Geriatric Ankle Fractures

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Objectives

- Prevalence of Geriatric Ankle Fractures
- Unique Challenges
- Treatment Options
- Outcomes
- Case Examples

https://www.freepik.com/free-vector/active-elderly-people-concept-illustration_9558509.htm

Geriatric Ankle Fractures

- American Population is Rapidly Aging
  - 15% of population currently over the age of 65
  - 20% By 2050

- Advances in Technology and Medicine resulting in an aging population with continuously increasing activity levels

Increased number of injuries with increasing activity levels

- 1 in 4 Adults over the age of 65 experience at least one fall per year
- Nearly 40% of these falls result in an injury requiring medical treatment.
- In 2015, the total medical costs for falls totaled more than $50 billion. Medicare and Medicaid shouldered 75% of these costs.

Geriatric Ankle Fractures

- Ankle fractures are third most common fracture among geriatric patients behind hip and wrist fractures

- 8.3 per 1000 Medicare patients experience and ankle fracture yearly

Challenges in Treating Geriatric Patients

- Large, Heterogenous Population
  - Not all 65 y/o created equal
  - Not all 90 y/o created equal
- Multiple Medical Comorbidities
  - Medicare patients >65 have on average 4 medical comorbidities
- Poor Bone Quality
- Treatment Must Match Patient – Maximize benefits while minimizing complications.

Challenges in Treating Geriatric Patients

- Unlike fractures about the hip and wrist in elderly patients, ankle fractures thought to be related to factors other than poor bone quality.
  - No correlation of ankle fractures to diagnosis of osteoporosis
  - Propensity to fall – i.e. Poor balance, poor coordination with inability to protect self/recover while falling.
  - Increased obesity
  - **Poor bone quality plays a major role when planning treatment/fixation techniques

Treatment Goals

- Stable Joint
- Ability for Patient to perform/participate in ADL's as soon as possible
- Minimize Complications

Historical Treatment

- Non operative treatment was previous mainstay
  - Avoid chance of surgical complications
  - Decreased demands allow more tolerance with non-operative treatment compared to younger cohorts. --FALSE
- Up to 21% Complication Rate with Surgical Fixation
- Salai et al. – Higher AOFAS scores with non-operative treatment
  - **Patients with poor reduction or who lost reduction were moved to surgical group.
  - **Patients in surgical group likely had more severe injuries leading to worse AOFAS scores

Disadvantage of Non-Operative Management

- Limited Mobility
  - Delayed Rehab
  - Increase risk of complications related to immobility
    - Pulmonary Issues
    - Blood Clots
    - Bed Sores
- Increased duration of splinting/casting
  - Requires diligent skin care, frequent radiographs and adjustments to splinting/casting
  - Increased chance of casting complications, especially given increased incidence of sensory deficits with elderly population (Neuropathy)
- **<u>** 48%-73% Historical Rate of Malunion and Nonunion</u>**

Operative Treatment

- Improved intrinsic stability
- Decreased time to rehab
- Decreased duration of immobilization
- 85% of patients return to pre operative level of function

Disadvantage of Operative Management

- Up to 20% complication rate
- **10% wound complication rate**

Operative Vs Non Operative Management

- Increased mortality with non operative management
  - Increased hospital readmission with operative treatment
  - 2x Increase in mortality of hospitalized Medicare patients with ankle fractures treated non operatively.
- 85% return to previous levels of function after operative treatment
- Improved range of motion and functional outcomes with operative treatment
- Outcomes of operative treatment similar to those expected with treatment of younger cohorts.

Initial Work Up

- Thorough History and Physical
  - Comorbidities
  - Previous level of function
  - Soft Tissue Envelope
    - Significant increase in mortality with open fracture
- X-rays
  - Standard orthogonal x-rays
  - Stress Images
- Advanced Imagining – low threshold

Radiographs – Complete Orthogonal Films

- AP Mortise Lateral

- Imperative to determine stability
  - Stable Pattern Allows Early Weightbearing with Non-Operative Management

