test
(Newman, Adams, & Waddington, 2012)
No
MTSS
Yes
MTSS

Tuning Fork

Toney, Games, Winkelmann, & Eberman, 2016
Using Tuning-Fork Tests in Diagnosing Factures

Schneiders, Sullivan, Hendrick, Hones, McMaster, Sugden, & Tomlinson, 2012
The Ability of Clinical Tests to Diagnose Stress Fractures: A Systematic Review and Meta-Analysis

Results do not support the use of ultrasound or tuning fork as a stand alone diagnostic test

- The support for tuning forks must be critically evaluated because of the limited and conflicting information

This can be part of the evaluation but not the end all be all

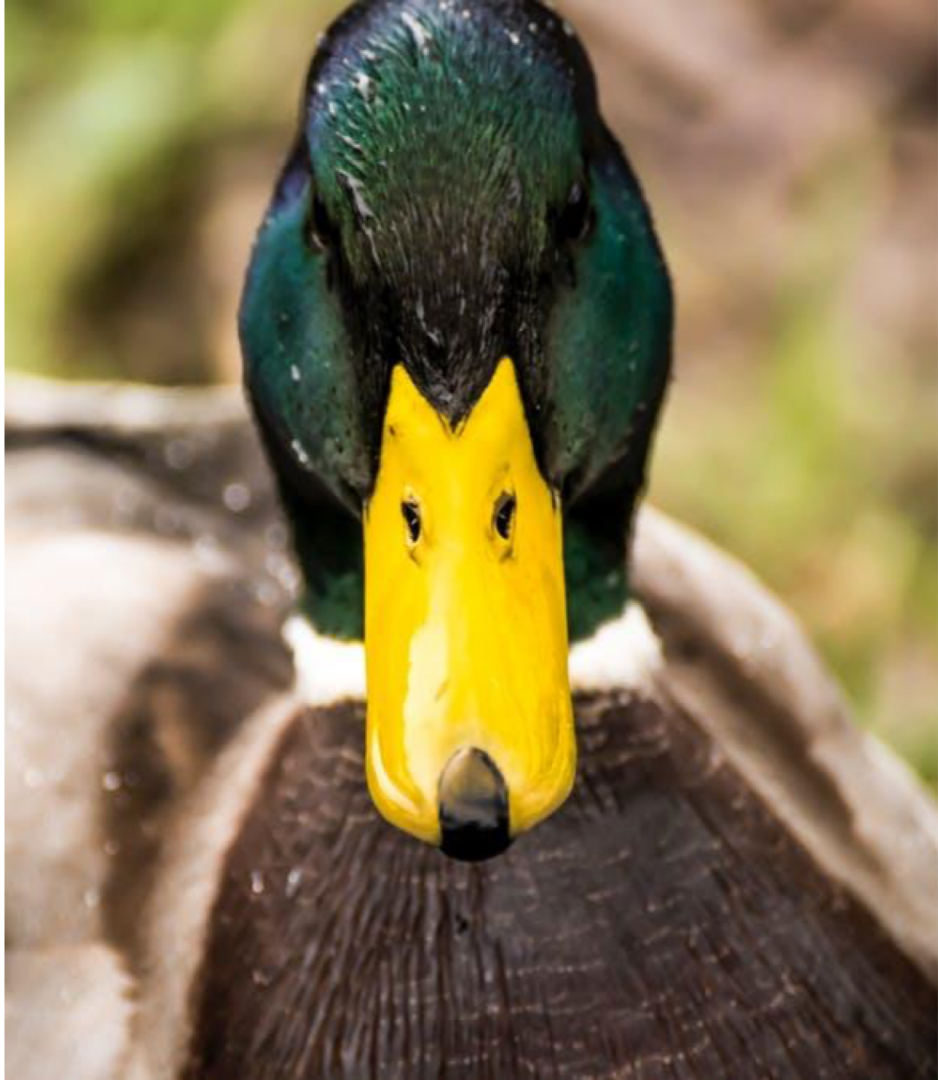
Imaging Techniques

Radiographs are typically unremarkable → can show callus build up if stress fx present

(Brewer & Gregory, 2012)

Magnetic Resonance Imaging (MRI) and Bone Scans can show high signal along posteromedial border of tibial especially when bone injury has progressed

(Brewer & Gregory, 2012)



How is this condition appropriately managed?

