Occurrence of Lateral Ankle Ligament Disease/Injury in Stage II-IV Adult Acquired Flatfoot, Confirmed on MRI.

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Purpose

Lateral hindfoot and ankle pain associated with stage II-IV adult acquired flatfoot is often attributed to sub fibular impingement. Preoperative MRI performed at our institution has identified a relatively high incidence of lateral collateral ligament disease/injury associated with these patients. The purpose of our study is to determine the incidence of lateral collateral ligament disease/injury associated with adult acquired flatfoot and to determine its significance.

Methodology/Hypothesis

The subjects were identified using a searchable computerized hospital database between the years 2015 to 2016. Patients with stage 2 or 3 adult acquired flatfoot deformity were confirmed via chart review and radiographic analysis. Of the initial search, 74 patients were identified. Of the 74 patients with ICD-10 codes indicating a patient with flat foot deformity including posterior tibial tendon dysfunction, adult acquired flat foot and adult acquired deformity of foot, 58 feet in 57 patients met inclusion criteria within the study.

In order to be included within the study patients must have been diagnosed with Johnson and Strom stage 2 or 3 flatfoot deformity with documented lateral ankle pain, and pre-operative MRI available with radiologist report available. Patient exclusion criteria included patients under the age of 18 years, patients with flatfoot deformity secondary to previous trauma or Charcot deformity, patients with previous surgery, or patients with incomplete medical records.

Once the patients were identified, data was compiled including age of patient, patient gender, Johnson and Strom classification stage, lateral ankle ligament injury identified on MRI, and surgical procedures performed.

Statistical analyses were performed using IBM SPSS Statistics software, version 24.0 (IBM SPSS Inc., Armonk, NY) by our hospital statistician. The distribution of the data was assessed using the Shapiro-Wilk test.

Subgroup analysis was performed using the flatfoot stage 2 and stage 3 patients. Differences between the staging groups in non-normally distributed continuous variables were analyzed by the Mann-Whitney U test. The chi-square test was used to determine the association of categorical variables. A result was considered to be statistically significant with a value of P<.05. Our hypothesis was that there would be a significant number of patients with MRI findings of lateral ankle instability in patients with Stage 2-3 flatfoot deformity.

Results

The study population was composed of 57 patients including 58 feet. Of the 58 feet evaluated, there were 29 patients in each group between individuals with stage 2 and stage 3 disease respectively. Mean age at the time of enrollment was 52.9 ± 11.6 years (median, 53.5; range, 25 – 74 years). Within the adult acquired flat foot stage 2 group the average age was 51.0 ± 13.7 years. Average age of the stage 3 population was 54.7 ± 9.0 years (Table 1).

Overall, of the total 58 feet included, 56.9% (33'58) had documented lateral ankle ligament injury on pre-operative MRI (Figure 1). 43.1% (25'58) feet were shown to not have any lateral ligamentous injury associated with their deformity. This finding through statistical analysis showed a significant difference (P = 0.034) between those patients with lateral ankle ligament injury confirmed via MRI versus those patients who did not show any lateral ankle ligament injury.

Of the 25 feet that did not have ligamentous injury, seven patients had documented reason explaining their lateral ankle pain. Five out of the seven patients had documented inflammation within the sinus tarsi consistent with subfibular impingement (Figure 2).

When examining the other two patients, one had documented ankle effusion and the other was diagnosed with an osteochondral lesion of the lateral talar dome.

When comparing stage 2 and stage 3 patient cohorts, 66% of the feet evaluated with stage 2 deformities were shown to have lateral ankle ligament injury associated with their flat foot deformity. Two of the patients within this population were shown to have documented inflammation within the sinus tarsi. Stage 3 patients were shown to have a lower rate of lateral ankle ligament injury in that 48% of the feet evaluated had lateral ankle ligament injury with five patients having documented alternative findings including one patient with a lateral OCD lesion, one patient with a lateral ankle joint effusion, and three patients with sinus tarsi syndrome.

There were no significant differences between the stage 2 and stage 3 flatfoot groups with respect to patient age (50.1 ± 14.3 vs. 54.7 ± 9.0, P = .17) or sex (20 women (69%), 9 men (31%) vs. 18 women (62.1%), 9 (31%) men), P = .58). The presence of lateral ankle ligament injury on pre-operative MRI was 65.5% (19'29) in the stage 2 flatfoot group and 48.3% (14'29) in the stage 3 flatfoot group. Lateral ankle ligament injury was not significantly associated amongst the different flatfoot groups (P = .19). However, there was a higher prevalence found within the stage 2 flatfoot group than stage 3 (Table 3).