Radiographs – Stress Exam

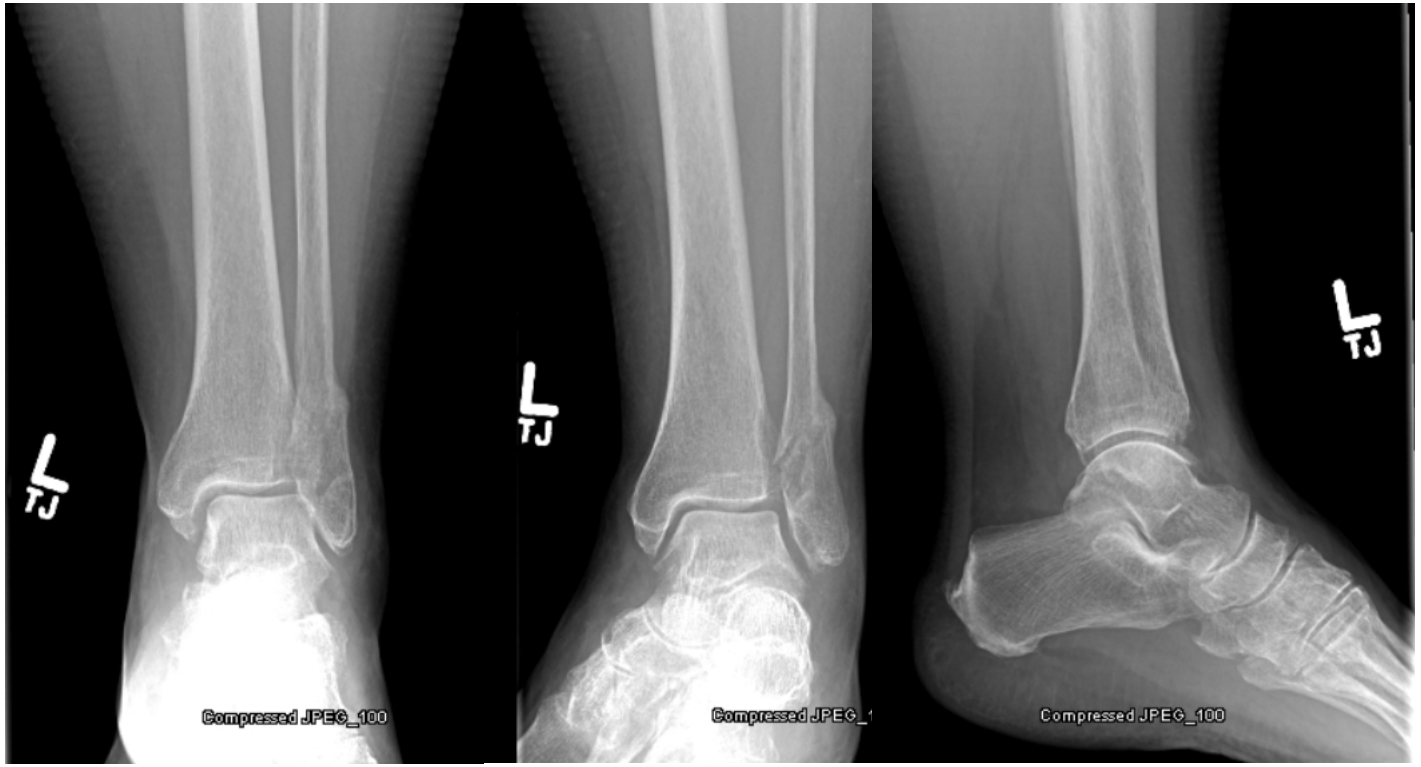
- Non-Weightbearing

- WB films demonstrate no instability

- Weightbearing

- Patient Treated with Weightbearing as tolerated with removal orthosis

3 Months Post Injury



Radiographs – Stress Exam Cont

- Gravity Stress External Rotation Xrays

- Non – Stress

- Gravity Stress

- Increased medial clear space with stress indicating instability

3 Months Post op

- Surgical Treatment Chosen to decrease duration of immobilization and timing to weightbearing
- No instability noted intra operatively after fixation. Allowed to WB with removable orthosis at 2 weeks post op once incision healed.

Advanced Imagining

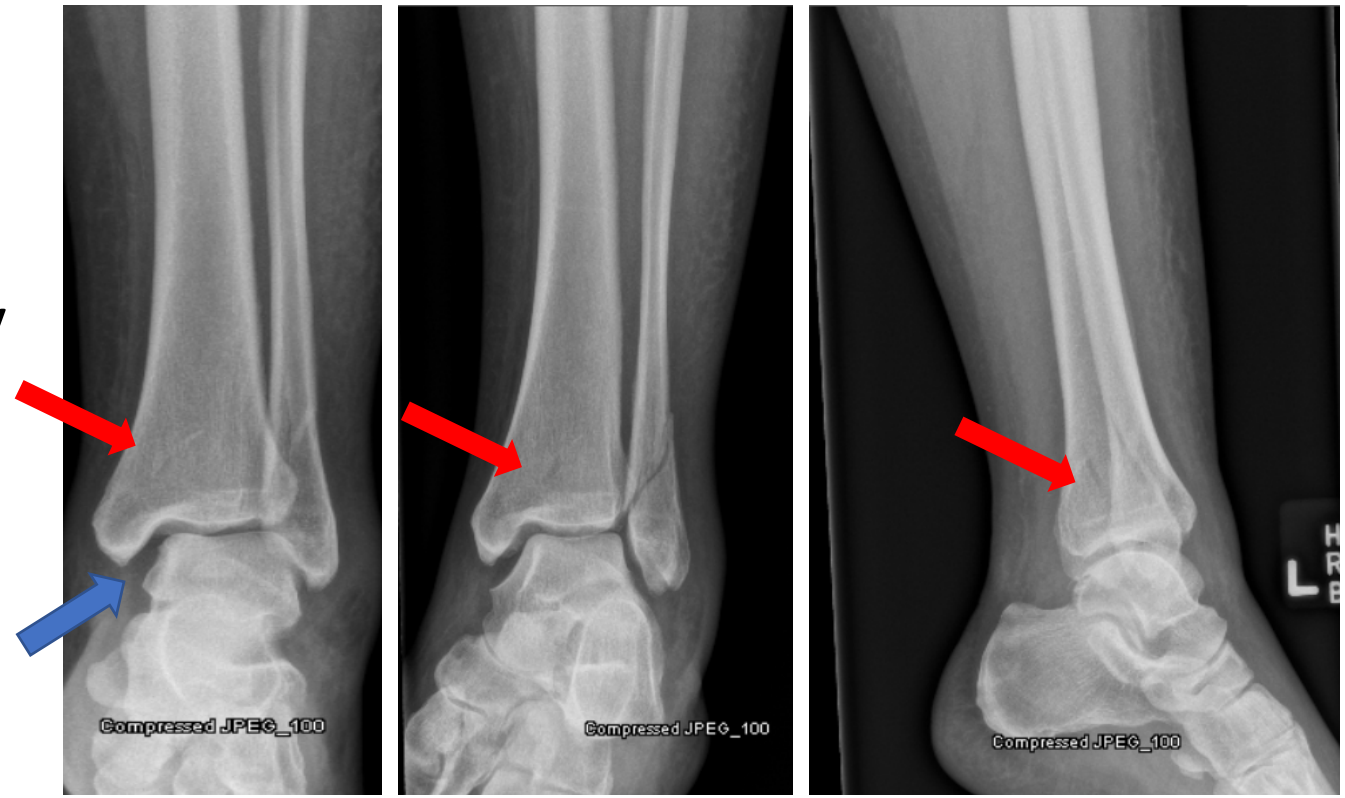
- Often X rays alone not sufficient alone to guide treatment
  - Increased incidence of comminution comparted to younger patients
  - Poor bone quality/Large soft tissue envelope leading to poor penetration
  - Difficulty positioning
  - Chronic Degenerative changes/Previous injuries
- CT scan often required to further delineate injury and guide treatment
  - Improved Assessment of Syndesmosis and Posterior Mal
  - Patients more likely to be hospitalized due to injury and treatment guides discharge planning

