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Routine Use of Low Molecular Weight Heparin DVT Prophylaxis following Certain Foot and Ankle Surgeries: A Cost Effectiveness Analysis



Percutaneous Kirschner Wire versus Commercial Implant for Hammertoe Repair: A Cost-Effectiveness Analysis



Cost-effectiveness Analysis of Primary Arthrodesis versus Open Reduction Internal Fixation for Primarily Ligamentous Lisfranc Injuries

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- **Radiographic Parameters are Poorly Correlated with Patient Centered Outcomes in Hallux Valgus Surgery**
- **Scoring Mental Health Quality of Life With the SF-36 in Patients With and Without Diabetes Foot Complications**
- **Medial Structure Injury during Suture Button Insertion Utilizing “Center-Center” Technique for Syndesmotic Stabilization**
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Routine Use of Low Molecular Weight Heparin DVT Prophylaxis following Certain Foot and Ankle Surgeries: A Cost Effectiveness Analysis

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Abstract

The purpose of this study was to determine whether certain foot/ankle surgeries would benefit from routine use of low molecular weight heparin (LMWH) as postoperative DVT prophylaxis.

We conducted a formal cost-effectiveness analysis using a decision analytic tree to explore the healthcare costs and health outcomes associated with a scenario of no prophylaxis and a scenario of routine LMWH prophylaxis for 4 weeks. The two scenarios were compared for five procedures: 1) Achilles tendon repair (ATR), 2) total ankle arthroplasty (TAA), 3) hallux valgus surgery (HVS), 4) hindfoot arthrodesis (HA), and 5) ankle fracture surgery (AFS).

Outcomes assessed included short and long-term costs, quality-adjusted life-years (QALYs), and incremental cost per QALY gained. Costs were evaluated from the healthcare system perspective and expressed in US dollars at a 2015 price base.

In the short-term, routine prophylaxis was always associated with greater costs compared to no prophylaxis. For ATR, TAA, HA and AFS, prophylaxis was associated with slightly better health outcomes; however, the gain in QALYs was minimal compared to the cost of prophylaxis (ICER was well above \$50,000/QALY threshold). For HVS, prophylaxis was associated with both worse health outcomes and greater costs.

In the long-term, routine prophylaxis was always associated with worse health outcomes and either cost more (HA, AFS, HVS) or saved very little (ATR, TAA).

We conclude that policies encouraging routine use of LMWH following foot/ankle surgery are unlikely to be cost-effective. Decisions to perform prophylaxis should be made on a case-by-case basis and emphasize individual patient risk factors.

Level of Clinical Evidence: 2, Economic and Decision Analysis



Percutaneous Kirschner Wire versus Commercial Implant for Hammertoe Repair: A Cost-Effectiveness Analysis

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Abstract

Hammertoe deformities are one of the most common foot deformities affecting up to one-third of the general population. There are a multitude of surgical techniques to correct fixed and/or complex hammertoes with proximal interphalangeal joint arthrodesis. Fusion of the joint can be achieved with various devices with today's focus on percutaneous Kirschner (K-) wire fixation or commercial intramedullary implant (CI) devices. The purpose of this study was to determine whether surgical intervention with percutaneous Kirschner wire versus commercial intramedullary implant is more cost effective for proximal interphalangeal joint arthrodesis in hammertoe surgery.

A formal cost-effectiveness analysis using a decision analytic tree model was conducted to investigate the healthcare costs and outcomes associated three years postoperatively with either K-wire or CI fixation. Outcomes assessed included long-term costs, quality-adjusted life-years (QALYs), and incremental cost per QALY gained. Costs were evaluated from the healthcare system perspective and expressed in US dollars at a 2017 price base.

Our results found commercial implants were minimally more effective than K-wires, but carried significant more cost. The total cost for treatment with percutaneous K-wire was \$5,041 with an effectiveness of 0.82 QALYs versus commercial implant cost of \$6,059 with an effectiveness of 0.83 QALYs. The incremental cost-effectiveness ratio (ICER) of commercial implants was \$146,667. With an ICER of greater than \$50,000, commercial implants fail to justify their proposed benefits to outweigh the cost of percutaneous K-wires.

In conclusion, percutaneous K-wires would be the preferred treatment for arthrodesis of the PIPJ for hammertoes from a healthcare system perspective.

Level of Clinical Evidence: II - Economic and Decision Analysis



Cost-effectiveness Analysis of Primary Arthrodesis versus Open Reduction Internal Fixation for Primarily Ligamentous Lisfranc Injuries

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Abstract

The purpose of this study was to determine whether surgical intervention with open reduction internal fixation (ORIF) or primary arthrodesis (PA) for Lisfranc injuries is more cost effective.

