WHO SAID THIS ABOUT STEM CELLS?

• Of course you have cheese, you’re Dominos! You make pizza!

OVERVIEW

• Goal: Correlate US tendon findings with optimal Rx
• Why is an US Evaluation Scale Needed?
• Literature review of current tendinopathy classification
• Proposed tendinopathy classification
• Treatment proposals
WHY IS AN US EVALUATION SCALE NEEDED?

- Regenerative Medicine has coincided with the rise of US MSK imaging.
- US Evaluations of tendon injuries especially in sports medicine has become the preferred imaging technique.
- MRI has 0.1 mm resolution but a good high frequency US probe can deliver 0.7 mm of resolution.
- Elastography may also allow for strain/shear forces (hardness) to be identified.

WHY IS AN US EVALUATION SCALE NEEDED?

- Because US imaging is now becoming the preferred method of diagnosis in tendon conditions, it is important to have a scale available to use US in the recovery process especially after injections or procedures as a means to document progress and the success on the interventions.
- A viable US nomenclature for the common types of tendon injuries would be useful in giving consistency to what treatment worked for a specific type of tendon injury.

LITERATURE REVIEW

- PubMed Search
  - Tendinosis, tendinitis, tendon, tendinopathy, ultrasound and Classification (all variations)
  - By known authors, such as Cole, Mishra, Fortier, Amooyi
  - Van Holsbeeck (1991)
- Other Books
LITERATURE REVIEW

- Classifications exist for other body parts
  - OA (Kellgren-Lawrence)
    - Initially proposed in 1957
  - Muscle tears (Multiple and confusing)
  - Specific: Post tendon (2017)


DIAGNOSIS OF TENDINOPATHY

- Clinical Exam
- X-ray (r/o bony pathology)
- CT (olden days)
- MRI
- US (office-based, less expensive)

TREATMENT OF TENDINOPATHY

- No long term benefit
  - NSAID's, Steroid inj’s B SORT

TREATMENT OF TENDINOPATHY

• Eccentric ex’s ARE beneficial in the resolution of tendinosis

Eccentric Exercise For Rotator Cuff Tendinopathy


TREATMENT OF TENDINOPATHY

• What about these?
  • Percutaneous Needle Tenotomy (PNT)
  • Percutaneous needle debridement
  • Dextrose
  • PRP
  • High vs. Low RBC, High vs. Low WBC
  • Stem Cells (Autologous, Allogeneic)
  • SVF


CORRELATING DIAGNOSIS & TREATMENT

• “Treating” Osama bin Laden with a slingshot won’t be effective
• Treating him with nukes is overkill
  • And get collateral damage
• Treating him with a surgical strike is best
IT STARTS WITH DIAGNOSIS

- Must be accurate
- Must grade the severity
- Thus classification system is needed

TENDINOPATHY

- General tendinopathies
  - RC, CEO (elbow), patellar tendon, etc.
  - Achilles tendon falls into a different category due to the differences in disease pathology
- If a tendon has 1 or more of the characteristics in a category, it will be placed in that particular category
TENDINOPATHY: GRADE 0, PATHOLOGY

- Normal Tendon
- Normal Thickness
- Consistent Fibrils throughout the tendon without no disruptions
- Intact bony cortex

TENDINOPATHY: GRADE 0, US

- Intrinsic Degeneration with loss of fibrillar echotexture
- Ruptured collagen fibers, especially the cross-linking fascicles (Van Holsbeeck, 1991, p. 66)
TENDINOPATHY: GRADE 1, US

- Subtle increased distance between the individual longitudinal fibers
  - Elastography can help diagnose

  Hyperchoic Areas in the tendon
  Loss of Striated Fiber Pattern

TENDINOPATHY: GRADE 2, PATHOLOGY: IS TEAR

- Intrinsic degeneration with loss of fibrillar echotexture
- Rupture of collagen bundles
- Decreased mean diameter of the collagen fibrils
- Disorganized arrangement
- Increased quantity of acid mucopolysaccharide ground substance
  - Merkel, et al. 1982!

TENDINOPATHY: GRADE 2, US

- Intrasubstance Tear is definitely visible
- Even more pronounced increased distance between the individual longitudinal fibers: Diffuse hypoechoic area
- Califications (Enthesis)

- Intrinsic degenerative changes hyper and hypoechoic
  - Intrasubstance Tear
TENDINOPATHY: GRADE 3, PATHOLOGY

- Hypoechoic foci = Mucoid degeneration
- Focal thickening = Fibrinous necrosis
- Early breakdown of interface of the teno-osseous junction.