CT Scan

- Low energy fall, presented 3 days after injury due to continued pain with weightbearing
- Evidence of Possible Instability
- Concern for more complex injury

CT Scan

- Low energy fall, presented 3 days after injury due to continued pain with weightbearing
- Evidence of Possible Instability
  - Blue Arrow
- Concern for more complex injury
  - Red Arrow



CT Scan – Cont.

- Large Posterior Mal Fragment
- Decision made for posterior fixation to stabilize PITFL
- Potentially allow early weightbearing

Early WB allowed Once Incisions Healed

Fixation Techniques

Fixation Goals

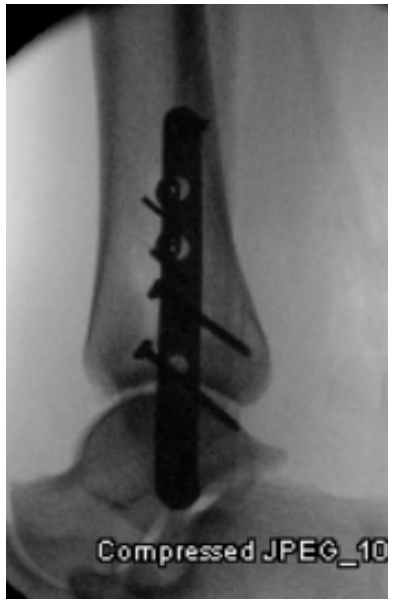
- Anatomic Alignment
  - Length/Alignment/Rotation
- Minimize Soft Tissue Compromise
- Optimize fixation construct to ensure best chance of healing while allowing for early mobilization
- **Fracture Pattern Ultimately Dictates Fixation
- **No two patients are alike. Each has unique treatment goals and challenges.

Fixation Techniques

Fibular Fixation

Plate Position – Lateral vs Posterior Lateral

- Lateral
  - Neutralization
  - Reduce with clamps, lag, place plate



- Posterior Lateral
  - Antiglide
  - Can utilize plate to assist with reduction if bone quality allows
  - Lag through plate

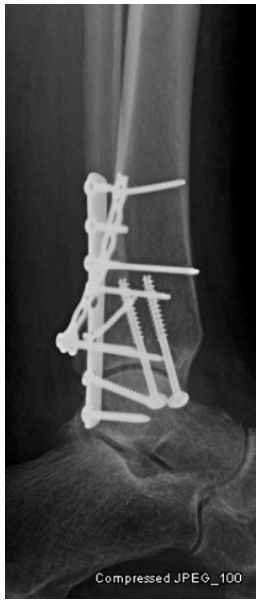


Plate Position – Lateral vs Posterior Lateral

- Lateral position with standard plates biomechanically inferior
  - Especially evident in osteoporotic bone
- Posterior plating allows longer screws, possible bicortical fixation distally in fibula
- Lateral plate allows placement of syndesmotic fixation through plate for unstable injuries or to augment fixation.
- Lateral plate can lead to symptomatic hardware
- Posterior plate can cause peroneal tendon irritation

Locking Vs Non-locking

- Risk of ankle fracture not correlated with diagnosis of osteoporosis but osteoporosis has profound affects on bone strength and healing after fixation
- 10 million adults in United States meet criteria for Osteoporosis
  - Results in Qualitative and Quantitative Changes to Bone
  - Increased risk construct failure including-
    - Loss of reduction
    - Screw pull out
    - Periarticular fracture

Advantage of Locked Plates In Osteoporotic Bone

- Improved pullout strength
- Angular stability
- Higher torque to failure
- Pre-contoured periarticular plates allow increased number of screws distal to fracture site

- Disadvantages –
  - Increased Cost
  - Implants often bulky and can lead to hardware prominence
  - ***<u>Differences only noted in osteoporotic bone</u>***

Intramedullary Fixation

- Alternative to traditional distal fibula plating
- Commercial implants, flexible intramedullary nails, standard cortex screw (i.e. 3.5mm fully threaded screw)
- Can be placed with minimal tissue disruption in cases of poor tissue quality
- Biomechanically similar to standard plate constructs
- Multiple studies demonstrating good long term outcomes with maintenance of reduction, good functional outcomes, and low rates of complications.
- **Small Learning curve, not appropriate for all fracture patterns, high implant removal rates in some studies

Intramedullary Fixation – Cont.

- 94yo female low energy fall
- Poor soft tissue envelope
- Decision to treat with fibular nail to minimize soft tissue dissection
- **Also small posterior fragment noted
- Intramedullary nail allows placement of syndesmotic fixation to improve stability of construct

Intramedullary Fixation – Cont.