We conducted a formal cost-effectiveness analysis using a Markov model and decision tree to explore the healthcare costs and health outcomes associated with a scenario of ORIF versus PA for 45 years post-operatively. Outcomes assessed included long-term costs, quality-adjusted life-years (QALYs), and incremental cost per QALY gained. Costs were evaluated from the healthcare system perspective and expressed in US dollars at a 2017 price base. ORIF was always associated with greater costs compared to PA, and was less effective long term. When calculating the cost required to gain 1 additional QALY, the PA group cost \$1429/QALY, while the ORIF group cost \$3958/QALY.

The group undergoing primary arthrodesis overall spent on average \$43,192 less than the ORIF group, and was overall a more effective technique. Strong dominance over ORIF was demonstrated in multiple scenarios and the model's conclusions were unchanged in the sensitivity analysis even after varying key assumptions. ORIF failed to show functional or financial benefits.

We conclude that from a healthcare system's standpoint, primary arthrodesis would clearly be the preferred treatment strategy for predominantly ligamentous Lisfranc fracture/dislocations.

Level of Clinical Evidence: 2, Economic and Decision Analysis

Honorable Mention

Radiographic Parameters are Poorly Correlated with Patient Centered Outcomes in Hallux Valgus Surgery

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Abstract

Evaluation of patients undergoing hallux valgus surgery has historically emphasized radiographic angles and relationships. However, patient-reported outcomes have taken center stage now as healthcare systems trend towards a “value-based” delivery approach.

We conducted a retrospective analysis of pre-existing data in our practice to examine whether patient-reported outcomes after bunion surgery, determined via Foot and Ankle Outcome Scores (FAOS), correlated with radiographic parameters commonly measured in hallux valgus deformity. Pearson correlation statistics and simple and multiple linear regression models were used to identify important radiographic predictors.

There were 80 patients (80 feet) with mean follow up of 59.3 ± 11.6 weeks (median 55, range 45.7-96.3 weeks) with complete data. No radiographic variable achieved anything more than a weak correlation with any of the FAOS subscale scores at final follow up (the study's best was postoperative 1st/2nd intermetatarsal [IM] angle with sports & recreation scores, $r = -0.328$, $p=0.005$). There was no correlation found between change in hallux valgus angle, change in 1st/2nd IM angle, magnitude of preoperative hallux valgus angle or magnitude of preoperative 1st/2nd IM angle ($p>0.05$ for all). Furthermore, none of the study's final multivariable models achieved an $R^2 > 0.24$, and nearly all fell between 0.10 to 0.17.

We conclude that radiographic angles are poorly correlated with patient centered outcomes in hallux valgus surgery. This study calls into question the current emphasis that is placed on X-ray values both preoperatively and postoperatively.

Level of Clinical Evidence: Level III, Prognostic Study

Honorable Mention

Scoring Mental Health Quality of Life With the SF-36 in Patients With and Without Diabetes Foot Complications

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Dane K. Wukich, MD

Introduction: Diabetic foot disorders affect quality of life as demonstrated by lower physical component summary (PCS) scores on the Short Form 36 (SF-36) but their impact on mental component summary (MCS) score have not reached the same significance. The study aim was to apply orthogonally and obliquely determined factor scoring coefficients to the SF-36 to examine if either detects changes in health-related quality of life (HRQoL) differently.

Methods: Three-hundred diabetic patients completed the SF-36. One-hundred fifty-five patients had diabetic foot complications (DFC) and 145 patients didn't. SF-36 scores were calculated using factor-scoring coefficients determined by orthogonal and oblique rotation principle component analyses.

Results: DFCs patients reported significantly worse outcomes in all SF-36 subscales. Differences were in both orthogonal ($p < 0.00001$) and oblique ($p < 0.00001$) PCS scores which were significantly lower in patients with DFCs. There were no differences in orthogonal MCS scores ($p = 0.156$). In contrast, the difference in the Mental Health subscale responses was corroborated by oblique MCS scores ($p = 0.0005$). PCS scores determined orthogonally and obliquely did not differ significantly among patients with DFCs ($p = 0.159$) and without DFCs ($p = 0.214$). Orthogonal MCS scores were significantly higher than oblique scores in patients without DFCs ($p = 0.005$) and with DFCs ($p = 0.0004$).

Conclusion: In patients with poor physical function, orthogonal scoring coefficients lead to significantly greater MCS scores than oblique scoring. Despite significantly lower Mental Health scores in patients with DFCs, orthogonal MCS scores showed no statistical difference. Therefore, orthogonally calculated MCS scores in patients with poor physical function as seen with DFCs, may overestimate mental HRQoL.

Level of Clinical Evidence: 3

Honorable Mention

Medial Structure Injury during Suture Button Insertion Utilizing “Center-Center” Technique for Syndesmotic Stabilization

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Gregory C. Berlet, MD

Mark A. Prissel, DPM, AACFAS

Abstract

The “Center-Center” technique for syndesmosis fixation has been described as an improved and reliable technique for proper reduction of the syndesmosis during ankle fracture repair. The use of a flexible suture button is becoming an established means of syndesmotic stabilization. The purpose of this cadaveric study was to assess for medial structure injury during the placement of a suture button utilizing the “Center-Center” technique for ankle syndesmotic repair at 3 insertion intervals.

