Subtalar Arthroscopy: Emerging Concepts and Surgical Pearls

James Whelan, DPM, AACFAS
Foot and Ankle Center of Nebraska and Iowa

APMA Annual Scientific Meeting 2019
July 11-14, 2019
Disclosures

- None
Objectives

• Review indications for subtalar arthroscopy

• Review subtalar arthroscopy literature focused on outcomes and complications

• Review surgical technique for subtalar arthroscopy
Historical Perspective

1919 Oloff: described talonavicular and calcaneocuboid arthroscopy

1931 Parisien: published on subtalar arthroscopy in cadaver specimens, describing anterior and posterior portals

1970 Wantanabe: developed 1.7 mm scope and examined 28 ankles

1972 Wantanabe: described the anteromedial, anterolateral and posterolateral portals of the ankle /// described MPJ arthroscopy

1974 Frey: introduced the middle portal for subtalar arthroscopy

1994 Frey

1996 Oloff: described talonavicular and calcaneocuboid arthroscopy
Indications
• Less invasive
• Decreased morbidity, rapid rehabilitation

• More predictable outcomes
• Surgery based on anatomy

<table>
<thead>
<tr>
<th>Indications and Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
</tr>
<tr>
<td>------------------------------</td>
</tr>
<tr>
<td>Persistent subtalar pain</td>
</tr>
<tr>
<td>Soft tissue subtalar impingement (usually scarred ligs)</td>
</tr>
<tr>
<td>Chronic synovitis</td>
</tr>
<tr>
<td>Osteochondral lesion</td>
</tr>
<tr>
<td>Arthrofibrosis</td>
</tr>
<tr>
<td>Loose body</td>
</tr>
<tr>
<td>Symptomatic subtalar coalition</td>
</tr>
<tr>
<td>Control of articular fixation</td>
</tr>
<tr>
<td>Degenerative articular disease</td>
</tr>
<tr>
<td>Os trigonum syndrome</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Contraindications

- Localized soft tissue infection
- Advanced DJD
- Severe edema
- PVD
- Poor skin quality

**Absolute contraindications**

**Relative contraindications**
Evidenced Base Review of Arthroscopic Approaches for STJ Pathology
Sinus Tarsi Pathology

Lee et al, 2008
• 33 cases of STS
• Intra op Dx
  – 29 (88%) partial tear of interosseus lig
  – 11 (33%) partial tear of cervical lig
  – 18 (55%) synovitis
  – 8 (24%) arthrofibrosis
  – 7 (21%) soft tissue impingement

Frey et al, 1999
• 14 cases of STS
• Intra op Dx
  – 10 interosseus lig tears

Subtalar arthroscopy is excellent diagnostic tool for STS

48% excellent
39% good
12% fair
Sinus Tarsi Pathology

A. Synovitis

B. OCL

C. Loose body
Subtalar Coalition

Field et al, 2009

- Arthroscopic assistance to visualize resection AND debulk areas of synovitis

Partial debridement of middle facet

Insertion of osteotome into coalition
Control of Articular Fixation

Talus fracture
Sitte et al, 2012
• 2 cases
• AOFAS 47 to 97 at 6 mo

Calcaneal fracture
Rammelt et al, 2002
• 59 cases of percutaneous reduction of intra-articular fx
• 22% cases step off
• AOFAS 94 at 1 yr

Schuberth et al, 2009
• 10/24 pts arthroscopic-assisted reduction/fixation
• Reduction in step off, medial wall displacement, Boehler’s angle
• No soft tissue complications, no STJ fusion at 1 yr
Control of Articular Fixation

• Arthroscopic debridement of an arthroereisis

• Fibrosis can interfere with replacing an implant
# Arthroscopic Subtalar Arthrodesis