Fibula Fixation – Other Options

- Augmented Fixation
- Dual Plating Constructions
  - Posterior/Lateral Plating with additional anterior plate (mini-frag)
  - Captures Wagstaff fragment
- Nail/Plate Combinations
  - Intramedullary K-Wires can provide interference to allow better screw purchase while adding strength
- Quad-Cortical Fixation
  - Augment fibula fixation with screws extending into tibia with or without syndesmotic destruction

Fixation Techniques

Medial Malleolus Fixation

Medial Malleolus Fixation

- Isolated medial fractures rare
  - Obtain stress exams/CT scan to ensure stability
  - Follow closely clinically for signs of instability

- Bimal and Trimal fractures typically unstable
  - Determine patient fitness for surgical intervention
- **Medial skin frequently compromised**
- **Fracture Pattern Determines Fixation**

Medial Malleolus Fixation

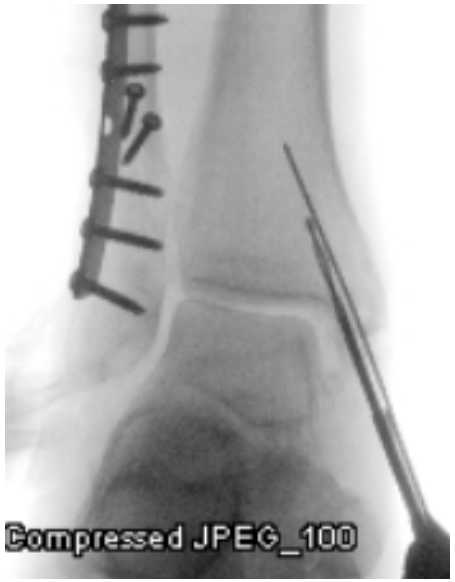
- Majority of medial fractures treated with fixation perpendicular to fracture plane
- Must pay close attention to bone quality and size of fragment requiring fixation during pre op planning so not to compromise construct

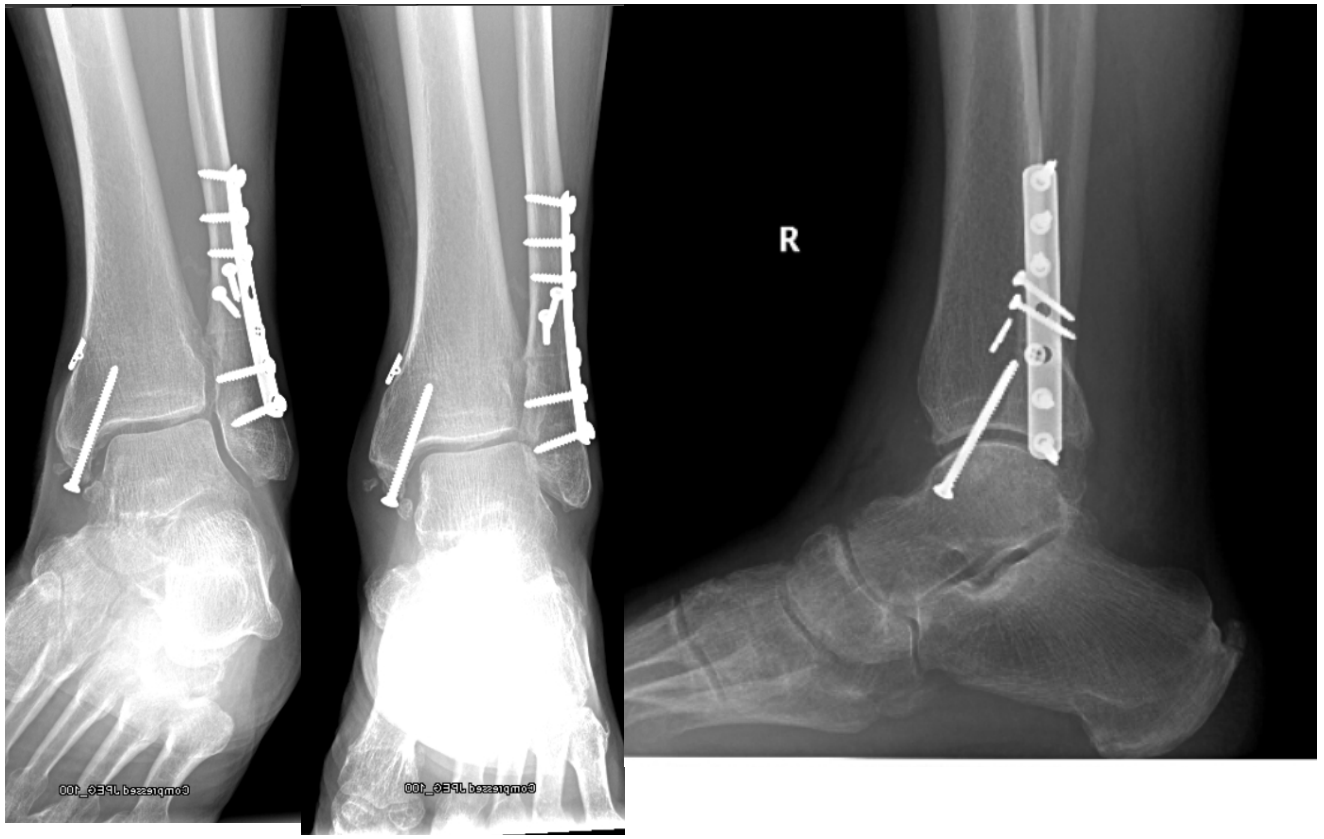
- Tri-mal fracture
- Medial fragment large and amenable to fixation with two 4.0 Cannulated screws

