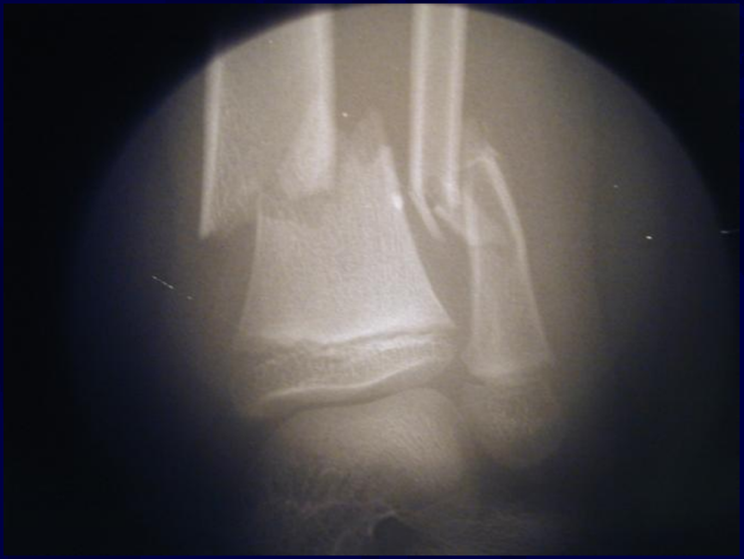
Fractures of the Tibia & Fibula in the Pediatric Patient



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Revised: Steve Rabin, MD February 2011
Revised: Steven Frick, MD August 2006
First Edition: Steven Frick, MD March 2004

Growth and Development of the Tibia and Fibula

- Most growth from proximal physes
  - *Proximal tibia: 55% (6 mm/yr), distal tibia: 45% (5 mm/yr)
  - *Proximal fibula: 60% (6.5 mm/yr), distal fibula: 40% (4.5 mm/yr)
- Fibula moves posterior to the tibia with growth
- Proximal tibia physis closes from posterior to anterior and within that tibial tubercle physis closes from proximal to distal
- Distal tibia physis closes from central to medial then lateral
- Extra-physeal fractures rarely disturb future growth and development
- Girls typically skeletally mature at physiologic ages of 14 y/o, boys at 16 y/o

*Estimations in Rockwood and Wilkins' *Fractures in Children*, 6th ed., p. 103-104

Relevant Anatomy

- Tibia and fibula bound together by interosseous membrane
  - Distally syndesmosis formed by 4 structures
    - Anterior-inferior tibiofibular ligament (runs from Chaput tubercle on tibia to Wagstaffe's tubercle on fibula)
    - Posterior-inferior tibiofibular ligament (originates from Volkmann's tubercle on tibia)
    - Inferior transverse ligament (distal extent of PITFL)
    - Interosseous ligament (continuation of interosseous membrane)
- At proximal and distal tibiofibular joints some motion occurs normally (proximal/distal translation, internal/external rotation, impaction/diastasis)
- Subcutaneous location of anteromedial face of the tibia carries implications for susceptibility to injury and healing potential, especially in open fx's

Incidence

- Low-energy fractures common (toddler's fracture aka childhood accidental spiral tibial (CAST) fx)
- Tibia is the most frequent location for open fractures (higher-energy injuries, i.e. peds v. auto, athletics)

History

- As with all Pediatric Fractures:
  - A high index of suspicion for Child Abuse should be maintained.
    - Especially with inconsistent story/mechanism, fx’s in preambulatory children, multiple long bone fx’s, metaphyseal corner fx’s on skeletal survey
  - Be alert for other causes of multiple fx’s (often low-energy) such as osteogenesis imperfecta and rickets

Physical Examination

- As with any fracture, complete primary/secondary/tertiary musculoskeletal surveys crucial to promptly and accurately diagnose fx/dislocations and avoid missing injuries
  - in trauma situation, Trauma team administers primary survey, Orthopaedics secondary survey, and if patient temporarily non-assessible (i.e. head injury, intubated/sedated) tertiary survey required when patient awake/alert
- Integrity of the skin and severity of soft tissue injury in closed and open fx's (this includes assessment of involved compartments, in awake/alert pediatric patient most reliable sign of evolving compartment syndrome is increasing pain medication requirement)
- Neurovascular exam
  - Dorsalis pedis and posterior tibial artery pulse exam (warm v. cold, palpable v. dopplerable v. neither)
  - FHL/EHL, lesser toes flexion/extension, ankle plantar/dorsiflexion
  - Sensation to light touch superficial and deep peroneal, saphenous, sural, and tibial nerve distributions

Radiographic Evaluation

- Two orthogonal views usually adequate
  - Visualize knee and ankle joints (always Xray joint above and below any fx)
  - Assess for displacement: angulation and translation in orthogonal planes, shortening
  - Rotation best assessed clinically

Classification

- Closed/Open
- Tibia, fibula fractured, or both
- Fx location- proximal/middle/distal, metaphyseal/diaphyseal, involvement of physes (Salter-Harris classification)
- Fx pattern- transverse, short-oblique, spiral, comminuted (? butterfly present)

Decision Making & Principles for Treatment

- With closed or open reduction restore acceptable length, alignment, rotation, and translation
- What is acceptable?...Difficult to find great data, depends on age of patient
- General guidelines for acceptable position: <10° angulation in orthogonal planes, <2cm shortening, rotation symmetric with other side, <50% translation

Remodeling Guidelines

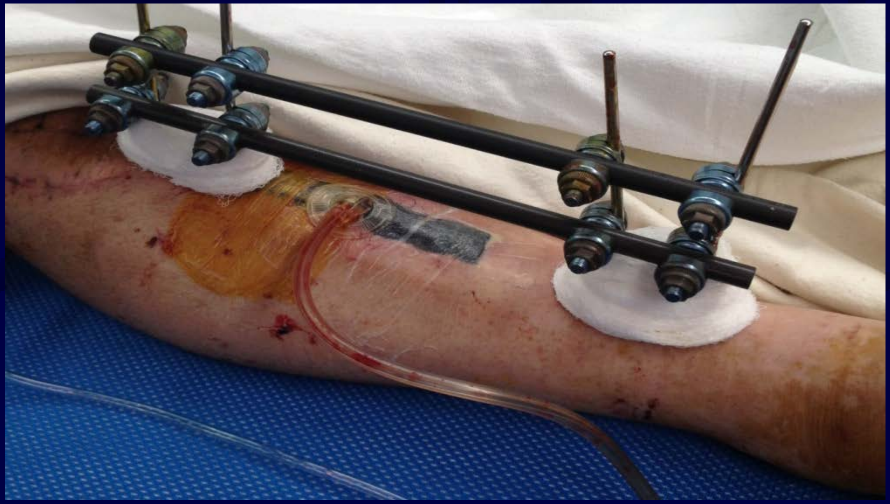
- Fractures that heal in positions outside the aforementioned guidelines may remodel or go on to good clinical result – BUT May Not!!!
  - Children <10 years old have more potential to remodel
  - Remodeling more reliable in plane of joint motion (i.e. proximal tibia sagittal plane deformity more acceptable b/c of flexion/extension as primary plane of motion at knee)
  - Metaphyseal fractures remodel better than diaphyseal (i.e. Cozen's proximal metaphyseal tibia fx)
  - Do not expect rotational deformity to fully remodel although there is potential if you extrapolate from pediatric BBFF data
  - Overgrowth can occur but not predictable