Simulated open syndesmosis repair was performed on 10 cadaveric specimens. Three intervals were measured at 10mm, 20mm, and 30mm proximal to the level of the distal tibial articular surface along the fibula. Proper longitudinal alignment of the “Center-Center” technique was completed under fluoroscopic guidance and was marked on the medial aspect of the tibia. The 3 intervals were drilled in the appropriate technique trajectory. The suture button was passed through each drill-hole interval. Using a digital caliper, the distance was measured from each suture button aperture with respect to the anterior tibial tendon, posterior tibial tendon, greater saphenous vein and nerve by single observer.

Direct impingement of the greater saphenous vein was seen in 11/30 (36.6%) interval measurements. Six of the 11 (54.5%) entrapment intervals occurred at the 10mm drill hole.

The results of the present study suggest the use of the “Center-Center” technique for syndesmotic repair with suture button application allows for risk of injury to the greater saphenous neurovasculature.

Level of Clinical Evidence: 5

Honorable Mention

Factors Associated with Emergency Room Visits within 30 days after Outpatient Foot and Ankle Surgeries

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Abstract

Within 30-day emergency department (ED) visits after elective surgery have been utilized as a quality measure by many institutions. However, the significance of the measure as a postoperative complication in foot and ankle surgery is unknown, nor are risk factors for such returns.

We conducted a retrospective cohort study to determine risk factors associated with ED visits after outpatient foot and ankle surgeries. After adjusting for clinically relevant covariates, we found that previous ED visits within 6 months of surgery and non-elective surgeries were associated with the postoperative ED visit. Having private insurance was protective against postoperative ED visits.

Though these factors may not be easily modifiable by surgeons, understanding these risk factors may improve patient education and transitional care to prevent over-crowding of ED.

Level of Evidence: III

Variables Influencing Surgical Decision Making

Greatest Feared Complications in Patients with Diabetic Foot Disease: An Expanded Follow-up Study

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Abstract

Introduction: The purpose of this study was to expand on a previous study of patients' feared complications of diabetes by utilizing a newly designed survey. The aim was to determine to what degree patients presenting with diabetes related foot pathology fear the complications that can occur with DM (death, dialysis, heart attack, stroke, blindness, diabetic foot infection, minor amputation, and major amputation) and to assess if there exists a difference between the fears of patients with diabetic foot disease and those with diabetes but no foot disease.

Methods: This study included 247 patients with diabetes who presented as outpatients. A thirty-two question Likert-type scale survey was given to each patient to assess their fear of eight different complications of diabetes.

Results: Patients with diabetic foot disease reported more significant fear of blindness ($P=0.038$), foot infection ($P<0.001$), minor amputation ($P<0.001$), and major amputation ($P<0.001$), compared to patients without. We did not identify any significant differences in the fear of foot infection, minor amputation, major amputation or blindness in patients with established diabetic foot disease.

Discussion: Patients with diabetic foot disease fear foot related complications and blindness significantly more than patients without diabetic foot disease. Our findings show that patients likely require earlier and more aggressive education and that patients may only be realizing the actual risk of amputation once they develop foot complications and not beforehand. Better understanding of specific patient fears may allow us to find the gaps in patient knowledge and therefore formulate better individualized treatment plans.

Level of Clinical Evidence: 3

Meta-Analysis of Efficacy of Autogeneous Bone Graft in Ankle Arthrodesis

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Abstract

Statement of Purpose: The goal of this study was to accurately identify the true efficacy of bone autograft in lower extremity surgery with specific regard to tibiotalar arthrodesis.

Methodology A comprehensive meta-analysis was performed with rigid adherence to specific inclusion and exclusion criteria to minimize confounding and effect modification. A random effects model was applied to account for heterogeneity and provide an accurate estimate of ankle union rates. A priori comparisons were planned for structural autograft, non-structural autograft, and no graft outcomes.

Results: Initially, 886 studies were identified and evaluated for relevance. There were 50 articles with a total of 1,282 ankle arthrodeses and mean follow-up of 36.8 ± 27.9 months that met all prospective inclusion criteria necessary for analysis. There was no evidence of publication bias. The crude fusion rate was 88.8% [85.6%, 91.3%] with 64% treated with autograft and the remainder with no graft. Random effects model found that both structural and non-structural autograft provided an enhanced arthrodesis as compared to ankle joint arthrodesis with no graft. Additional a priori sources of heterogeneity were evaluated by subgroup analysis and meta-regression which found that structural autograft outperformed no graft by 17.5% ($p=0.005$, $Q=15.93$) and non-structural autograft outperformed no graft by 13.2% ($p=0.047$, $Q=17.12$) while reducing heterogeneity.

Conclusion: Meta-analysis of current data supports the use of autograft for reducing risk of non-union particularly in the setting of tibiotalar arthrodesis.