- Reduction directly visualized
- K wires placed for reduction and cannulated screw placement

- History of previous trauma
- Small medial fracture
- Only enough bone for single 3.5mm screw

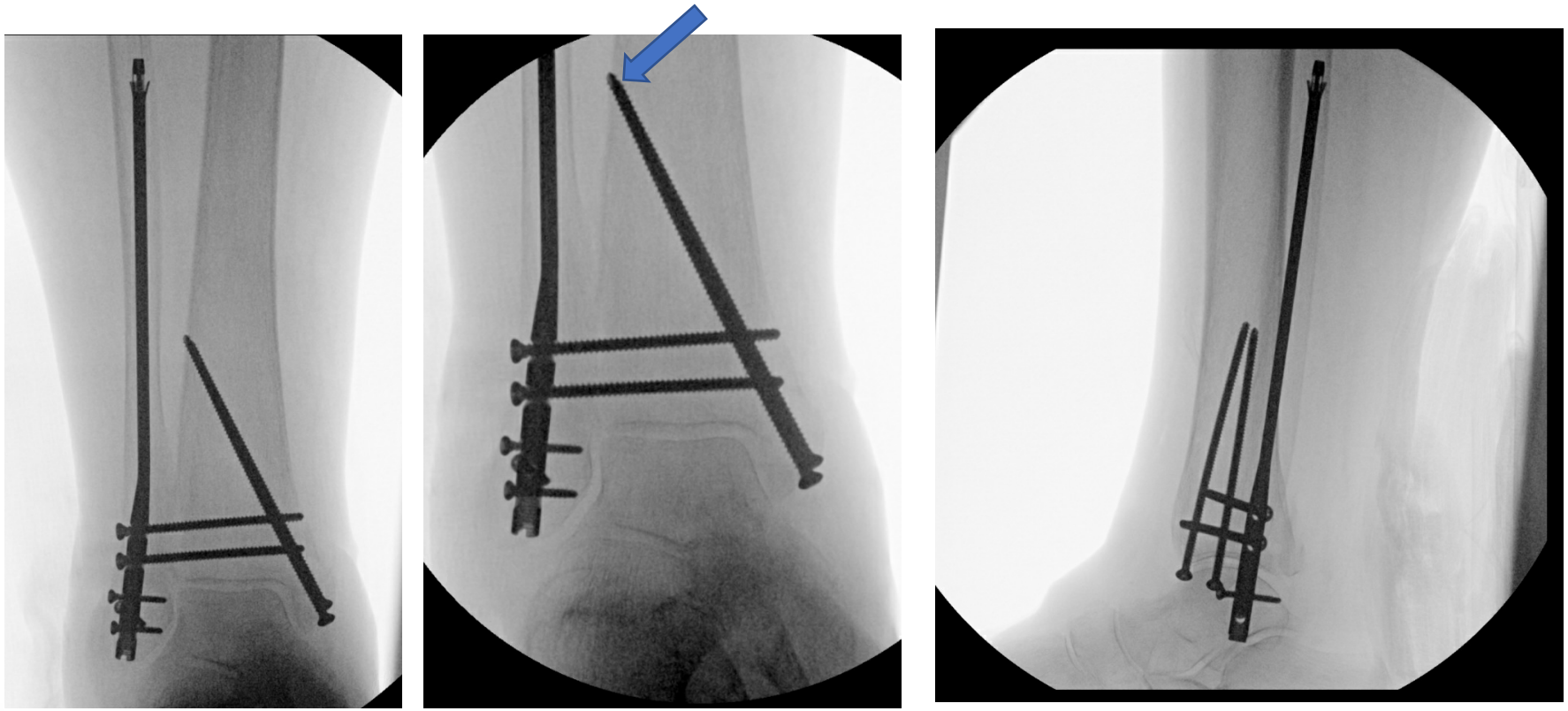
- Compression with clamp and rotation control with supplemental small K-wire