Principles of Treatment

- Majority of tibia/fibula fx's in children can be treated closed
- Above-knee v. below-knee cast
- Radiographic monitoring at regular intervals during early healing: wedge cast, or remanipulate/recast for unacceptable reduction/position if early enough f/u
- Must weigh risk of discomfort and chance of compartment syndrome against no need to transition immobilization in early f/u with initial casting (bivalving and overwrapping with ace bandage in ED and later overwrapping with fiberglass in clinic way to meet both goals)

Treatment Options

- Usually cast above knee initially for injuries above simple ankle fx's, but below knee acceptable for stable fracture patterns or after early healing
  - Initial below-knee immobilization likely acceptable in triplane and even toddler's fx's, literature evolving as discussed later…
- Pin fixation and cast: simple and effective, especially in oblique fractures, younger children
- External fixation: high-energy fractures with associated soft tissue injuries (open fx's or tissues not amenable to ORIF/IMN), don't forget exfix's can be dynamized
- Flexible IMN for tibial shaft fx's: usually proximal medial and lateral insertion
- Rigid IMN if near skeletal maturity
- Plate fixation if soft tissues allow; submuscular plating preserves biology



Specific Fractures

- Proximal tibia physeal injury
- Tibial tuberosity avulsion fx
- Toddler’s fx
- Proximal tibia metaphyseal fx
- Isolated fibula fx
- Isolated tibia shaft fx
- Open tibia fx
- Distal metaphyseal tibia fx
- Pathologic fx

Proximal Tibia Physeal Injuries

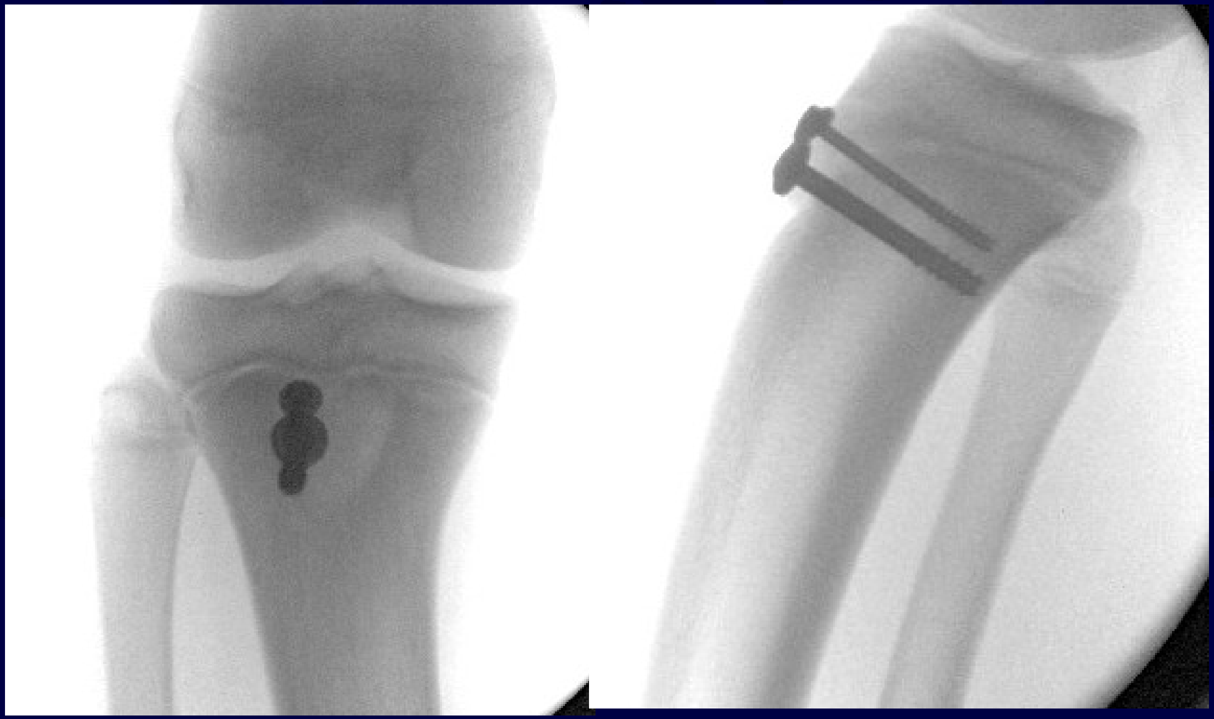
- <1% of all physeal injuries: epiphysis is protected by distal knee ligamentous attachments to tibial metaphysis and fibula
- Most common injury is 11-14 y/o boys with hyperextension, metaphysis displaced posteriorly (NV compromise possible)
- Beware of compartment syndrome
- Sometimes only fleck at metaphysis visible on XR if non-displaced, role for MRI or stress radiographs???
- Treatment:
  - nondisplaced above-knee cast 4 weeks
  - displaced, closed reduction/cast v. smooth K-wires or screws across epiphysis if reduction tenuous
  - open reduction, cast v. fixation if interposition of pes anserinus
- Angular deformity, limb-length discrepancy possible
- No sports for 4 months or so

Tibial Tuberosity Apophysis Avulsion Fractures

- Mechanism: Jump and landing where quadriceps contraction pulls off the tubercle as the knee flexes
- Beware of compartment syndrome as anterior tibial recurrent artery can be culprit if torn
- Growth disturbance rare but genu recurvatum possible (as posterior growth outpaces anteriorly disturbed growth), especially in patients less than 11 y/o

Tibial Tuberosity Avulsion Fx's: Treatment

- Non/minimally displaced fx's: above-knee cast for 6 weeks with the knee extended
- Displaced fractures require ORIF with screws



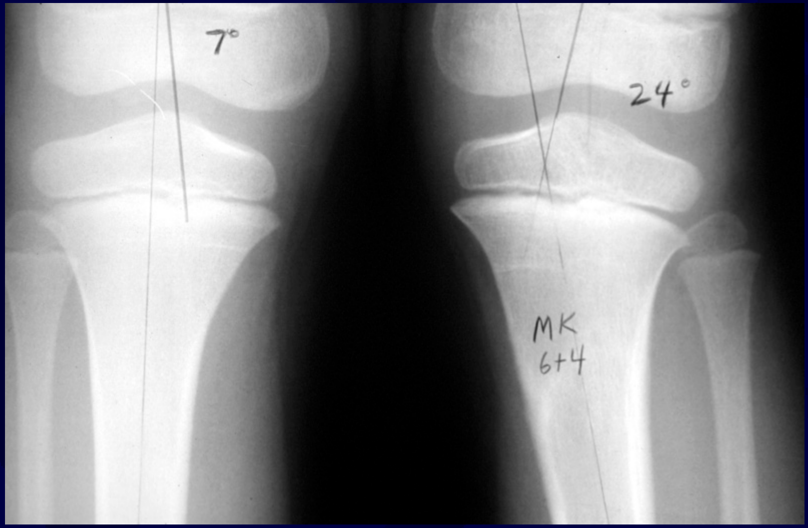
Toddler's Fracture

- Isolated tibia fracture (fibula intact), usually distal half of shaft
- Very common in walking toddlers
- Usually twisting injury, hence spiral fx pattern
- Stable injuries given robust periosteum
- Treatment:
  - If distal, short leg cast for 3-4 weeks
  - If proximal, above knee cast with knee flexed 10 degrees for 3-4 weeks, but emerging evidence can treated with immediate short leg cast, more later…