Level of Clinical Evidence:
Meta-Analysis, Therapeutic Level 1 Study

Limb Salvage Status Post Transmetatarsal Amputation with Single Vessel Run-off to the Foot: A Retrospective Study and Review of the Literature

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Carolyn N. Winters DPM

Abstract:

Single vessel runoff to the foot is advocated in vascular literature as adequate for healing wounds and distal amputations. When other options for limb salvage fail, establishing single vessel run off with accompanying TMA may provide a viable limb salvage option for some patients.

In this study, we examined limb salvage in patients who underwent a TMA with a vascular procedure which resulted in single vessel run off to the foot. Patients who underwent a proximal leg amputation were considered a failure. Analysis of the single vessels available to give runoff to the patients TMA site was performed in both successful TMAs and failures. We examined bypass versus endovascular procedures, and the role of comorbidities.

Out of 26 patients who underwent a TMA, 30.8% underwent a proximal leg amputation. Limb salvage outcomes between patients who underwent a bypass to establish single vessel run off to their TMA compared to those patients who underwent endovascular intervention neared statistical significance. Neither diabetes nor obesity played a role in limb salvage. However, ESRD likely plays a role in limb salvage.

Despite lower healing rates, performing a TMA in the presence of reduced blood flow is an option for limb salvage as it allows the patient to have a functional limb. Single vessel run off to the foot is greatly debated in the literature. Regardless, if limb salvage is to be attempted, efforts should be made to attain as much blood flow as possible to ensure adequate healing of wounds and TMA survival.

Level of Evidence: III, Retrospective comparative study

Lower Extremity Surgical Cast Management: A Review of 537 Cases Reporting Incidence of Surgical Site Complications

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Abstract

Immobilization of the foot or ankle after surgery frequently requires casting or splinting to maintain position and alignment, prevent motion, protect the foot, and to control post-surgical edema. Despite routine use in practice after foot or ankle surgery, there are scant references and few published scientific studies to guide the practitioner regarding duration of lower extremity casting or timing of cast or splint removal and/or replacement. Complications such as excessive swelling and compartment syndrome are often anecdotally cited as the reason for not placing a hard, short leg cast in the operating room.

We identified 537 cases over a 5-year period where a short leg fiberglass cast or posterior splint was applied in the operation room and left intact for an average of 31 days post operatively. Incidence of surgical complications including infection, incision site dehiscence and DVT in the immediate post operative period was evaluated. An algorithm for identifying high risk patients who may need planned early cast removal and criteria for unplanned removal was devised and patient groups who are significantly higher risk for complication were elucidated. There was an overall undetected complication rate of 1.3% reported across all patients in our study group.

Based on these findings, a post-operative cast may be safely applied in the operating room and often left intact for the duration of desired immobilization period without significant risk of complications

Level of Evidence: Level 4

Relationship between BMI and Complications in Total Ankle Arthroplasty: A Single Surgeon's Experience in Ninety-seven Replacements

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Abstract

The purpose of this study was to compare complication rates after total ankle replacement (TAR) in two groups of patients based on their body mass index (BMI).

The total cohort was divided into two groups based on BMI. Group 1 included patients with a BMI \leq 30. Group 2 included patients with a BMI $>$ 30. Available charts were reviewed for patients who underwent primary total ankle arthroplasty. Patient demographics, BMI, prosthesis used, concomitant procedures and intra-operative and postoperative complications recorded. Ninety - seven patients who were available for follow up underwent TAR from March 2012 to July 2016. Average follow up was 26.3 months (range 12-62). Average age was 66.4 years (range 23 – 85). Average BMI was 29.6 kg/m² (range 20.6 – 49.5). Forty-three male and 54 female. Fifty-three patients in group 1 (BMI \leq 30) and 44 patients in group 2 (BMI $>$ 30) .

Total complication rates for group 1 was 18.9% (10/53) and 11.4% (5/44) in group 2. There were a total of 10 minor complications and 5 major complications. There was no statistical difference between the groups ($p = 0.308$) in terms of complication rates. All patients underwent at least one concomitant procedure at the time of the index ankle replacement.

TAR can be safely utilized in patients with BMI greater than thirty. In the present study, there was no statistical significance in complication rates in the two groups.

Level of Evidence: III

Novel Considerations for Soft Tissue and Osseous Treatment of the Ankle

Arthroscopic Evaluation of the Subtalar Joint in the Presence of Ankle Joint Pathology: A Pilot Study

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Abstract

Concomitant pathology present in the subtalar joint has not been extensively explored in current literature in the presence of ankle joint pathology. The focus of our study was to identify pathology in the subtalar joint at the time of ankle joint arthroscopy.

We performed a retrospective review of 39 consecutive patients that had undergone subtalar arthroscopy at the time of ankle arthroscopy for symptomatic ankle joint pathology. Ankle arthroscopy was performed prior to subtalar arthroscopy in all patients. Data were obtained from intraoperative arthroscopic findings that were documented in the operative note or with arthroscopic photography. Additional procedures including lateral ankle stabilization and peroneal tendon repair were recorded. The Fisher's exact test, odds ratio and 95% confidence intervals were calculated to compare the occurrence of subtalar chondromalacia and instability to ankle OCD, ankle instability and peroneal tendonopathy.

