Intra-articular Distal Tibia Fractures: Maximizing Outcomes

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Avoiding complications: staged approach — protects soft tissues; poor timing of surgical intervention guarantees poor outcome; wait ≥10 days (240 hr) before definitive fixation

Early stage: place transarticular ex fix and fix fibula to stabilize soft tissues

Goals: restore skeletal length; span joint and distract across ankle joint to stabilize soft tissues; plate fixation of fibula requires anatomically correct alignment; malreduction prevents correction of articular displacement

Timing: fix fibula when ex fix placed; delay fibular fixation if swelling significant, if another physician will definitively fix tibia, or if unsure of fixation approach

Technique: place temporizing fixator with pins in tibia and calcaneus; distract fracture; check length, alignment, and rotation; examine fluoroscopy; assess articular landmarks; talus belongs under anterolateral fragment; plate compression dressings under frame; wait until soft tissue ready for surgery (2-6 wk); look for resolution of edema, wrinkling of skin, and reepithelialization of fracture blisters

Late stage: definitive articular reconstruction and removal of fixator; goals — avoid complications; anatomically restore joint with stable fixation to allow motion and maximize function

Understanding injury: obtain good radiographs and computed tomography after placement of ex fix; fracture fragments — anterolateral, medial, and posterior; typical areas of comminution and impaction — comminution laterally between anterolateral and posterolateral fragment; impaction or free fragment near axilla or medial side; central impaction or free fragment from posterior fragment

Characteristics of fibula fracture: compression failure — limb in valgus; multifragmented comminution; tension failure — simple transverse fracture patterns; varus ankle position; intact fibula — complex articular injury or simple fracture pattern

Choosing correct incision: cheat fibular incision posterolateral to allow more fixation options; mechanically appropriate fixation — medial or anterolateral approach most common

Compression failure: place lateral plate to prevent valgus collapse; fixation strategy — begin with posterolateral fragment;
initially fix posteromedial to posterolateral fragment; reduce central impaction; reconstruct articular surface; bring anterolateral fragment down with wires; perform definitive fixation

Tension failure: medial support required to prevent varus collapse; may also require small lateral incision for anterolateral impaction; fixation strategy — fix from medial side; approach and fixation for joint and articular surface may differ from approach and fixation required for biomechanics; minimize dissection by sliding plates up with percutaneous screw fixation

Postoperative protocol: cast until sutures removed (≈3 wk), followed by CAM Walker until neutral position maintained; avoid bearing weight for 8 to 12 wk; patients improve (subjectively) for 2.5 yr

Instability of Syndesmosis Following Ankle Fracture

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Background: inadequate or incomplete treatment of rotational ankle fractures can lead to chronic instability of syndesmosis; presentation — lateral tilt, widening of syndesmosis, loss of joint space, pain, and deformity

Causes of instability: fibula not restored to length; rotation not corrected; residual translation (loss of lateral buttress effect and loss of lateral loading of fibula increase strain on deltoid and change contact forces); lack of posterior tibiobular ligament activation when restoring fibular length after posterior malleolar fracture (creates posterolateral deficit in tibial plafond)

Case 1: high fibular fracture; difficult to reduce lateral malleolus into tibial incisura; squeezing medial to lateral and moving fibula into notch in oblique plane increases risk of driving fibula anteriorly or posteriorly (more common) out of notch

Case 2: lateral malleolar fracture or deltoid-equivalent bimalleolar fracture; weight-bearing films 3 to 4 mo later show diastasis and periosteal change from avulsion of posterior tibiobular ligament; stress testing — perform Cotton test (assess interosseous membrane and posterior and anterior tibiofibular ligaments) and/or external rotation abduction test after fixation; maintain high index of suspicion to avoid missing instability of syndesmosis

Case 3: fibula restored to normal length; syndesmotic screw removed at 3.5 to 4.5 mo; patient returns with anterior ankle pain; partial to complete tears of anterior tibiobular ligament and partial injuries to interosseous membrane can present with stable syndesmosis; eventually present as syndesmotic instability and pain

Surgery: goals — restore fibula to length; correct rotation; reduce fibula into tibial incisura (chronic cases require removal of scar tissue from incisura); repair or replace syndesmotic ligaments or consider arthrodesis; maintain reduction; previous studies suggested tibiobular arthrodesis or syndesmotic fusion limit ankle and fibular motion; fusion recommended for incongruent ankle associated with instability and chronic diastasis

Study: Olson et al (2011) performed retrospective study of patients with chronic syndesmotic diastasis from rotational ankle fracture

Methods: assessed radiographic and functional outcomes after reduction and fusion of syndesmosis; 10 patients presented with activity-related anterolateral ankle pain with radiation along interosseous membrane; performed fibular osteotomies and medial ankle joint debridements; fusion maintained reduction of syndesmosis

Results: medial clear space reduced from ≈6 mm to ≈2 mm; statistically significant correction of talar tilt in trimalleolar fractures; talocrural angle demonstrated fibula brought out to length; no radiographic progression of ankle arthritis; functional outcomes — American Orthopaedic Foot and Ankle Society ankle hindfoot scores significantly improved from 37 (preoperative) to 85 (postoperative); pain scores improved; no change in ankle or hindfoot range of motion; complications — symptomatic hardware and anterior ankle impingement (one patient each); no patient has required ankle fusion

Conclusion: syndesmotic arthrodesis salvages chronic instability in setting of ankle arthritis; may postpone need to convert to ankle arthrodesis