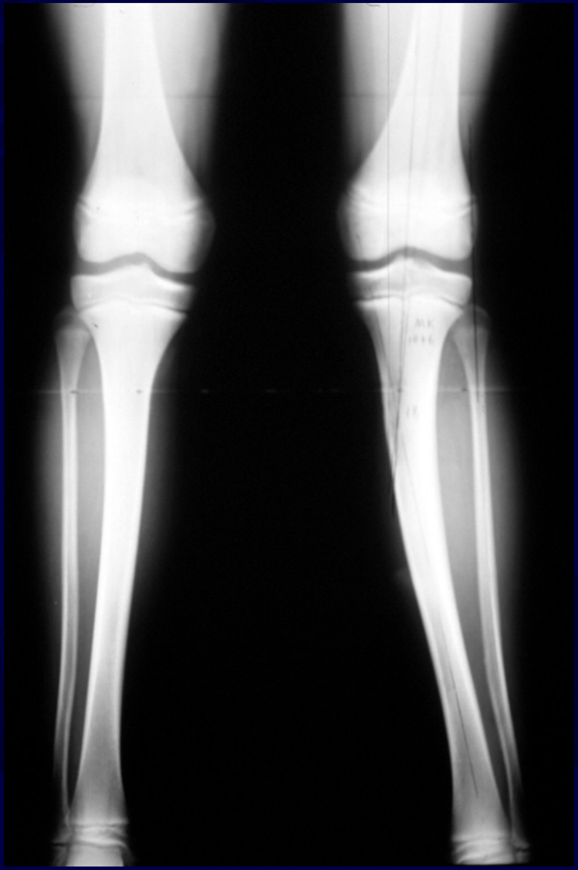
Proximal Tibia Metaphyseal Fracture

- Usually 3-6 years old when femoral-tibial angle is growing towards valgus, typically incomplete/stable fx's
- Mechanism typically low-energy valgus force across knee (i.e. child going down slide into lap of adult)
- Tendency toward transient valgus deformity (Cozen's phenomenon)
- Varus mold above-knee cast <u>may</u> prevent
- Open reduction rarely needed if pes interposed
- Valgus can be severe but <u>usually</u> remodels over 12-24 months such that hemiepiphyseodesis (skeletally immature) or corrective osteotomy (skeletally mature) unnecessary

Valgus after Proximal Tibia Metaphyseal Fracture



Asymmetric growth



Persistent valgus bow

Valgus following Proximal Tibia Fracture

Case courtesy of K. Shea. Observe and often improve with time, but may need guided growth surgical intervention if growth remaining

Isolated Fibula Fractures

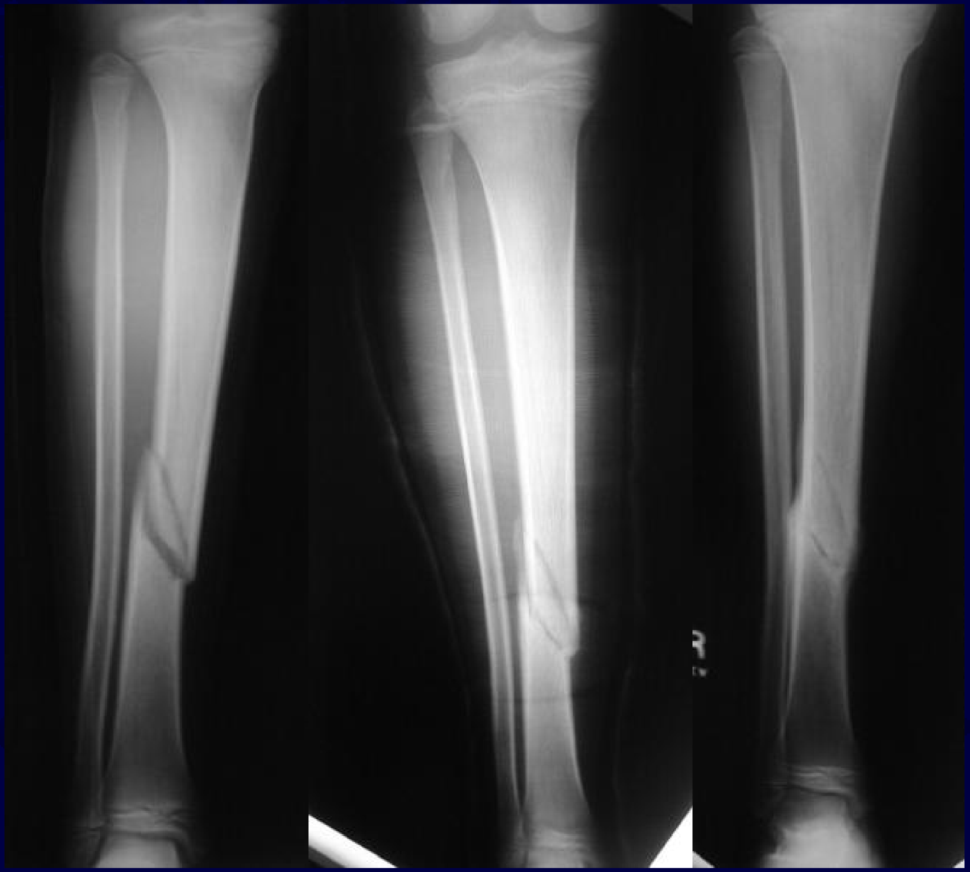
- Direct blow/impaction mechanism
- Immobilize as needed for comfort only (fibula 10-15% of weight bearing) and can WBAT immediately
- Carefully assess ankle (r/o Maisonneuve injury with proximal fx's and distal syndesmotic disruption, raise suspicion with twisting mechanism)

Tibial Shaft Fractures

- 5% of all pediatric fractures
- 70% have intact fibula, 30% both bones fractured
  - Often at middle/distal third of shaft
  - With intact fibula muscle forces/biomechanics usually result in drift of tibia into varus angulation
  - Valgus mold in initial cast
  - Can wedge at 2 weeks but more difficult because of intact fibula

Example: Intact Fibula

- Isolated tibia fx casted with valgus mold – healed uneventfully with anatomic alignment



Below-knee cast may be adequate for all pediatric tibia fx's

Klatt et al. OTA 2010

- Retrospective cohort study of open and closed fx's
- 269 pediatric tibial shaft fx's (age 6 mo.-16 y/o) without fibula shaft fx, transitioned from initial splint 5-10 days later, 44 to above-knee cast, 225 to below-knee and allowed WBAT
- Groups not compared due to differences in age, fx pattern, and fx location; conclusions drawn from below-knee group only
- Most fx's mid-diaphyseal and spiral, no pts required cast wedging
- No significant loss of alignment or malunion with below-knee cast
- Oblique (rather than spiral) and transverse patterns had most propensity to displace
- All fx's healed, avg. healing time 5.2 wks

Indications for Surgery

- Inability to obtain/maintain acceptable reduction
- Open injuries
- Polytrauma (multiple fx's) to permit easier mobilization