Subtalar arthroscopic examination revealed that all cases (100%) had intra-articular synovitis or capsular adhesions present. Nineteen cases (45%) demonstrated subtalar joint instability, five cases (12%) had chondromalacia and 1 case (2%) had an exostosis present. Ankle and subtalar instability were found to have statistically significant probability of dependence.

This study found that the subtalar joint was most often affected by synovitis and instability in patients with symptomatic ankle joint pathologies requiring ankle arthroscopy. There was a relatively low incidence of chondromalacia or exostosis formation in our series.

Level of Clinical Evidence: Level 4

Early Return to Activity Following "All Inside" Arthroscopic Lateral Ankle Reconstruction with Internal Brace: A Case Series and Surgical Technique

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Michael A. Howell, DPM, AACFAS

Abstract

Within the active population, lateral ankle sprains are amongst the more common injuries treated by foot and ankle surgeons. As surgical techniques have evolved, minimally invasive surgery has become a favorable option as it has been shown to decrease local tissue disruption, allow for earlier transition into physical rehabilitation, as well as decrease post-operative swelling. However, direct visualization while repairing the anterior talofibular ligament (ATFL) with arthroscopy has yet to be described.

In the current study, the authors introduce a novel all inside arthroscopic technique using 4 small stab incisions in which the repair of the ATFL is directly visualized while utilizing the Internal Brace allowing for an accelerated - much more aggressive post-operative approach with earlier return to full activity in comparison to the recently described 'all inside Brostrom' with anchor fixation.

Visual Analogue Scale (VAS) and American Orthopedic Foot and Ankle Society (AOFAS) scores showed significant improvement with early return to weight bearing and return to activity compared to traditional open techniques. A total of 8 consecutive patients with mean follow up of 52 weeks were included in this study.

Level of Evidence: 4 - A Case Series and Surgical Technique

Ankle Stabilization with Arthroscopic Versus Open with Suture Tape Augmentation Techniques

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Abstract

Ankle instability is a common problem, which often leads to surgery to stabilize the ankle if conservative methods are unsuccessful in returning the patient to full activity. Surgical ankle stabilization, including arthroscopic and open methods, has been performed with overall excellent results reported. Although initial ligament strength after repair is weaker than the native ligament, new methods of augmentation with suture tape have yielded initial strength comparable to native ligament.

The current study compares arthroscopic ankle stabilization to open stabilization with suture tape augmentation. A retrospective comparative trial was undertaken with a follow-up satisfaction survey. 55 patients were ultimately included and consisted of 43 arthroscopic patients and 12 open with suture tape augmentation patients. The average follow-up was 24.2 months in the arthroscopic group and 21 months in the open group.

There was a statistically significantly faster return to activity/sports in the arthroscopic group, 127.2 vs 170 days ($p=0.008$). Although not statistically significant, there was a trend to favor the open group in terms of revision surgery and patient satisfaction.

The current study indicated both methods of stabilization to be reasonable for ankle instability repair.

Level of Evidence: 3, retrospective comparative study

3-Dimensional Computed Tomographic Characterization of Normal Anatomic Morphology of the Distal Tibiofibular Syndesmosis

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Abstract

Malreduction of distal tibiofibular syndesmosis disruption is common and leads to poor functional outcomes with ankle surgery. The difficulty achieving anatomic alignment of the syndesmosis is due in part to variable morphology of the fibular incisura of the tibia and paucity of literature on its morphologic characteristics.

We evaluated 775 consecutive ankle computed tomographic scans from 2008-2011. Two observers performed quantitative and qualitative descriptive measures to evaluate fibular incisura morphologies and fibular orientation recording Tang ratios for fibular rotation, anterior and posterior tibiofibular distances, fibular incisura depth and subjective morphologies on computed tomography using both multiplantar reconstruction and maximum intensity projection volume rendering. We identified 5 morphologic variations of the fibular incisura of the tibia: Crescentic, Trapezoid, Flat, Chevron, Widows Peak. The most common fibular incisura morphology was crescentic at 61.3% followed by trapezoid shape at 25.1% while the least common morphology as flat at 3.1%. Interobserver variability was slightly higher for all quantitative measures on computed tomography (ICC=0.72-0.81) versus maximum intensity projection (ICC=0.64-0.75). Intraclass correlation coefficient for incisura shape and depth were poor on both modalities (0.13-0.38).

This comprehensive computed tomographic study reports on both quantitative and qualitative descriptive measures to evaluate fibular incisura morphologies and fibular orientation. This study also defines the frequency of DTFS measures and shows good to excellent interobserver performance.