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>N</th>
<th>Fusion rate</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amendola et al</td>
<td>2007</td>
<td>11</td>
<td>91%</td>
<td>8 very satisfied, 1 satisfied, 1 not satisfied</td>
</tr>
<tr>
<td>Glanzmann et al</td>
<td>2007</td>
<td>41</td>
<td>100%</td>
<td>AOFAS 53 to 84</td>
</tr>
<tr>
<td>Lee et al</td>
<td>2010</td>
<td></td>
<td>94% @ 11 wks</td>
<td>AOFAS 35 to 84</td>
</tr>
<tr>
<td>Albert et al</td>
<td>2011</td>
<td>10</td>
<td>100% @ 9 wks</td>
<td>AOFAS 47 to 78</td>
</tr>
</tbody>
</table>

Yields excellent fusion rates 96%
Arthroscopic Subtalar Arthrodesis
# Os Trigonum Pathology

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>N</th>
<th>Results</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horibe et al</td>
<td>2008</td>
<td>11</td>
<td>100% excellent results</td>
<td>None</td>
</tr>
<tr>
<td>Park et al</td>
<td>2013</td>
<td>23</td>
<td>AOFAS score 71.3 to 94.7</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VAS score 6.7 to 1.5</td>
<td></td>
</tr>
</tbody>
</table>
Subtalar Arthroscopy Results

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Mean Follow-up</th>
<th>Post-operative Diagnosis</th>
<th>AOIFAS/VAS Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frey, 1999</td>
<td>49</td>
<td>54 mo</td>
<td>36 interosseous lig injury, 7 arthrotibrosis, 4 DJD, 2 fibrous coalition of calcaneonavicular jt</td>
<td>47% excellent, 47% good, 6% poor</td>
</tr>
<tr>
<td>Oloff, 2001</td>
<td>29</td>
<td>18 mo</td>
<td>29 synovitis, 1 chondromalacia</td>
<td>85 post op, return to activity at 4 months</td>
</tr>
<tr>
<td>Lee, 2008</td>
<td>33</td>
<td>24 mo</td>
<td>29 partial tear interosseous lig, 18 synovitis, 11 partial tear of cervical lig, 8 arthrotibrosis, 7 soft tissue impingement</td>
<td>43.1 to 86.2, VAS 7.3 to 2.7, 87% good to excellent results</td>
</tr>
<tr>
<td>Ahn, 2009</td>
<td>115</td>
<td>42 mo</td>
<td>31 synovitis, 35 DJD, 6 chondromalacia, 11 loose body, 10 arthrotibrosis, 8 os trigonum, 6 OCL, 10 calc frx, 2 talar fx, 1 calc tumor</td>
<td>69 to 89, 33 to 88 fusion, 97% satisfied</td>
</tr>
</tbody>
</table>
Summary of Complications

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Mean Follow-up (mo)</th>
<th>Complication Rate (%)</th>
<th>Type of Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frey, 1999</td>
<td>49</td>
<td>54</td>
<td>10.2</td>
<td>3 neuritis involving branches of the SPN, 1 sinus tract formation, 1 superficial wound infn</td>
</tr>
<tr>
<td>Oloff, 2001</td>
<td>29</td>
<td>18</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Lee, 2008</td>
<td>33</td>
<td>24</td>
<td>3</td>
<td>1 irritation of the lateral branch of the SPN</td>
</tr>
<tr>
<td>Ahn, 2009</td>
<td>115</td>
<td>42</td>
<td>2.6</td>
<td>1 neuritis involving branches of the SPN, 1 superficial wound infn, 1 HWR owing to irritation</td>
</tr>
</tbody>
</table>

Relatively low complication rates
Pre-operative Planning

- Radiographs
- MRI
- CT
- Bone scan
- Selective diagnostic injections
Limitations with Diagnostic Imaging

Goldberger et al, 1998
- 12 patients
  - 7 pre-op MRI
  - 6 pre-op bone scan
- Both uniformly underestimated degree of articular damage