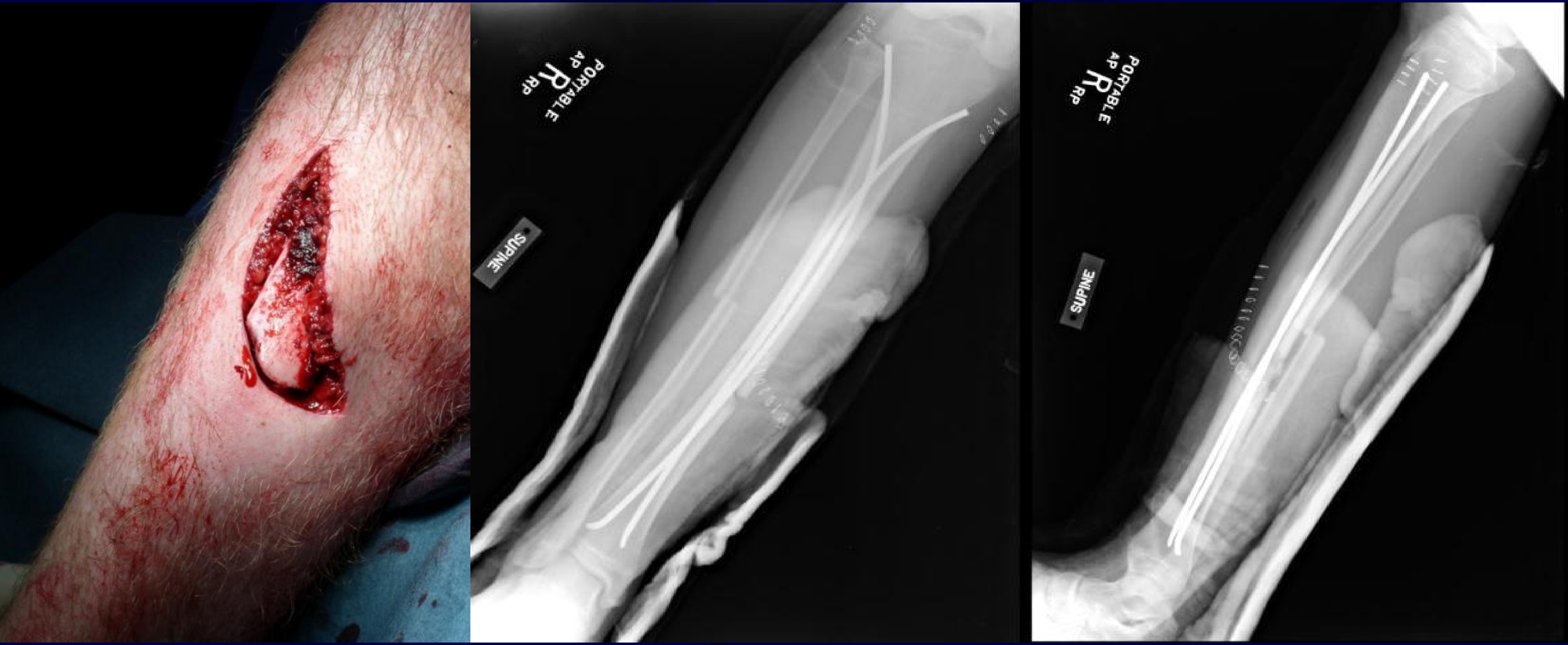
Open Tibia Fractures

- Soft tissue injuries typically less severe than in adults
- Periosteum often intact on concavity
- Early antibiotics, timely debridement
- Pins/cast, external fixation, flexible IMN, rarely plates all useful – choice depends on age, fx pattern, status of soft tissues, associated injuries
- Lower malunion rates and best outcomes seem to be reported after flexible nailing

Open Tibia Fracture with Soft Tissue Compromise

Appropriate Schanz pin placement and construct needed to control varus

Open Tibia Fracture:
I&D, Flexible Nailing



Distal Metaphyseal Tibia Fracture

- “Gillespie” fracture – apex posterior angulation of the distal tibia
- Dorsiflexion of ankle to neutral in splint/cast may exacerbate apex posterior angulation
- Cast in equinus until early healing, then change cast and dorsiflex to neutral
  - Requires close/frequent outpatient surveillance

Gillespie Fracture – Healed apex posterior as was originally casted in neutral

Pins and Cast after failure to hold acceptable alignment

Expected Outcomes for Tibia Fractures

- Heal in 6-12 weeks in juveniles/adolescents
- Heal in 3-4 weeks in toddlers
- Nonunions are rare, kids are like salamanders!!!

Complications/Sequelae

- Compartment syndrome (only a complication if it's missed!!!)
- Malunion/deformity
- Growth arrest

Compartment Syndrome

- Can occur in skeletally immature patient after closed or open tibia fracture
  - Reported in up to 5-10% of pediatric tibial shaft fx's
- Pain out of proportion (increasing pain medication requirements) most reliable sign in kids, pain with passive stretch, paresthesias in distribution of nerves that are in compartment, motor deficit late and vascular deficit even later (and likely heralds missed comp sx)
- Compartment pressure measurement may be diagnostic in young or non-assesable children, usually confirmatory (typically diagnosis made clinically)
- Consider conscious sedation/general anesthesia in child to measure pressures
- Fasciotomies emergently if diagnosed
- COMPARTMENT SYNDROME CAN OCCUR EVEN IN APPARENT "LOW ENERGY" SPIRAL FX PATTERNS

Malunions

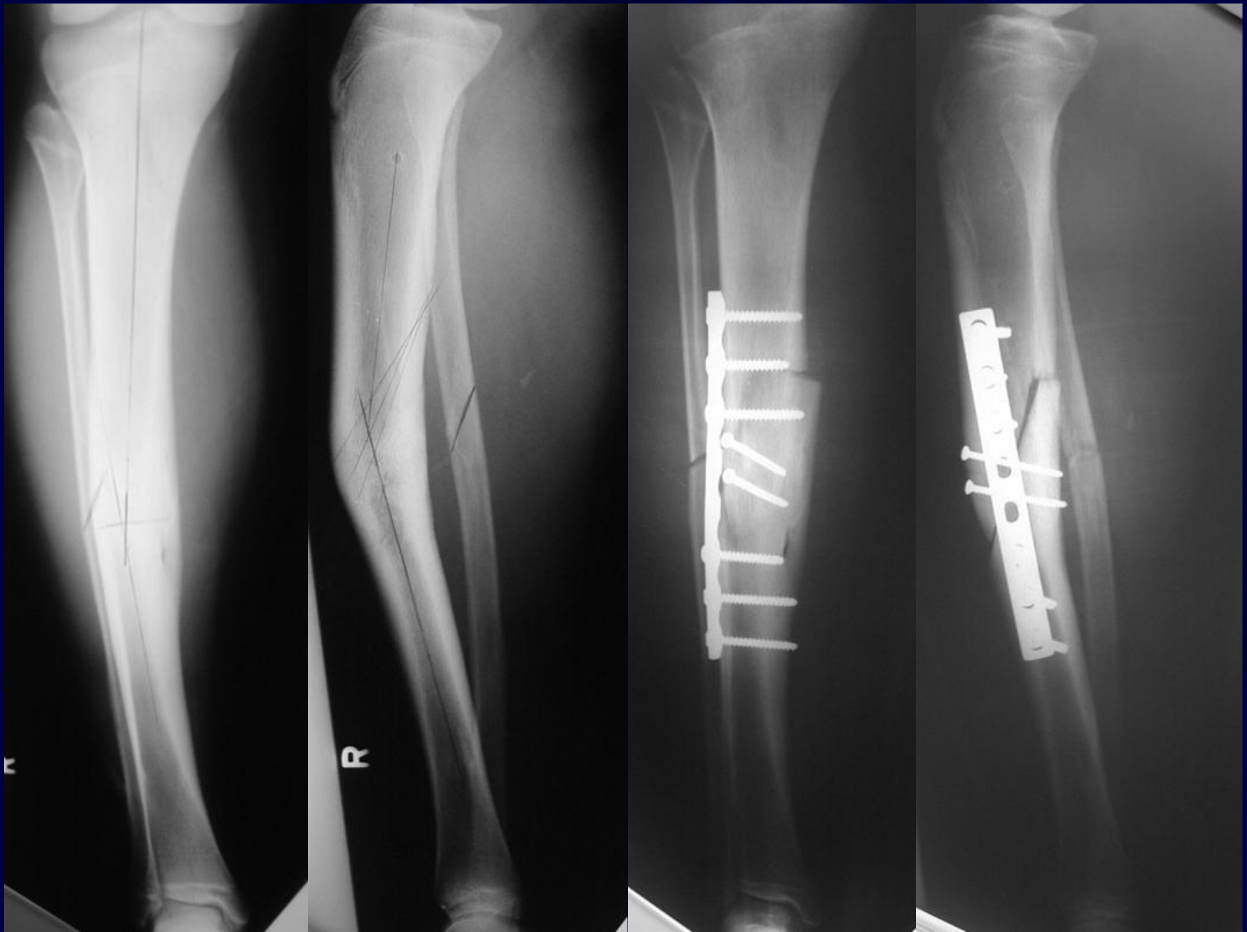
- No consistent literature to define malunion
- Long term adverse effects of malunion not well documented in children
- General guidelines for acceptable reduction: <10° angulation, <2 cm shortening, <50% translation, rotation equal to opposite side