Level of Evidence: 4

Calcific Insertional Achilles Tendinopathy: Functional Outcome Following Achilles Repair with Flexor Hallucis Longus Tendon Transfer

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Abstract

Calcific insertional Achilles tendinopathy (CIAT) is a relatively common musculoskeletal entity that results in significant pain and disability. There is a lack of evidence-based criteria to support the timing of operative intervention, choice of procedures, or whether equinus requires treatment. The purpose of this study was to retrospectively review the outcomes of 45 patients (48 feet) who have undergone surgical management of CIAT. All patients underwent debridement and repair of the Achilles tendon, ostectomy of the calcaneus, reattachment of the Achilles tendon to the calcaneus and Flexor Hallucis Longus (FHL) tendon transfer.

The focus includes functional patient-reported satisfaction, time to normal shoe gear, as well as the incidence of revision surgery. The overall average of time to weight bearing was 4.3 weeks. Post operatively, 73.3% (33/45) of the 45 patients responded to the question: "Would you have this surgery done again?" Of these patients, 93.9% (31/33) responded "Yes" and 6.1% (2/33) responded "Unsure." Of the same 33 patients, 84.8% (28/33) responded that they were "Very Satisfied" with the procedure and 15.2% (5/33) responded that they were "Satisfied." 26.7% (12/45) of patients did not respond to either question. One of the 12 patients (8.3%) that did not respond had bilateral procedures. None of the patients experienced tendon rupture, DVT, or the need for revision surgery. Four patients (8%) experienced a superficial infection, while one patient (2%) developed a deep infection.

Based on patient outcome scores in this study, this surgical approach appears to be an effective intervention for CIAT.

Level of Clinical Evidence

4 - Retrospective Case Series

Occurrence of Lateral Ankle Ligament Disease with Stage 2-3 Adult Acquired Flat Foot Deformity Confirmed via MRI: A Retrospective Study

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Abstract

Lateral hindfoot pain associated with stage II-III adult acquired flatfoot is often attributed to sub fibular impingement. Preoperative MRI is generally performed at our institution to assess bony and soft tissue deformity and disease pre-operatively. With these studies, we have identified a relatively high incidence of lateral collateral ligament disease.

The purpose of this study is to determine the incidence of lateral collateral ligament disease/injury associated with adult acquired flatfoot. The subjects were identified using a searchable computerized hospital database between the years 2014 to 2016. Patients with stage 2 or 3 adult acquired flatfoot deformity were confirmed via chart review and radiographic analysis. Lateral ankle ligament injury was confirmed using patient MRI results per the hospital radiologist and documented within the patients' chart. 58 patients were identified using our search parameters. Of the 58 patients, 33 patients (56%) had documented lateral ankle ligament injury on MRI, 25 patients (44%) did not. Of the 29 patients with stage II adult acquired flatfoot, 19 (66%) had confirmed lateral ankle ligament injury on MRI while 10 (34%) did not. Of the 29 patients with stage III adult acquired flatfoot, 14 (48%) had confirmed lateral ankle ligament injury on MRI while 15 (52%) did not.

This study demonstrates a relatively high incidence of lateral ligament disease/injury associated with adult acquired flat foot deformity. These findings might have long-term implications regarding ankle arthritis following surgical management of adult acquired flatfoot.

Level of Evidence: Level IV Therapeutic Study Case Series

The Influence of Surgical Approach and Syndesmotic Screw Fixation on the Development of Avascular Necrosis of the Distal Tibia Following Pilon Injury

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Abstract

Introduction: The pilon fracture is a challenging injury to manage due to complex fixation and varying severity. Reduction via screws, plates, and intramedullary nailing has been proven to disrupt extra-osseous vascular supply. Avascular necrosis in the distal tibia may indicate eventual hardware removal and potential ankle arthrodesis.

Objective: To determine predicting factors for development of avascular necrosis of anterolateral corner of distal tibia

Study design: Retrospective Cohort Study

Methods: A level I trauma center was queried for all distal tibial fractures treated with ORIF between the years of 2008 – 2012. A panel of orthopedic trauma and foot & ankle surgeons independently and consecutively examined x-rays to verify the diagnosis of pilon fracture and progression to avascular necrosis. Those classified were analyzed according to AO/OTA fracture classification, surgical approach used, and syndesmotic screw usage.

Results: Following exclusions, 56 cases of pilon fracture remained. 26 cases of AVN in the anterolateral corner of distal tibia were found. From Chi-Square Univariate analysis, 43-c3 fractures ($p < 0.01$) and anterolateral approach ($p < 0.01$) were associated with the development of AVN. A multivariate analysis with variables of syndesmotic screw usage, operative approach, smoking status, fracture classification, diabetes, and operating surgeon found significance in variables of fracture classification ($p < 0.01$) and surgical approach ($p = 0.07$) in predicting development of AVN.

Discussion: Increased fracture severity is most responsible for disruption to vasculature; however, surgical approach is also associated with the development of AVN. This study warrants further research to this topic to determine key factors of AVN in the distal tibia.