Lee et al, 2008
- 30 feet
- Pre-op MRI compared to intra-op findings
- Full agreement: 10%
- Partial: 50%
- None: 40%

Arthroscopy most accurate method to diagnose articular damage/STS pathology

None 40%

VS
Limitations with Diagnostic Imaging

Frey et al, 1999
- “most accurate to evaluate for subtalar instability”
- Pre-op 1 case of ST instability
- Intra op 7 cases ST instability

Mittlemeier et al, 2015
- Used to reconfirm diagnosis prior to ligament reconstruction

Importance in diagnosing ST instability apparent
Technique with Pearls
Subtalar Arthroscopy In Modern Day

• Underutilized procedure
Equipment and Setup

- Insufflate the STJ with 5-10 mL of sterile saline
- Fluid pump pressure start at 30-40 mm Hg

Place viewing platform on the contralateral side of the patient for the supine approach
Equipment and Setup

• Arthroscope
  – Size: 1.9, 2.7, 4.0
  – Degree: 30, 70

• Small joint shavers/ abrader set: 2.0, 2.5, 3.5, 4.0

• Distractors
  – Invasive, semi-invasive or non-invasive
    No distraction

• Tourniquet/ Ropivicaine w/ epi NS
Positioning

- **Supine**
- Prone
- Lateral decubitus
- Knee bent and leg hanging down

- General anesthesia preferred
Portals

- Anterolateral
- Accessory lateral
- Medial
- Middle
- Posteromedial
- Posterolateral

Portals marked before insufflation to avoid losing anatomic boundaries
Nerve injury from arthroscopic portal placement

- Anterior portal
  - 21.3 mm to nearest nerve
- Middle portal
  - 20.9 mm to nearest nerve
- Posterior portal
  - 11.4 mm to nearest nerve

Tryfondis et al, 2008
Arthroscopic Anatomy of the STJ

- Posterior facet
- Middle facet
- Anterior facet
- Plantar lateral aspect of talonavicular joint
- Interosseous ligament
- Cervical ligament
- Extensor retinaculum
What do we actually see?

**Wagner et al, 1992**

- Load transferred from posterior facet through anterior/ middle facets to adjacent joint pathways in the midfoot

Is that enough?

- Abnormal kinematics → pathology forms
General Technique

1. Identify anterior portal with 18-gauge needle and insufflate joint with 20-cc syringe
2. Perform skin incision and blunt dissection using hemostat
3. Place cannula with trocar followed by 2.7-mm, 30º oblique arthroscope
General Technique

4. Identify middle portal under direct visualization using 18-gauge needle and outside-in technique

(The posterior portal can be placed at this time using the same direct visualization technique)
General Technique

• The arthroscope is used to visualize the region of the sinus tarsi for synovitis, meniscoid lesions, adhesions and arthrofibrosis present.
General Technique

- The ligaments that insert on the floor of the sinus tarsi can be visualized. The deep interosseous ligament is observed more medial to fill the tarsal canal.
- Evaluate the posterior facet for OCL or chondromalacia present.
General Technique

• Stress the STJ to evaluate for subtalar instability.

“loss of parallelism noted of the posterior facet of the calcaneus and the talus”

“a medial glide of the calcaneus out from under the talus”

Clanton et al, 1989
Frey et al, 1999
General Technique

- The lens is rotated to view lateral capsule with ligament attachments to the calcaneus.
Post Operative Care

- Compressive dressing applied
- Ambulation WB as tolerated with crutches
- Sutures removed at 14 to 21 days
- Immediate gentle active ROM exercises
- Return to activities at 6 weeks
Arthroscopic evaluation of the subtalar joint: a review and survey of pathology
• 53 limbs in 49 consecutive patients underwent subtalar arthroscopy for symptomatic subtalar joint pathology