Table 1. Characteristics of the study population. Continuous data are shown as mean ± standard deviation and categoric data as number (%)

Variable	Mean ± SD or No. (%)
Stage 2	29 (50)
Age in years (n=28)	51.0 ± 13.7
Gender (n=28)	
Male	9 (32.1)
Female	19 (67.9)
+ Anterio talofibular ligament injury by MRI	19 (65.5)
- Anterio talofibular ligament injury by MRI	10 (34.5)
Stage 3	29 (50)
Age in years (n=29)	54.7 ± 9.0
Gender (n=29)	
Male	11 (37.9)
Female	18 (62.1)
+ Anterio talofibular ligament injury by MRI	14 (48.3)
- Anterio talofibular ligament injury by MRI	15 (51.7)
Stage 2 and Stage 3 Combined	
Age in years (n=57)	52.9 ± 11.6
Gender (n=57)	
Male	20 (35.1)
Female	37 (64.9)
+ Anterio talofibular ligament injury by MRI	33 (56.9)
- Anterio talofibular ligament injury by MRI	25 (43.1)

Table 3. Characteristics of patients and feet with versus without ATLF injury by MRI
* Indicates significant value

Variable	With ATFL Injury by MRI (n=33)	Without ATLF Injury by MRI (n=25)	P
Overall Data	33 (56.9)	25 (43.1)	0.034 *
Age in years	53.4 ± 12.3	51.1 ± 11.9	0.48
Gender			0.44
Male	10 (30.3)	10 (40)	
Female	23 (69.7)	15 (60)	
Staging			0.19
Stage 2	19 (57.6)	10 (40)	
Stage 3	14 (42.4)	15 (60)	
Sinus tarsi syndrome	0	2 (8)	0.10

Figure 1. MRI Axial T2 showing ATFL injury.

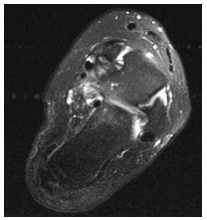


Figure 2. MRI Axial T2 showing intact ATFL (A) and subfibular inflammation (B).

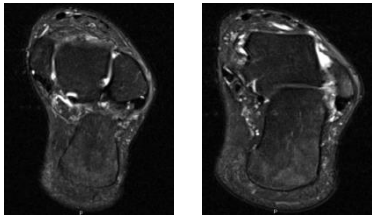
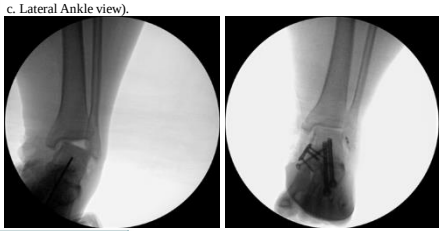


Figure 3. Intra-operative radiographs status post flat foot reconstruction with lateral ankle stabilization (A. Stress Radiograph of Ankle, B. AP Ankle view, c. Lateral Ankle view).



Literature Review

Lateral hindfoot pain, in association with posterior tibial tendon disease has yet to be fully understood. It is explained by many authors within the literature, that the local area of pain is secondary to subfibular impingement. However, there is very little evidence indicating the occurrence of subfibular impingement and the frequency in which it causes inflammation.

Malicky et al. evaluated, through computed tomographic scans, the occurrence of sinus tarsi and calcaneal fibular impingement within a flat foot population. Their study revealed that 92% of their nineteen patient population showed signs of sinus tarsi impingement via the fibula. They also showed that 66% of the patients showed signs of calcaneofibular impingement. Thus, they concluded that lateral hindfoot impingement may occur in a stepwise fashion.(6) However, Malicky's study was not able to identify the inflammatory cause of pain within the local area (6).

Our study showed that 56% of our study population may be having lateral ankle pain secondary to ligamentous injury as opposed to impingement alone. Our study also demonstrated that this occurrence was more prevalent in the stage 2 population as opposed to the stage 3 population, though this result was not significant. It is our opinion that this is secondary to the increased motion within the stage 2 population as opposed to the stage 3 population in which there is fixed deformity. Also, our study showed only 8.6% of our population having documented inflammation within the sinus tarsi region consistent with subfibular impingement. Though the results of this study are unique, there were several limitations to this study. First, the study was limited in the amount of patients included. A larger population might be more meaningful in determining significant results. Another limitation is the lack of follow up on the patient population. The senior authors within the study mainly see tertiary referrals from outside practitioners, thus, our study represents a more advanced disease group compared to the standard population. Finally, our study is limited in that though the MRI results show inflammation and disease to the lateral ankle ligaments, there is minimal clinical evaluation of the ankle ligaments documented. Future studies including both MRI and clinical evaluation of the lateral ankle ligaments would further the arguments that lateral ankle pain are more associated to ligament injury as opposed to impingement. .

Analysis/Discussion

Although previous research has attributed lateral ankle pain in adult acquired flatfoot to sub-fibular impingement, this study demonstrates a relatively high incidence of lateral ankle pain that may be secondary to lateral ankle ligament disease/injury. This was identified more frequently in stage 2 deformity. These findings might have long-term implications regarding ankle arthritis following surgical management of adult acquired flatfoot. Further studies to investigate the significance of our findings might include lateral ankle ligament stress testing in those patients with positive MRI findings (Figure 3). Additionally, radiographic evaluation for ankle arthritis following adult acquired flatfoot surgery, comparing patients with and without lateral ankle stabilization would be worthwhile

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