Forefoot and Midfoot Reconstruction

Evans Calcaneal Osteotomy: Assessment of Multiplanar Correction

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Abstract

Flatfoot deformity consists of a collapse of the medial arch, forefoot abduction, increased talonavicular uncoverage, and hindfoot valgus.¹⁻³ Although numerous soft tissue and bony procedures have been proposed to correct each plane of deformity, there is a lack of objective data in the literature quantifying the amount of structural correction.

The purpose of this study was to determine the multi-planar deformity correction of the lateral column lengthening osteotomy (Evans) on hindfoot alignment through objective, reproducible, radiographic measurements. We retrospectively reviewed 45 Evans calcaneal osteotomy procedures in 24 female (53%) and 21 male (47%) feet performed on 40 patients (5 bilateral). The mean follow-up was 31 weeks (range, 5 to 116). The mean age at the time of surgery was 35 years (range, 11 to 73).

Statistically significant improvement in radiographic alignment was found in the calcaneal inclination angle, tibial-calcaneal angle, tibial-calcaneal position, and talo-first metatarsal angle ($P < 0.0001$ for all). Although a direct correlation between graft size and degree of angular correction was not observed, it should be noted the calcaneal graft size (mean, 11.8 mm) and the amount of hindfoot valgus correction (mean, 12.6 °) appear to be clinically related.

The results of this study support that the Evans calcaneal osteotomy corrects the hindfoot alignment in three planes as evidenced by our multiplanar radiographic measurements.

Level of Clinical Evidence: IV

One Year Outcome Study of Anatomic Reconstruction of Lesser Metatarsophalangeal Joints

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Abstract

Background: Lesser metatarsophalangeal joint and plantar plate pathologies are commonly seen forefoot conditions. Traditional rebalancing techniques, such as capsulotomies, capsulorrhaphies and metatarsophalangeal joint (MTPJ) releases are commonly used but floating toes, digital instability and malalignment are concerning adverse effects. The purpose of this study was to critically analyze the one year outcomes of a new technique consisting of anatomic repair of the plantar plate and collateral ligaments involving lesser MTPJs.

Methodology: A retrospective cohort study of 50 consecutive patients treated with anatomic plantar plate and collateral ligament reconstruction were evaluated for lesser MTPJ imbalances due to complex hammertoe deformities between 2013 and 2016. The primary outcome was post-operative digital stability defined as a normal dorsal drawer test and normal paper pull-out test. Secondary outcomes included pre-operative and post-operative Visual Analog Scale pain measurements, MTPJ radiographic alignment and ACFAS Forefoot modules scores (includes: pain, appearance of foot, functional capacities, radiographic alignment, range of motion, digital purchase, dorsal drawer sign and presence of limp).

Results: Final follow-up revealed that 92% of patients showed improved digital stability, $P=0.0005$. Multivariate regression found a statistically significant improvement in pain reduction via the visual analog scale ($P<0.0001$) and all ACFAS Forefoot module scores (total, subjective, objective), $P<0.0001$. Of the 45 joints with pre-operative abnormal transverse plane deformity, all had either complete ($n=29$) or partial ($n=16$) radiographic MTPJ correction.

Conclusion: These results suggest that anatomic repair of lesser MTPJ improved digital stability, pain, function and radiographic alignment with greater than one year of follow-up.

Level of Evidence: IV

Structures at Risk from an Intermetatarsal Screw for Lapidus Bunionectomy: A Cadaveric Study

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Abstract

The Lapidus first tarsometatarsal arthrodesis is used for the treatment of hallux valgus. Recurrence of the deformity remains a concern. A transverse screw spanning the base of the first metatarsal to the base of the second can increase stability. The neurovascular bundle is located within the proximity of this screw.

A study was undertaken to assess the risks with this technique. In ten specimens, a guide wire was placed and a 4.0-mm cannulated screw was inserted. With careful dissection, the neurovascular bundle was inspected for trauma, and the proximity of the screw was measured using a digital caliper. There were ten specimens. The mean distance from the screw to the first metatarsal base was 11.24 mm. The deep plantar artery and deep peroneal nerve were free from injury in all specimens. The screw was measured to be within 5 mm in three specimens. In these instances, the average distance of the screw distal to the first tarsometatarsal joint was 12.1 mm. Injury to the neurovascular bundle did not occur with placement of the intermetatarsal screw, but there was close proximity.

Further study is warranted to evaluate clinical results.

Level of Evidence: 5

Factors Associated with Early Loss of Hallux Valgus Correction

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Abstract

Recurrence is common after hallux valgus corrective surgeries. While many investigators have studied risk factors associated with a suboptimal hallux position at the end of long-term follow up, few have evaluated factors associated with an actual early loss of correction.

We conducted a retrospective cohort study to identify predictors of lateral deviation of the hallux during the post-operative period. We evaluated demographic data, pre-operative severity of the hallux valgus, other angular measurements characterizing underlying deformities, amount of hallux valgus correction and post-surgical alignment of the corrected hallux valgus, for association with recurrence.

