Lateral Ankle Sprain Anatomy – Can the Bifurcate Ligament be Consistently Identified with Ultrasound on Cadavers

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Overview

• Objective
• Bifurcate ligament anatomy
• Understanding lateral ankle injury
• Methods & Materials
• Results and clinical significance
• Conclusion
Objective

• Investigate whether the bifurcate ligament could be identified using ultrasound on cadavers as a training exercise for anatomy education, clinical training, and assessment
Introduction

• The bifurcate ligament (BFL) is under appreciated regarding lateral ankle injuries
• Similar orientation to the anterior talofibular ligament (ATFL)
Understanding Lateral Ankle Sprains

- **Typical Mechanism**
  - Plantar flexion
  - Inversion

- **High Recurrence**
  - A survey of 380 athletes revealed 73.5% of 563 ankle sprains had been previously injured

- **Variable Recovery Time**
  - Average non-surgical complete rehabilitation: 36-72 days

Fallat, Grimm, Saracco, 1998
Methods

- **Literature Search** – current imaging text and online journals
- **Dissection** – 58 cadavers to identify BFL
  - 55 (n=110 sides; 55R:55L) Carolina solution
  - 3 (n=6; 3R:3L) Freedom Art solution
Methods

• Evaluate Structural Relationships – Digital caliper measurements between:
  – Apex distal fibula (ADF), 5\textsuperscript{th} metatarsal tuberosity (5MT)
  – ADF, Proximal aspect of BFL ligament (PBFL)
Methods

• **Surface Anatomy Template** - developed using palpable bony landmarks for proper probe placement

• **Ultrasound** – 31 donor cadaver patients (n=61 30R:31L) utilizing surface anatomy template
Materials

- **Ultrasound systems used**
  - Sonosite M-Turbo – Classic probe
  - Fukuda-Denshi AG760 machines - SonicEye finger probe
Results

• **Literature Search** – Revealed no studies of ultrasound (US) identification of BFL on cadavers
  – Study of 19 patients revealed 95% positive I.D. by US of ATFL damage (confirmation by Arthroscopy)

• **Dissection & Measurements**
  - Ratio $\text{ADF-PBFL : ADF-5MT} = 1/3$ from ADF
  - ADF – 5MT 60.22mm ± 0.43
  - ADF – PBFL 42.18mm ± 0.51
Results

- **Surface Anatomy Template**
  - Revealed 76.27% positive BFL I.D. with 1\textsuperscript{st} probe placement
  - Modified 2\textsuperscript{nd} attempt revealed 92.86% positive I.D. with slight transducer adjustment

Accuracy of 61 US probe placements utilizing surface anatomy template and palpable landmarks
Results

Caveric tissue

In vivo
Results

Caveric tissue

In Vivo
Conclusion & Discussion

- The bifurcate ligament can be positively identified using ultrasound on cadavers.
- Utilizing the surface anatomy template provides accurate and efficient I.D. with multiple different ultrasound systems and transducers.
- Ultrasound provides cost effective, quality imaging of affected anatomy regarding lateral ankle injuries.
- Accurate identification of **ALL** injured structures can reduce recurrence, recovery time, and improve overall patient care.
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References