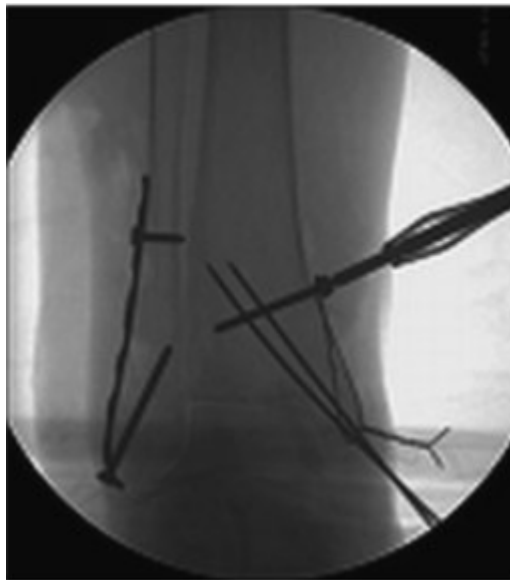
Bicortical Fixation

- Increase strength of medial fixation with bicortical fixation



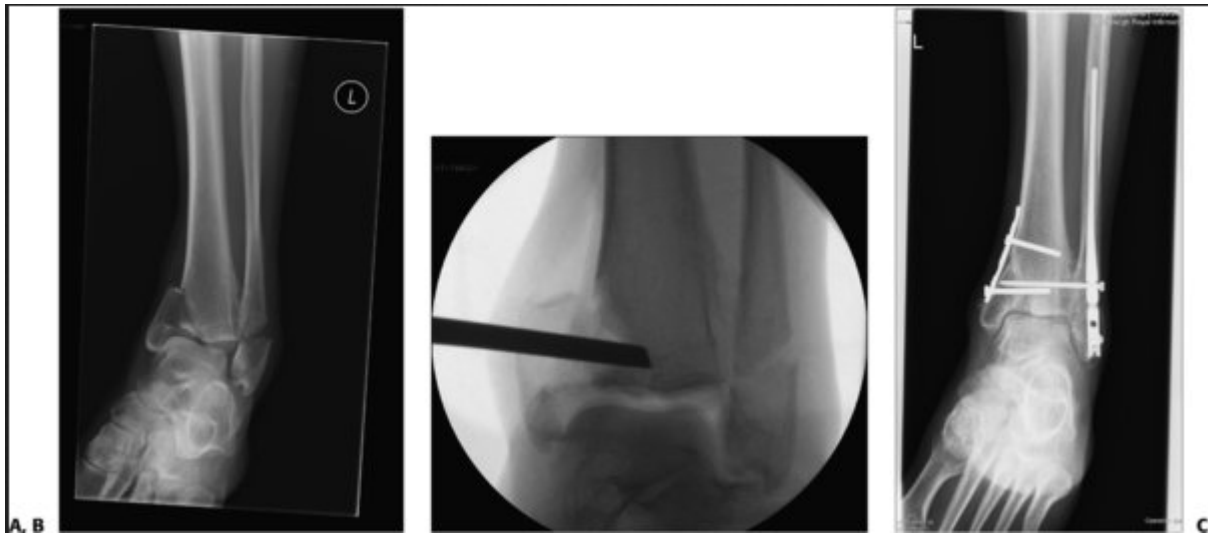
Tension Band Construct

- Especially useful with small or comminuted medial fracture patterns
- K Wire fixation allows capture of diminutive fragments and tension allows compression of fragments as a unit
- Can be done with limited soft tissue stripping



Supination Adduction Pattern

- Cannot miss
- Shear pattern leads to rapid loss of fixation if not addressed appropriately
- Often large intra articular impaction medially that must be addressed



Non-operative

- At times, medial skin will not allow fixation
  - Stage, fix lateral/posterior components and return when soft tissue is amenable
  - Percutaneous fixation
  - Stabilization of lateral/posterior and conservative treatment of medial side

Non-operative – 89yo F B/L ankle fractures

- Closed skin over medial mal on left but significantly swollen and very tenuous. Not amenable to surgical intervention.

Cont -

- Fibula nail with syndesmotic fixation utilized, minimal instability appreciated
- No medial skin issues and patient did not require return trip to operating room

Fixation Techniques

Posterior Malleolus and Syndesmosis

Syndesmosis Fixation

- Same principles for all ankles regardless of age
- Determine stability
  - X-ray entire tibia
  - Look for any medial clear space or tib/fib widening
  - Obtain contralateral ankle x-rays
  - Stress X-ray
  - Very low threshold to CT
- Missed syndesmotic injury can lead to poor patient outcomes

Syndesmosis Fixation

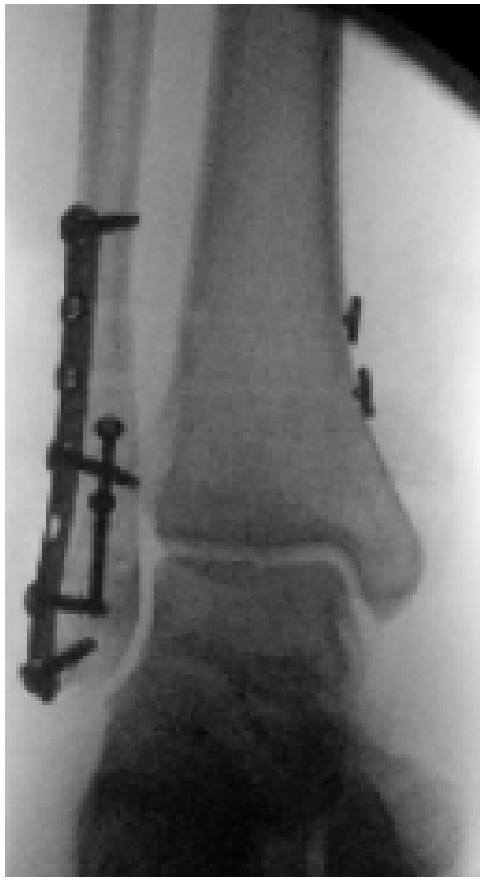
- Fixation Technique – Surgeon Choice
  - Reduction Technique
    - Open vs closed
    - Ankle position at time of fixation
    - O-Arm?
  - Screw Fixation
    - 1 or 2 screws
    - 3 or 4 cortices
    - Remove screws or leave
  - Suture Fixation vs Screw Fixation