After adjusting for the covariates, the only factor associated with recurrence was the post-operative tibial sesamoid position. The recurrence rate was approximately 50% and 60% when the post-operative tibial sesamoid position was more than 4 and 5 out of the 7-point scale, respectively.

Level of evidence: III

Third Screw Fixation Versus Suture Endobutton for Transverse Plane Instability in the Modified Lapidus Arthrodesis: A Retrospective Comparative Study

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David R. Collman, DPM, FACFAS

Abstract

Traditionally, a third screw is used as an additional point of fixation for residual transverse plane instability in metatarsus primus varus following a modified Lapidus arthrodesis. Complications of third screw fixation include stress riser, painful hardware, hardware failure and removal. The suture endobutton may be an appropriate alternative to the third screw construct. To the authors' knowledge, the utility of the suture endobutton as a third point of fixation for the modified Lapidus bunionectomy has not been reported.

The purpose of this study is to evaluate the clinical and radiographic outcomes as well as the complication rate of third screw fixation versus suture endobutton for residual metatarsus primus varus in the modified Lapidus arthrodesis. A retrospective chart review of 86 patients who underwent a modified Lapidus arthrodesis requiring a third point of fixation was performed (48 third screw and 38 suture endobutton). Cases were collected from two surgeons. Radiographic measurements included first intermetatarsal angle, hallux abductus angle, and tibial sesamoid position. There was a mean follow up period of 378 days. There was 1 non-union, one metatarsal fracture and two metatarsus primus varus recurrences with the suture endobutton. Third screw complications included 2 hardware removals 5 hallux varus deformities (three requiring surgical correction) and five delayed unions. An additional surgery was performed in 5/48 patients with the third screw fixation. The rate of union for both devices were similar.

In conclusion, there were similar radiographic and clinical outcomes for both groups, however the suture endobutton group had fewer complications.

Level of clinical evidence: Level III, Retrospective comparative study

Cross-sectional Area Measurement of the Central Tarsometatarsal Articulation: A Review of Computed Tomography Scans

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Abstract

Currently there is disagreement regarding the superior method for repairing a ligamentous Lisfranc injury, arthrodesis or open reduction and internal fixation? The two procedures differ between the amount of articular cartilage destroyed; arthrodesis removes all of the articular cartilage whereas open reduction and internal fixation places transarticular screws essentially destroying a portion of cartilage.

Our project is a retrospective review of 30 consecutive computed tomography scans that included both foot length and undamaged 1st, 2nd, and 3rd tarsometatarsal joints in order to quantify the amount of articular surface area destroyed by placement of the standardized 4mm diameter screws.

Measurements were performed using a freeform tool. The calculated surface area of the screws was subtracted from the measured surface area of the joint to yield the amount of surface area occupied by the screws. Our results demonstrated that the average amount of articular surface area destroyed in the 1st, 2nd, and 3rd tarsometatarsal joints were 4.87%, 4.79%, and 4.86% respectively, with a standard deviation of less than 1% for each of the joints.

Our results demonstrated that screw placement accounts for only a small percentage of articular surface destroyed. They also showed that the articular surface damage was comparable between the first three tarsometatarsal joints. Additionally, our results were similar to the articular surface area calculated from cadaveric specimen in a previous biomechanical study[1], thus demonstrating that computed tomography can allow for reliable and accurate assessments of articular surface areas in the foot.

Level of Clinical Evidence: 2

Combined Medial Column Arthrodesis with Open Reduction Internal Fixation of Central Column for Treatment of Lisfranc Fracture-Dislocation: A Retrospective Review of Consecutive Cases

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Abstract

Lisfranc fracture-dislocations can be devastating injuries with significant long-term sequelae with or without surgical intervention. The main goal of treatment is to minimize common long-term complications including pain, progressive arch collapse, DJD, hardware failure, and reoperation. Partial primary fusion involving the first, second, and third tarsometatarsal joints has become a common approach for primarily dislocation injuries with ORIF favored for Lisfranc injuries involving fracture. ORIF commonly requires revision surgery for hardware removal or delayed fusion. Major revision creates hardship for the patient due to prolonged recovery and even “simple” hardware removal can be traumatic to local nerve, artery and tendon structures. A common injury pattern includes the combined findings of primarily dislocation and instability of the first tarsometatarsal joint with oftentimes comminuted fracture to the second and third tarsometatarsal joints which does not fit the standard surgical approach.

We report a retrospective review of our preferred surgical approach consisting of medial column primary arthrodesis combined with central column ORIF and lateral column temporary pinning. We undertook an institutional review board-approved retrospective review of 35 consecutive Lisfranc injuries treated with this hybrid approach. Average follow-up time was 22.14 months. All but two patients had radiographic evidence of union at 10 weeks. Complications were identified including three with neuritis, one with medial column nonunion that was treated with a bone stimulator and one with revision of second metatarsal nonunion.

The present retrospective series highlights our experience with isolated primary fusion of the medial column in both subtle and obvious Lisfranc injuries.

Level of Clinical Evidence: 4