The Adult Acquired Flatfoot

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Background: management controversial; etiology of flatfoot (FF) deformity — posterior tibial tendon dysfunction (PTTD); concomitant hindfoot and midfoot arthritis; idiopathic with malleolar hypermobility; approach — individualize treatment; assess stage, location, extent, and plane of deformity; consider patient’s size, activity level, and comorbidities; classification — PTTD divided into 3 stages; stage 2 incompetent tendon with supple hindfoot; stage 3 rigid arthritic hindfoot; deltoid insufficiency has role in FF; medial column contributes to FF via hypermobility or foot with residual forefoot varus when heel placed in neutral position

Evaluation: double heel raise assesses subtalar flexibility; single heel raise assesses posterior tibial tendon; look for “too many toes” sign; no inversion of heel with pathologic FF; identify location of deformity (ie, hindfoot and/or midfoot); determine plane of deformity; measure anterior talometatarsal angle on AP radiograph; determine Meary metatarsotalar angle and fifth metatarsocuneiform height on lateral radiograph; diagnosis — made from weight-bearing films; mainly clinical diagnosis

Nonoperative treatment: immobilize with stirrup splint, boot, or cast; consider nonweight-bearing status; bracing — consider semirigid orthotic, Arizona ankle brace, ankle-foot orthosis (AFO), or double upright AFO

Operative treatment: substitution of flexor digitorum longus (FDL) — alone inadequate treatment for PTTD in stage 2 deformities; remove diseased posterior tibial tendon; address talonavicular or spring ligament tears; harvest FDL inferi- orly and bring up through hole in navicular for repair; alternatively, biotenodesis or interference screw can be used to repair tendon directly to navicular
Calcaneal osteotomy: adjunct to posterior tibial tendon repair
Medial displacement calcaneal osteotomy (MDCO): translates gastrocnemius soleus complex medially; provides static and dynamic support; corrects arch in cadaveric model; decreases deltoid ligament strain; shifts support toward medial side of ankle and foot; clinical results good

Lateral column lengthening: corrects FF deformity; powerful corrector of abduction; allows supination of foot; can result in elevation of medial column; consider lateral column lengthening (Evans calcaneal lengthening) or calcaneocuboid distraction arthrodesis for severe deformity; lateral column lengthening can increase calcaneocuboid pressure while limiting talonavicular and subtalar motion; associated with lateral foot pain; clinical outcomes — Toolan et al (1999) reported high degree of sural neuritis; high rates of nonunion also reported; Mosier-LaClair et al (2001) reported 14% of patients developed calcaneocuboid arthritis; radiographic outcomes — Bolt et al (2007) showed significant improvement in angular correction with lateral column lengthening compared to MDCO

MDCO vs lateral column lengthening: MDCO strongly corrects valgus in abduction with minimal complications; use
lateral column lengthening if MDCO results in undercorrection; perform distraction arthrodesis for preexisting arthritis or short anterior calcaneus.

Arthroereisis: alternative to lateral column lengthening; insert sinus tarsi implant with small incision; morbidity lower; keeps future options available; patient selection important; correction not as powerful; use for supple hindfoot deformity with <50% of talonavicular uncovering; useful in congenital FF supple deformity (not coalition) in adolescents or adults; efficacious as adjunct to Kidner foot procedure and MDCO.

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**Suggested Reading**

1. Which of the following statements explain(s) why intramedullary nailing of tibia fractures can be technically difficult?
   (A) The intramedullary canal is tight in the middle third but capacious proximally and distally
   (B) Deforming muscular forces around the knee can create valgus and procurvatum (flexion) deformities
   (C) Traditional positioning increases the risk for malalignment
   (D) All the above

2. Selecting a starting point to ream just off the _______ aspect of the lateral tibial spine and in line with the anterior cortex reduces the risk of valgus and flexion deformity for _______ tibia fractures.
   (A) Medial; proximal
   (B) Lateral; distal

3. To achieve the best outcome, fixation of the fibula should occur immediately after the injury regardless of soft tissue inflammation.
   (A) True
   (B) False

4. All the following are fibular characteristics observed with high-energy distal tibial fractures, except:
   (A) Compression failure
   (B) Tension failure
   (C) Rotational failure
   (D) Intact fibula

5. Chronic instability of ankle syndesmosis presents with which of the following findings?
   1. Lateral tilt
   2. Narrowing of the syndesmosis
   3. Loss of joint space
   4. Pain and deformity
   (A) 1,3
   (B) 2,4
   (C) 1,3,4
   (D) 1,2,3,4

6. Which of the following factors contribute to syndesmotic instability of the ankle?
   1. Fibula not restored to length
   2. Failure to correct rotation
   3. Residual translation
   4. Lack of posterior tibiofibular ligament activation
   (A) 1,3
   (B) 2,4
   (C) 1,2,3
   (D) 1,2,3,4

7. Which stress test assesses the interosseous membrane and the posterior and anterior tibiofibular ligaments?
   (A) Cotton test
   (B) Anterior drawer test
   (C) External rotation and abduction test
   (D) Balance test

8. Syndesmotic arthrodesis salvages chronic instability in the setting of ankle arthritis and may postpone need to convert to ankle arthrodesis.
   (A) True
   (B) False

9. Etiologies for the adult acquired flatfoot deformity include all of the following, except:
   (A) Posterior tibial tendon dysfunction
   (B) Hindfoot and/or midfoot arthritis
   (C) Lateral column hypermobility
   (D) Deltoid ligament insufficiency

10. Which of the following complications is(are) associated with lateral column lengthening in the treatment of adult acquired flatfoot?
    (A) Sural neuritis
    (B) Nonunion
    (C) Calcaneocuboid arthritis
    (D) All the above

Answers to Audio-Digest Orthopaedics Volume 36, Issue 05: 1-A, 2-A, 3-C, 4-A, 5-D, 6-B, 7-A, 8-B, 9-C, 10-D