Tibia Fracture Malunion/Nonunion

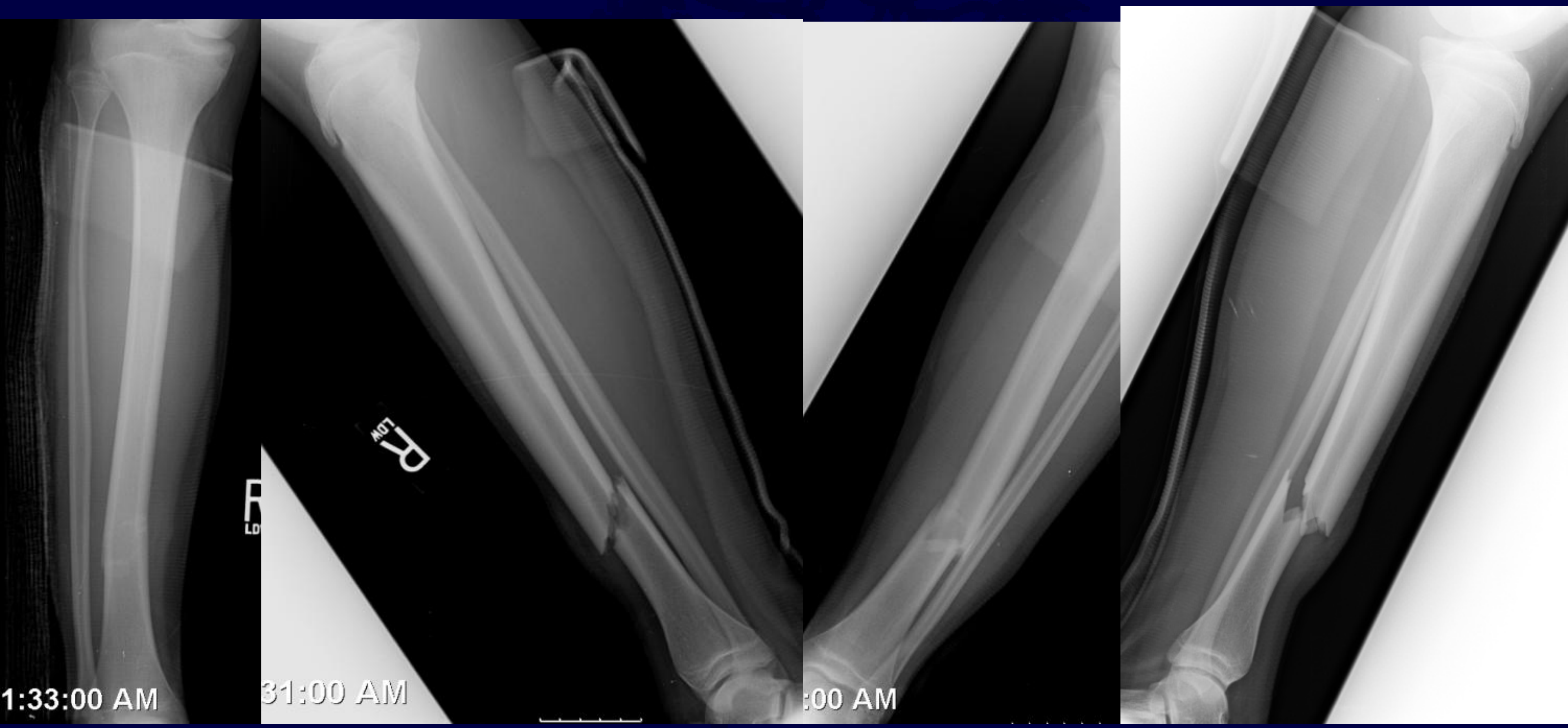
- Typical malunion deformity in shaft is varus, treated here with absolute stability

Malunion Example

- Varus/procurvatum malunion following premature removal of external fixator after open tibia fx, treated with osteotomy, rigid fixation