100% cases had STJ pathology present

<p>| Table 2. |
|----------------------------------|------------------|</p>
<table>
<thead>
<tr>
<th><strong>Intraoperative Subtalar Joint Findings</strong></th>
<th><strong>No. of Cases (%)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Synovitis and capsular adhesions</td>
<td>53 (100%)</td>
</tr>
<tr>
<td>Chondromalacia</td>
<td>7 (13%)</td>
</tr>
<tr>
<td>STJ(^a) exostosis</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>STJ(^a) instability</td>
<td>22 (42%)</td>
</tr>
</tbody>
</table>

\(^a\) Subtalar joint
<table>
<thead>
<tr>
<th>Comparison to Previous Studies</th>
<th>No. (%)</th>
<th>Frey et al(^1)</th>
<th>Lee et al(^15)</th>
<th>Olaff et al(^6)</th>
<th>Ahn et al(^14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases (N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral portals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anterior and middle</td>
<td>2</td>
<td>53 (100%) Synovitis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anterior, middle and lateral</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anterior, middle and lateral</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anterior, accessory and lateral</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synovitis and adhesions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synovitis</td>
<td>53</td>
<td>18 (55%) Synovitis</td>
<td>29 (100%) Synovitis</td>
<td>31 (27%) Synovitis</td>
<td></td>
</tr>
<tr>
<td>Impingement</td>
<td></td>
<td>27 (55%) Synovitis</td>
<td>7 (21%) Synovitis</td>
<td>29 (88%) ITCL(^a) injury</td>
<td>36 (74%) ITCL(^a) injury</td>
</tr>
<tr>
<td>ITCL(^a) injury</td>
<td></td>
<td>36 (74%) Synovitis</td>
<td>29 (88%) ITCL(^a) injury</td>
<td>2 (7%) ITCL(^a) injury</td>
<td>2 (7%) ITCL(^a) injury</td>
</tr>
<tr>
<td>CL(^b) injury</td>
<td></td>
<td>11 (33%) Synovitis</td>
<td>2 (7%) ITCL(^a) injury</td>
<td>2 (7%) ITCL(^a) injury</td>
<td>2 (7%) ITCL(^a) injury</td>
</tr>
<tr>
<td>Chondromalacia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chondromalacia</td>
<td>7</td>
<td>1 (3%) Chondromalacia</td>
<td>1 (3%) Chondromalacia</td>
<td>6 (5%) Chondromalacia</td>
<td></td>
</tr>
<tr>
<td>Arthrofibrosis</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arthrofibrosis</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STJ(^c) exostosis</td>
<td></td>
<td>1 (2%) Exostosis</td>
<td></td>
<td></td>
<td>11 (10%) Loose body</td>
</tr>
<tr>
<td>STJ(^c) instability</td>
<td></td>
<td>22 (42%) Instability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcaneonavicular coalition</td>
<td>2</td>
<td></td>
<td></td>
<td>1 (3%) Os trigonum</td>
<td>8 (7%) Os trigonum</td>
</tr>
<tr>
<td>Coaliton</td>
<td></td>
<td></td>
<td></td>
<td>1 (3%) Os trigonum</td>
<td>8 (7%) Os trigonum</td>
</tr>
<tr>
<td>Calcium pyrophosphate disease</td>
<td></td>
<td></td>
<td></td>
<td>1 (3%) Os trigonum</td>
<td>8 (7%) Os trigonum</td>
</tr>
</tbody>
</table>

\(^a\) Interosseous talocalcaneal ligament; \(^b\) Cervical ligament; \(^c\) Degenerative joint disease; \(^d\) Osteochondral lesion; \(^e\) Subtalar joint
Conclusions

– Subtalar pain comprises a wide spectrum of pathologic conditions

– Subtalar joint arthroscopy can be a valuable tool for therapeutic treatment and diagnostic evaluation

– The use of subtalar arthroscopy has expanded when nonoperative management fails or when a more accurate diagnosis is necessary

– Subtalar arthroscopy is underutilized
Thank you

jim.h.whelan@gmail.com