TENDINOPATHY: GRADE 3, US

- More microtears
- Fusiform swelling with diffuse hypoechoic areas
- Fat pad below is hyperechoic (from increased through transmission)
- Distinct Hypoechoic area, typically on the undersurface of the tendon
- Calcifications (Enthesis)
  - Larger or an enthesophyte
  - Starts immature and progresses (more dense)

TENDINOPATHY: GRADE 4, PATHOLOGY: PT

- Definite disruption of the tendon, but Partial Thickness
- Hypoechoic foci = Mucoid degeneration
- Nodules = granulation & scar tissue (Van Holsbeeck, 1991)
- Cystic changes in the tendon and/or bone (Enthesis)
TENDINOPATHY: GRADE 4, US: PT

- Anechoic area, partial thickness, typically undersurface
  - A: 0-25% depth (common)
  - B: 26-50% depth (common)
  - C: 51-75% depth (less common)
  - D: 76-99% depth (rare)
- Typically focal, up to approx. 1/3 width of tendon
- Fat pad below is hyperechoic (from increased through transmission)
- Calcifications (Enthesis)
  - Larger or an enthesophyte
  - Starts immature and progresses (more dense)
- Cystic changes in the tendon and/or bone (Enthesis)

TENDINOPATHY: GRADE 5, PATHOLOGY: FT, PW

- Definite disruption of the tendon
- Full Thickness Tear, Partial Width
- No Significant Retraction
- Bony Irregularity

TENDINOPATHY: GRADE 5, US: FT, PW

- Full Thickness, Partial Width Tear
- Anechoic area, Full Thickness, Partial Width
  - A: 0-25% width (common)
  - B: 26-50% width (less common)
  - C: 51-75% width (rare)
  - D: 76-99% width (rare)
- Typically focal, up to approx. 1/3 width of tendon
- Fat pad below is hyperechoic (from increased through transmission)
- Partial width tendon avulsion (Enthesis)
TENDINOPATHY: GRADE 6, PATHOLOGY: FT, FW

- Complete disruption of the tendon
- Full Thickness, Full Width
- Variable Retraction
- Boney Irregularity

TENDINOPATHY: GRADE 6, US

- Anechoic area, Full Thickness, Full Width
- Absence of rotator cuff tendon
- Delited onto of humeral cortex
- Retracted Tendon

PROGRESSION OF TENDINOSIS

Mild to moderate rotator cuff tendinosis

Moderate to advanced degenerative tendinosis with delamination tears and insertion site cystic changes
PROGRESSION OF TENDINOSIS

Progression of rotator cuff tendinosis to a partial thickness tear.

Partial thickness tear extending through 50% of the rotator cuff tendon.

PROGRESSION OF TENDINOSIS

Delamination tears and tendon insertion.
Cystic changes at bone attachments.

Bursal surface tear.
Large articular surface tear with cystic bone changes.

REGENERATIVE INJECTIONS FOR ADVANCED ROTATOR CUFF DISEASE

Injections for tendinosis and partial thickness tear.

Injection of delamination tear and tendinosis.
REGENERATIVE INJECTIONS FOR ADVANCED ROTATOR CUFF DISEASE

- Injection of bursal surface tear, delamination tear and severe insertion tendinopathy and cystic changes.

DR ALBANO

TENDINOPATHY: GRADE 1, RX
- Eccentric ex's
- Deep Tissue Massage
- LASER
- Continuous US
- LR-PRP
**TENDINOPATHY: GRADE 2, RX: IS TEAR**

- Eccentric ex’s
- Deep Tissue Massage
- LASER
- Continuous US
- LR-PRP
- Mild PNT
- +/- Percutaneous Debridement

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**TENDINOPATHY: GRADE 2, RX: IS TEAR**

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**TENDINOPATHY: GRADE 3, RX**

- Eccentric ex’s
- Deep Tissue Massage
- LASER
- Continuous US
- LR-PRP
- Moderate PNT
- +/- Percutaneous Debridement
TENDINOPATHY: GRADE 3, RX

- A: 0-25% of tendon DEPTH
- B: 26-50%
- C: 51-75%
- D: 76-99%
- LR-PRP, AFG, extensive PNT or Percutaneous Debridement (esp. B, C, D), consider adding BM (esp. B, C, D)

TENDINOPATHY: GRADE 4, RX: PT TEAR

- A: 0-25% of tendon WIDTH
- B: 26-50%
- C: 51-75%
- D: 76-99%
- LR-PRP, AFG, extensive PNT or Percutaneous Debridement, and BM
- Consider Surgery for debridement (D)

TENDINOPATHY: GRADE 5, PATHOLOGY: FT, PW

- A: 0-25% of tendon WIDTH
- B: 26-50%
- C: 51-75%
- D: 76-99%
- LR-PRP, AFG, extensive PNT or Percutaneous Debridement, and BM
- Consider Surgery for debridement (D)
TENDINOPATHY: GRADE 6, RX: FT, FW

- Surgery
- BM in conjunction intraoperatively or postoperatively.
- LR-PRP if BMAC is not available.