Case example: 13 ½ y/o male skiing, bilateral tibia fx’s



Patient, family elect for casting

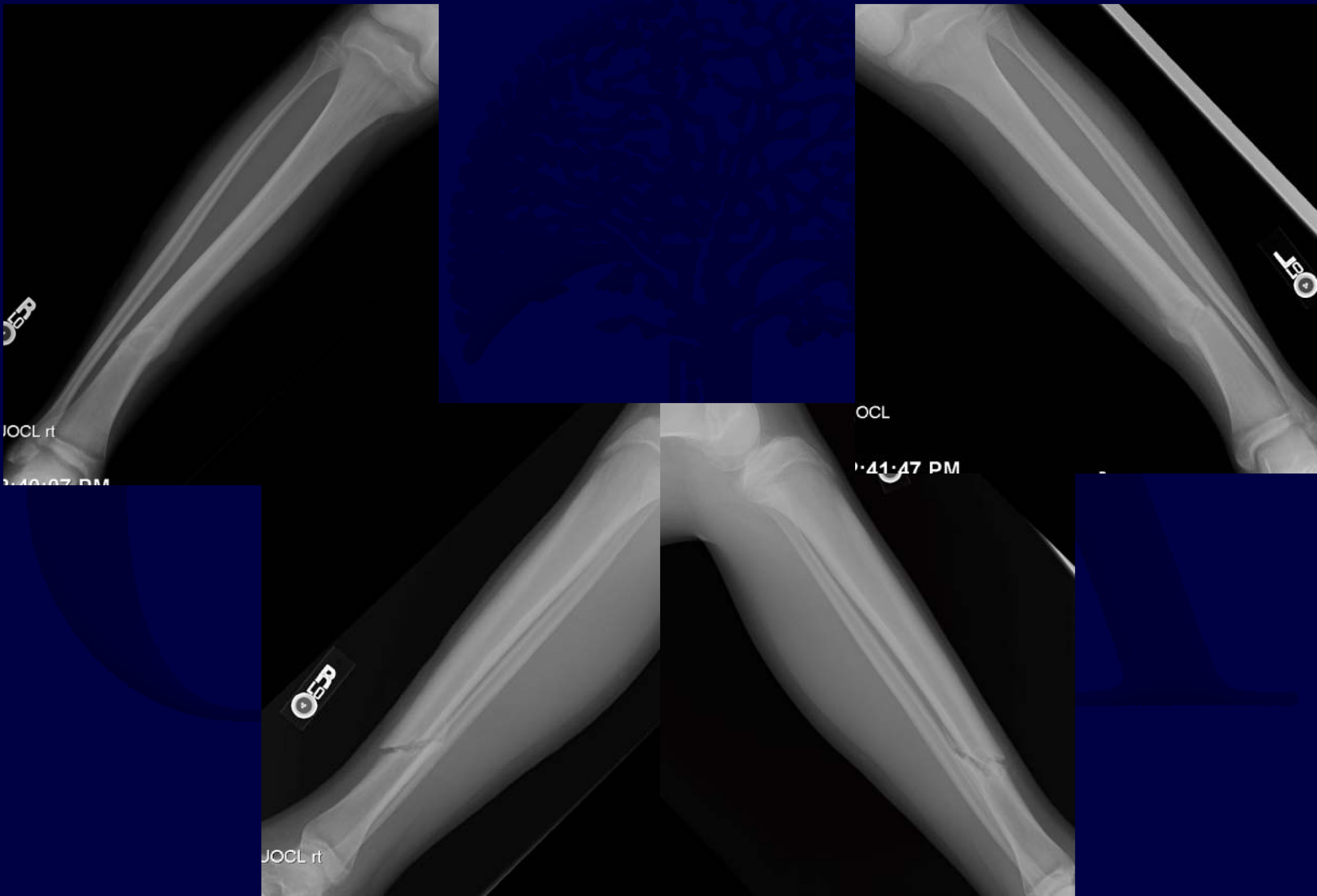
1 week f/u

3 weeks f/u

5 weeks



3 months



5 months

7 ½ mo. f/u

Now 14 y/o, varus malunion on left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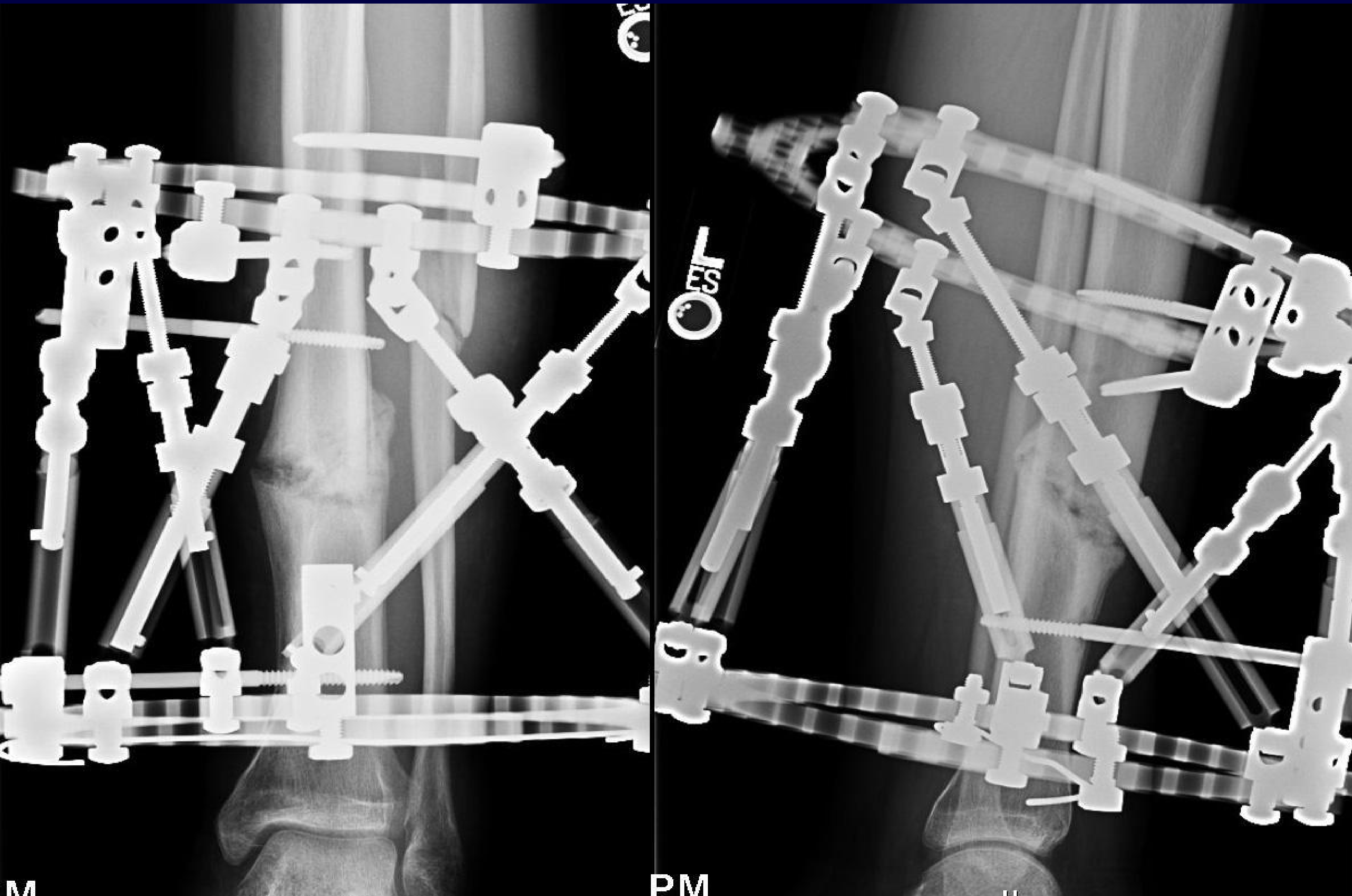
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Four months s/p osteotomy
Healed!!!

Pathologic Fractures

SEE ALSO SEPERATE TALK ON PEDIATRIC PATHOLOGIC FRACTURES IN OTA RESIDENT CORE CURRICULUM LECTURES

Fractures through bone tumors are often difficult to treat.

Pathologic fracture through nonossifying fibroma had the best outcome; union occurred with nonsurgical treatment in all cases.

Unicameral bone cyst fractures healed predictably without surgery. Surgery only required to avoid persistence of the cyst and refracture.

Aneurysmal bone cyst required surgical treatment for the lesion and fracture to heal. Percutaneous sclerotherapy may be the treatment of choice for many of these lesions.