Winters, Kostishak, Valovich McLeod, & Welch, 2014
Treatment of Medial Tibial Stress Syndrome: A Critical Review

Question: What are effective interventions for treatment of MTSS in reducing pain perceptions in collegiate athletes?

Bias methodologically prevents any of the treatments to be recommended "no high quality recommendation"

- The most promising seems to be ESWT → Further research is needed

Treatment
Iontophroesis
Ice Massage
Phonophroesis
Laser
Periosteal Pecking
Bracing
Graded Running
Extracorporeal Shockwave Therapy

S. Garcia, Rona, Tinoco, Rodriguez, D. Ruiz, Letrado,… & Alarcon, 2017

Shockwave Treatment for Medial Tibial Stress Syndrome in Military Cadets: A Single-Blind Randomized Controlled Trial

ESWT showed a more significant improvement than the exercise only group

- Exercise group (control) was able to run for 4 min after treatment
- ESWT was able to run for 17 min without pain after treatment

Scholze, Finze, Bader, & Lison, 2014

Treatment of Medial Tibial Stress Syndrome According to the Fascial Distortion Model: A Prospective Case Control Study

A targeted manual therapy technique

- Strong local pressure applied on painful points with the tip of the thumb
- Promising outcome- level of evidence?

Galbraith & Lavallee, 2009
Medial Tibial Stress Syndrome: Conservative Treatment Options

Strengthening of core and hip musculature may help improve gait and running mechanics and in turn help to prevent lower body injury

Limit muscle strengthening during the acute phase because of the increased strain it places on the tibia

Moen, Holtslag, Barten, Weir, Tol, & Backx, 2012
The Treatment of Medial Tibial Stress Syndrome in Athletes: a Randomized Clinical Trial

3 Groups

- 1: graded running program
- 2: graded running program with flexibility and strength training of calves
- 3: graded running program and compression stockings

No significant difference in time to complete running program or satisfaction with treatment between groups

Study provides insight on completion of graded running program

- Average time to complete a running program of 102.1+/-52.3 - 117.6 +/-64.2 days

So what’s the answer?

Based on the evidence make a sound treatment decision

Unloading → REST! REST!

Treatment

- Possible massage of the affected area
- Increase lower extremity chain strength
- Progressive return to running program

Return to Activity Guidelines

Phase I- Protection

- WB as tolerated
- Decrease volume of impact weight bearing exercise by at least 50% (Cross Train!) (Provencher, Davies, & Reider, 2015)
- Avoid any painful load, and if CKC can be performed without pain do it
- ID and address weaknesses in lower kinetic chain especially hip abductors (Niemuth, Johnson, Myers, & Thieman, 2005)
- Progression- no pain with PA/ADLs and reduced point tenderness

Return to Activity Guidelines

Phase II- Rehab Phase

- Orthotics? (Galbraith & Lavallee, 2009)
- Begin functional run to walk progression (Niemuth, Johnson, Myers, & Thieman, 2005)
- Open and closed chain exercises (Provencher et al., 2015)
- Basic WB exercises

Return to Activity Guidelines

Phase III- Return to Function

- Dynamic balance (Niemuth, Johnson, Myers, & Thieman, 2005)
- More aggressive plyometrics (Provencher et al., 2015)
- Completion of run walk program
- Pain free running on successive days = full return to activity (Provencher et al., 2015)

What about less severe cases?

Not every case will present as severe as the protocol that was discussed

Modification or restriction of activities that provoke symptoms is key (Granado et al., 2018)

In summary…

Key Points for Clinical Practice

One of the most accepted theories involves damage to the bone

Risk factors include female gender, higher BMI, increased navicular drop, and increased hip ER

(Rest may be best)

Graduated return and re-evaluate training programs

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Thank You!

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