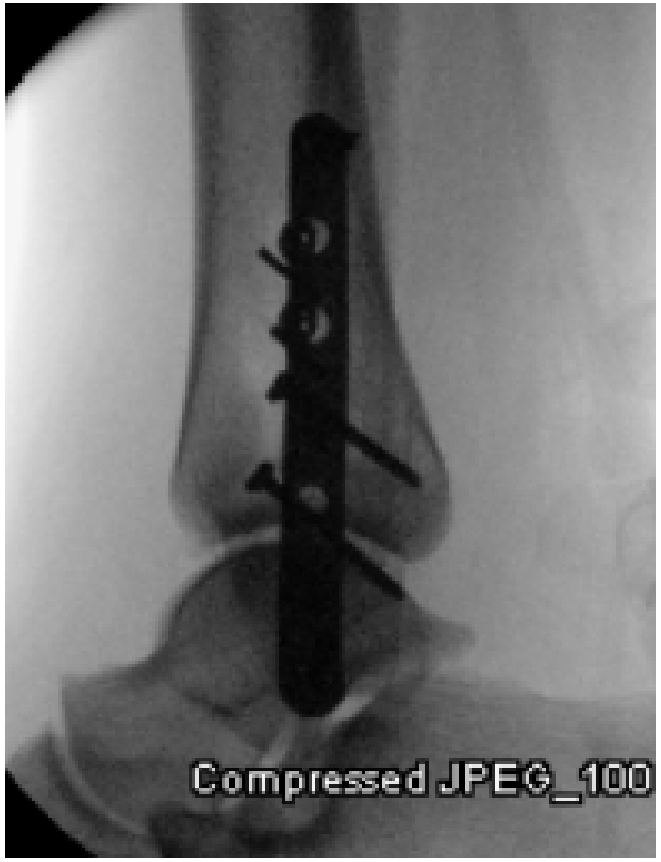
Syndesmosis – Authors preferred Algorithm

- Reduction hand tight with ankle in neutral flexion
  - Pin in place with K wire outside of planned fixation
  - Confirm with x-ray and direct visualization anterior when possible
  - Compare to contralateral ankle
- Determine bone quality and fracture pattern
  - Preference to use suture fixation
  - Comminuted fibula fracture and/or poor bone quality →Screw Fixation
    - Two screws through lateral plate to improve strength of fibula construct and syndesmotic fixation
    - Four cortices to increase strength and aide in removal if needed in future
    - In geriatric population, no plan for removal of screws. Counsel patient they may break once healed

- Lateral Mal Fracture with evidence of syndesmotic injury
- Remained unstable after fibular fixation
- Good bone quality, no fibular comminution

- Suture Fixation of syndesmosis performed
- Stabile on stress exam afterward





Posterior Malleolus Fracture

- Plays role in overall ankle stability
  - Attachment point of PITFL

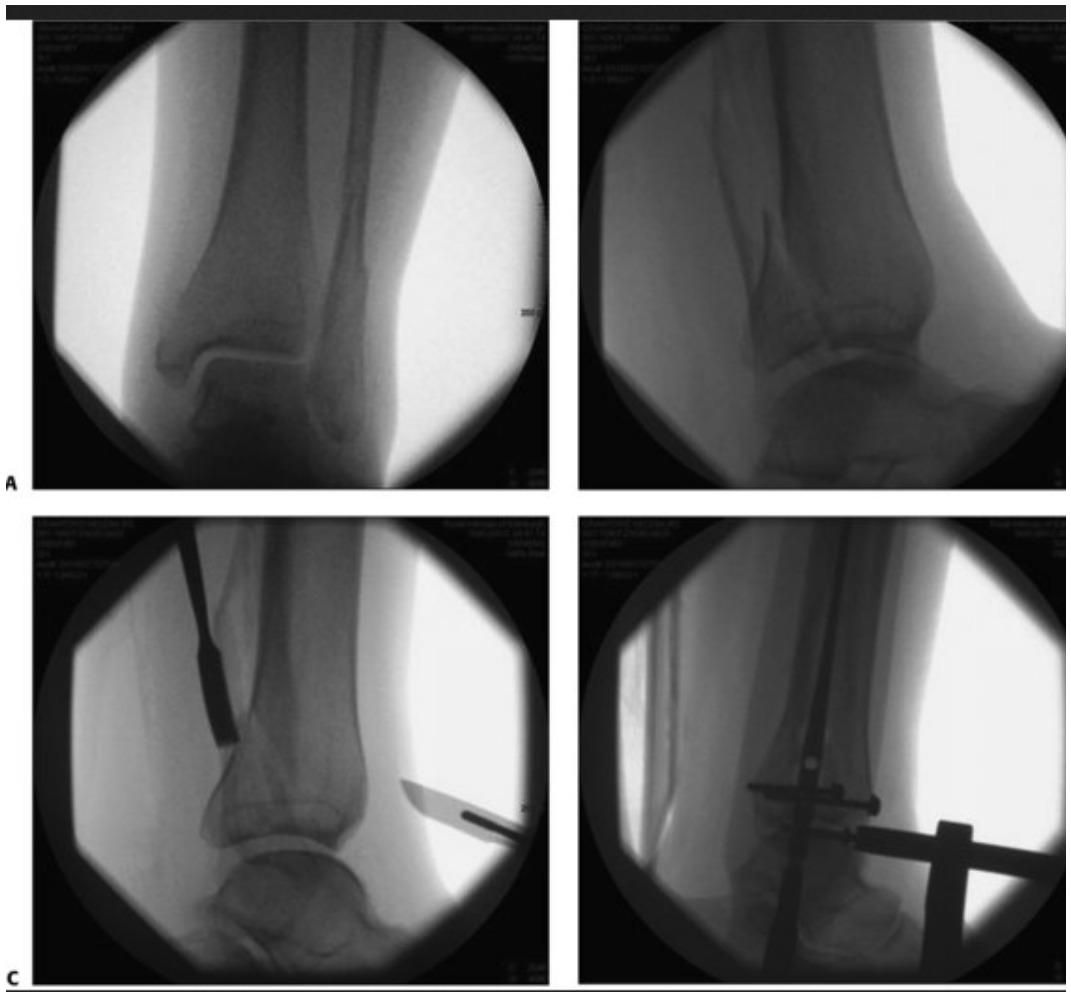
- Fixation technique dependent on fragment size, location, and often times more important patient comorbid conditions and soft tissue envelop.