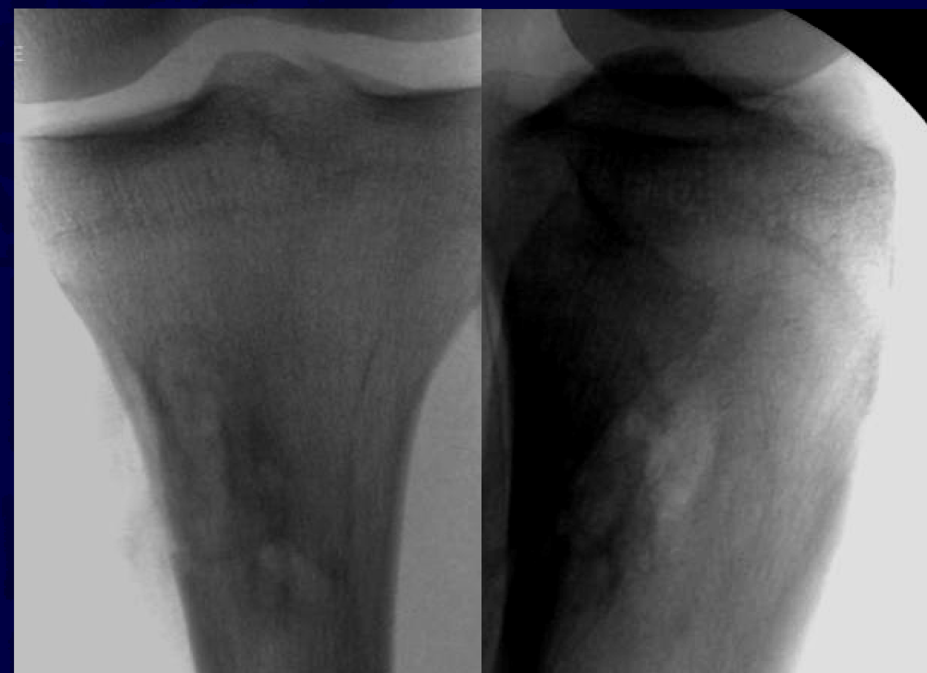
Fibrous dysplasia allows fracture healing with nonoperative therapy. Progressive deformity requires close follow-up and surgical correction.

Malignant lesions presenting as pathologic fracture are best managed by initial nonoperative therapy during tumor workup and typically neoadjuvant therapy when possible, followed by definitive treatment

Ortiz EJ, Isler MH, Navia JE, Canosa R. Pathologic fractures in children. Clin Orthop Relat Res. 2005 Mar.;(432):116–126.

Pathologic Fracture

- Example of healing fracture through unicameral bone cyst
- 6% of unicameral bone cysts occur in the proximal tibia and 5% in the distal tibia



Tibia Fractures Summary

- Most pediatric tibia fractures heal well with closed casting techniques
- The orthopaedic surgeon still needs to be vigilant to detect and treat the potential complications
- Do not assume that remodeling will consistently or reliably correct all deformities

References

- Mashru RP, Herman MJ, Pizzutillo PD. Tibial shaft fractures in children and adolescents. J Am Acad Orthop Surg. 2005 Sep.;13(5):345–352.

- Tibial shaft fractures are among the most common pediatric injuries.
- Treatment is individualized based on patient age, concomitant injuries, fracture pattern, associated soft-tissue and neurovascular injury, and surgeon experience.
- Closed reduction and casting used for diaphyseal tibial fractures.
  - Careful clinical and radiographic follow-up with remanipulation as necessary.
  - Surgical management options include external fixation, locked intramedullary nail fixation in the older adolescent with closed physis, Kirschner wire fixation, and flexible intramedullary nailing.
- Union of pediatric diaphyseal tibial fractures occurs in approximately 10 weeks; nonunion occurs in <2% of cases.
- Malunion possible if: sagittal deformity angulation >10 degrees, or 10 degrees of valgus, or 5 degrees of varus.
- Compartment syndromes associated with tibial shaft fractures occur less frequently in children and adolescents than in adults. Diagnosis may be difficult in a young child or one with altered mental status.
- Although the toddler fracture of the tibia is one of the most common in children younger than age 2 years, child abuse must be considered in the young child with an inconsistent history or with suspicious concomitant injuries.

References

- Gordon JE, Gregush RV, Schoenecker PL, Dobbs MB, Luhmann SJ. Complications after titanium elastic nailing of pediatric tibial fractures. J Pediatr Orthop. 2007 Jun.;27(4):442–446.

- A retrospective review of 60 diaphyseal tibia fractures (31 closed and 29 open fractures) treated with flexible intramedullary fixation. Fifty patients with 51 fractures were followed up until union.
- Forty-five fractures achieved bony union within 18 weeks. Five patients (11%) had delayed healing and 2 had nonunions that required secondary procedures to achieve union.
- Patients with delayed healing tended to be older (mean age, 14.1 years) versus the study population as a whole (mean age, 11.7 years).
- Other complications:
  - One patient healed with malunion (13 degree valgus), requiring corrective osteotomy.
  - One patient with a type II open fracture developed osteomyelitis.
  - Two patients developed nail migration through the skin, requiring manipulation or nail removal.
- The fixation of pediatric diaphyseal tibia fractures with titanium elastic nails is effective but has a substantial rate of delayed healing, particularly in older patients.

References

- Setter KJ, Palomino KE. Pediatric tibia fractures: current concepts. Curr Opin Pediatr. 2006 Feb.;18(1):30–35.

- **PURPOSE OF REVIEW:** Fracture of the tibia is a common occurrence in children. The operative treatment of pediatric tibia fractures has undergone a recent change. However, there is no clear consensus regarding the superiority of one treatment option.
- **RECENT FINDINGS:** The literature clearly supports the fact that the vast majority of pediatric tibia fractures can and should be managed nonoperatively. This is secondary to their inherent stability. A variety of factors including fracture type, location, severity, and patient age determine the best treatment options for a particular fracture. A thorough understanding of these factors and how they affect outcome help the clinician formulate the proper plan of treatment.
- **SUMMARY:** A randomized prospective controlled trial will be necessary to establish which surgical options are superior for which type of pediatric tibia fracture. Until then, recent studies have indicated that flexible intramedullary nails may lead to a shorter time to union and a decreased rate of refracture when compared with external fixation of unstable tibial shaft fractures. What remains unclear are the specific indications and contraindication for the use of flexible nails. External fixation still remains a successful treatment option for unstable tibial shaft fractures.

Treatment of Type II and Type III Open Tibia Fractures in Children
Bartlett, Craig S. III; Weiner, Lon S.*; Yang, Edward C.†

Journal of Orthopaedic Trauma July 1997 p. 357-362

Abstract
Objectives: To determine whether severe open tibial fractures in children behave like similar fractures in adults.
Design and Setting: A combined retrospective and prospective review evaluated treatment protocol for type II and type III open tibial fractures in children over a ten-year period from 1984 to 1993.
Patients: Twenty-three fractures were studied in children aged 3.5 to 14.5 (18 boys and 5 girls). There were six type II, eight type IIIA, and nine type IIIB fractures. Type I fractures were not included. Seven fractures were comminuted with significant butterfly fragments or segmental patterns.
Intervention: Treatment consisted of adequate debridement of soft tissues, closure of dead space, and stabilization with external fixation. Bone debridement only included contaminated devitalized bone or devitalized bone without soft tissue coverage. Bone that could be covered despite periosteal stripping was preserved.
Main Outcome Measurements: Clinical and roentgenographic examinations were used to determine time to union.
Results: All fractures in this series healed between eight and twenty-six weeks. Wound coverage included two flaps, three skin grafts, and two delayed primary closures. No bone grafts were required. There were no deep infections, growth arrests, or malunions. Follow-up has ranged from six months to four years.
Conclusions: Open tibia fractures in children differ from similar fractures in adults in the following ways: soft tissues have excellent healing capacity, devitalized bone that is not contaminated or exposed can be saved and will become incorporated, and external fixation can be maintained until the fracture has healed. Periosteum in young children can form bone even in the face of bone loss.