Posterior Malleolus Fracture - Options

- Direct Reduction with plate and screw construction
  - Most stable fixation
  - Often allows for anatomical reduction with direct visualization
  - In some instances can allow for earlier weightbearing
  - **Requires prone or lateral positioning (patient may not tolerate, makes medial fixation more challenging)
  - **Increased soft tissue dissection required, increased operating time
- Indirect reduction and fixation with Anterior to Posterior screw fixation
  - No need for special positioning
  - Minimal soft tissue injury
  - **Reduction more difficult
  - **Risk of neurovascular injury with anterior dissection
- Stabilization of ankle with syndesmotic type fixation and no fixation of posterior fragments
  - Minimal extra soft tissue dissection, no special positioning, no risk of anterior NV injury
  - **Risk of syndesmotic mal reduction
  - **Often requires longer immobilization than other techniques

Posterior Malleolus Fracture -

- Indirect reduction and fixation with Anterior to Posterior screw fixation

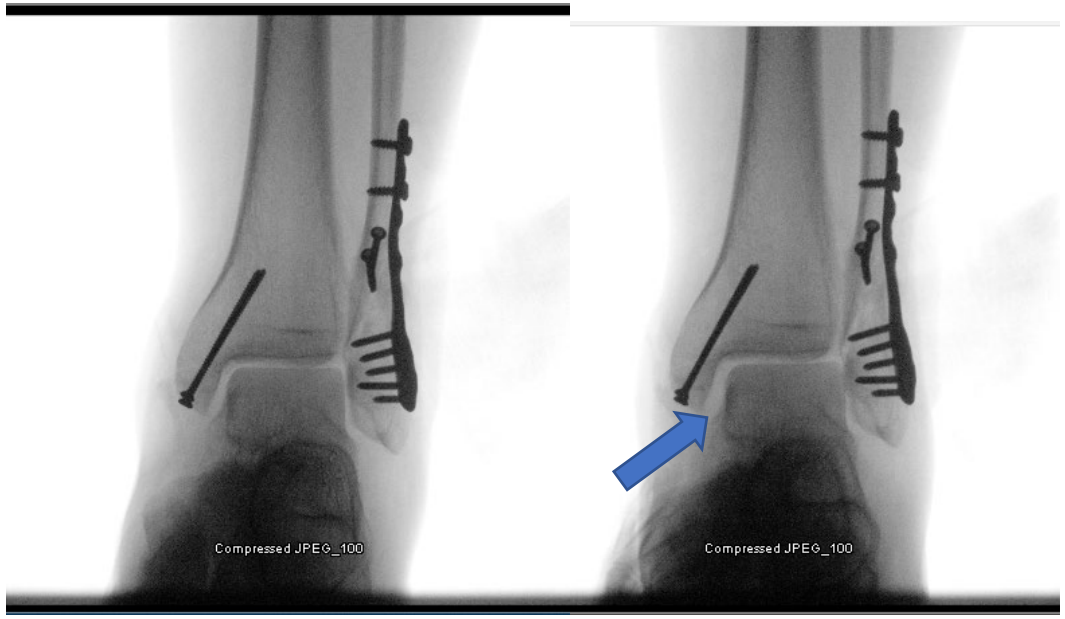


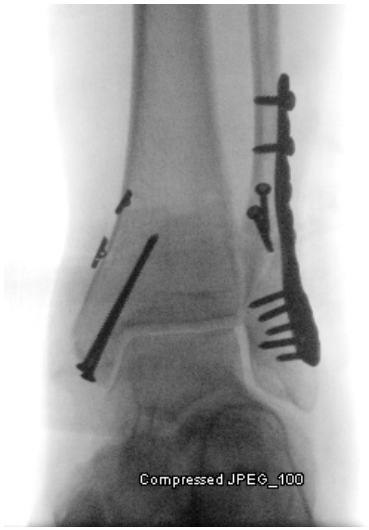
Posterior Malleolus Fracture - Options

- Stabilization of ankle with syndesmotic type fixation and no fixation of posterior fragments.
  - Trimal fracture Obese, diabetic male with chronic venous stasis issues

Posterior Malleolus Fracture

- Poor candidate for prone or lateral position. Poor soft tissue envelope
- Stabilization of medial and lateral components complete.
- Continued concern for instability with stress exam (arrow)
- Syndesmotic fixation added, no posterior fixation





Posterior Malleolus Fracture - Options

- Direct Reduction with plate and screw construction
  - Large posterior fragment (>50% of joint)
  - Ex fix utilized until skin and patient appropriate for prone position and direct posterior fixation through posterior lateral approach.

Fixation Techniques

Non-operative Management

Fixation Techniques – Non operative

- At times, surgery is not the correct answerer
  - Risks out weigh benefits
  - Patient Preference

Fixation Techniques – Non operative

- Patient presented 2 weeks from injury, ambulating during that period.
- Patient requested non-operative management.
- Continued to WBAT in cast despite recommendations. Minimal pain at 2 months

Fixation Techniques – Non operative

- Untreated pheochromocytoma. Blood pressures routinely 220/150's.
- Anesthesia and Hospitalist team deem to high risk for any procedure

Fixation Techniques – Non operative

- Casting with limited WB for 8 weeks followed by progressive WB.
- Minimal pain with ambulation at 8 months
- No change in pheochromocytoma status

Conclusion

- Geriatric ankle fractures are increasing as population ages
- Present unique challenges
- Patients have high amount of medical comorbidities
- Operative treatment has increased risk of complications compared to non operative treatment but leads to superior functional outcomes and decreases morbidity
- Each fracture is unique and fixation must be dictated by fracture pattern, bone quality, soft tissue condition
- Optimize fixation to allow for early mobilization
- Follow closely for complications