References

- The ortho-plastic management of Gustilo grade IIIB fractures of the tibia in children: a systematic review of the literature. Injury 2009 Aug.;40(8):876–879.

- **BACKGROUND:** The challenges of managing Gustilo IIIB tibial fractures in children are unique. We aimed to evaluate the evidence for the ortho-plastic management of Gustilo grade IIIB open tibial shaft fractures in children based on a review of all published data.
- **METHOD:** A systematic review of the literature was performed of Gustilo grade IIIB tibial shaft fractures in pre-adolescent and adolescent children
- **RESULTS: M**ean union time of 31 weeks included 33 weeks for adolescents and 23 weeks for pre-adolescents. Faster union time in pre-adolescents tended towards significance. Delayed union occurred in 22%, nonunion in 13%, mostly in adolescents.
- There was no correlation between method of skeletal fixation and union time.
- **CONCLUSION:** Gustilo IIIB tibial shaft fractures in pre-adolescents tended towards faster healing with fewer complications, irrespective of the method of skeletal fixation. In adolescents, healing times were similar to adults.
- Soft tissue closure without flaps was associated with deep infection in one-third of patients, requiring debridement and flap coverage. Adequate debridement and flap coverage is suggested in all cases, irrespective of age.

J Child Orthop June 2009

Open fractures of the tibia in the pediatric population: a systematic review

Keith D. Baldwin,[1] Oladapo M. Babatunde,[2] G. Russell Huffman,[1] and Harish S. Hosalkar [1,3]

Purpose

The management of open fractures of the tibia in a pediatric population represents a challenge to the clinician. Several case series over the course of many years have been performed describing the results of treating these injuries. It remains unclear, however, whether there is a preferred modality of treatment for these injuries, if a more severe injury confers a greater risk of infection, and if time to union is affected by Gustilo type, although trends seem to exist. The purpose of this study was to assemble the available data to determine (1) the risk of infection and time to union of various subtypes of open tibia fractures in children and (2) the changes in treatment pattern over the past three decades.

Methods

A systematic review of the available literature was performed. Frequency weighted mean union times were used to compare union times for different types of open fractures. Mantel Haentzel cumulative odds ratios were used to compare infection risk between different types of open fractures. Linear regression by year was used to determine treatment practices over time.

Results

No significant change in practice patterns was found for type I and III fractures, although type II fractures were more likely to be treated closed in the later years of the study compared to the earlier years. Type III fractures conferred a 3.5- and 2.3-fold greater odds of infection than type I and type II fractures, respectively. There was no significant difference in odds of infection between type I and II fractures. There was a significant delay in mean time to union between type I and type II fractures, and between type II and type III fractures.

Conclusions

With the exception of type II fractures, the philosophy of treatment of open fractures of the tibia has not significantly changed over the past three decades. Closed treatment or internal fixation are both viable options for type II fractures based on their relatively low incidence of infection. This study also demonstrates a strong relationship between Gustillo sub-types and odds of infection in this population. Not surprisingly, union rates are also delayed with increasing injury severity.

ALL FRACTURES TREATED WITH IRRIGATION AND DEBRIDEMENT AND STANDARD OF CARE ANTIBIOTICS

J. Pediatr Orthop 2005 Jul-Aug

Nonoperative management of pediatric type I open fractures.

Iobst CA[1], Tidwell MA, King WF.

Abstract

The purpose of this study was to examine the results of pediatric patients with type I open fractures managed nonoperatively. A retrospective chart review of all type I open fractures managed nonoperatively from 1998 to 2003 was performed. Forty patients were followed until healing of the fracture clinically and radiologically. One deep infection occurred in this series, producing an overall infection rate of 2.5%. This compares favorably with the literature's infection rate of 1.9% in pediatric type I open fractures treated operatively. There was a 0% infection rate in the 32 upper-extremity type I open fractures and a 0% infection rate in the 23 patients under age 12. These results suggest that nonoperative management of pediatric type I open fractures is safe and effective, especially in children under age 12 with upper-extremity fractures.

J. Pediatr Orthop 2009 Jan-Feb

Nonoperative management of pediatric grade 1 open fractures with less than a 24-hour admission.

Doak J[1], Ferrick M.

BACKGROUND:

The purpose of this study was to evaluate the results of nonoperative management of pediatric grade 1 open fractures treated either in the emergency room only or with a less than 24-hour admission.

METHODS:

A retrospective chart review was done on all patients with this type of injury who were treated by nonoperative modalities in the emergency room and who were admitted for no more than 24 hours for administration of intravenously administered antibiotics. Our population included 25 patients who were followed up until healing was confirmed clinically and radiographically.

RESULTS:

One patient with persistent serosanguineous drainage from the wound site and fever was admitted for 48 hours of intravenously administered antibiotics for presumed infection. That patient went on to heal both clinically and radiographically without further complication. Therefore, our infection rate was 4.0%.

CONCLUSIONS:

This study demonstrates the safe nonoperative treatment of grade 1 open fractures in our pediatric population. This management eliminates any possible anesthetic risk as well as significantly decreases the cost of caring for these patients in the health care system.

The Treatment of Type 1 Open Fractures in Pediatrics

US National Institutes of Health

<u>Currently enrolling patients in RCT,</u> estimated study completion 2016

Purpose

Open fractures are frequently encountered in orthopaedics. Treatment usually calls for a formal, operative procedure in which the bone is exposed, foreign tissue is debrided and the wound is irrigated. While this is the current standard of care, not all open fractures are equal. In retrospective studies, centers are reporting less aggressive operative management for open fractures may result in equal results without the time and expense of the operative theater. The investigators propose a prospective, randomized trial of children with type I open fractures to evaluate whether formal operative treatment is necessary. The investigators' hypothesis is that minor open fractures can be safely treated in the emergency room with irrigation, closed reduction and home antibiotics without an increased risk of infection or other complications. Children who meet the study criteria will be randomized into two treatment arms - formal operative management (OR) and emergency department (ED) management. Outcomes from each group will be evaluated and compared, including rate of infection, number of return visits to the operating room, time to union, and other complications.

References

- Nenopoulos S, Vrettakos A, Chaftikis N, Beslikas T, Dadoukis D. The effect of proximal tibial fractures on the limb axis in children. Acta Orthop Belg. 2007 Jun.;73(3):345–353.

- Treated children with fractures of the proximal tibia.
  - Fractures affecting the proximal tibial physis were excluded.
- Mean age at the time of injury was 7.1 years.
- 90.3% of patients developed post-traumatic tibia valga.
  - Deformities were observed at an average 5.3 months after injury.
  - All the cases with fractures of the medial cortex developed valgus angulation.
  - The mean valgus angular deformity was 5.5 degrees.
  - There was also an average of 5.31 mm limb lengthening.
- At an average of 7.4 years from the initial injury partial remodelling in 54.5% and total remodelling in 25%
- Recommend that children with proximal metaphyseal tibial fractures should be initially treated conservatively and followed up during skeletal development because valgus deformity tends to remodel with age.

References

- Dormans JP, Pill SG. Fractures through bone cysts: unicameral bone cysts, aneurysmal bone cysts, fibrous cortical defects, and nonossifying fibromas. *Instr Course Lect*. 2002;51:457–467.

- Fractures through bone cysts: unicameral bone cysts, aneurysmal bone cysts, fibrous cortical defects, and nonossifying fibromas.

Thank You

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