

Orthopedic Injuries that Need an Orthopedist NOW

(but don't seem like it)

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Disclosures

- No relevant financial disclosures

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Acknowledgements

- Many images are my own
- Others are from outstanding resources listed in references

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Some injuries obviously need an orthoped now



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Some injuries obviously need an orthoped now



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Some injuries obviously need an orthoped now



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Some injuries obviously need an orthopedist now



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Some injuries obviously need an orthopedist now



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Some injuries obviously need an orthopedist now



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Some injuries obviously need an orthopedist now



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Others look like it, but can wait



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Others look like it, but can wait



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Case 1

- An 84 year old male presents with left foot pain after his motorcycle tipped over
- Examination reveals tenderness over midfoot

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Park City Octogenarian



Image URL: <https://www.ignman.com/blog/fitness/84-year-old-man-has-better-muscle-than-you/>

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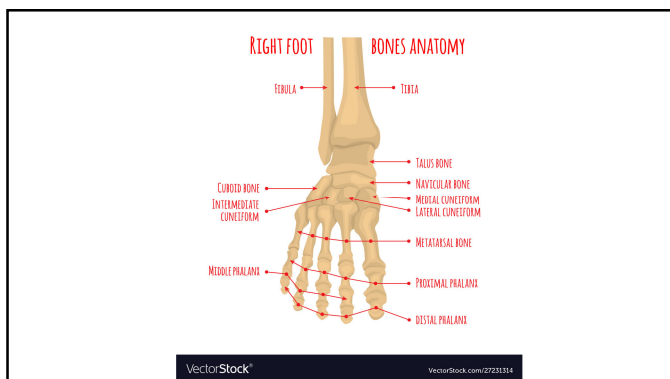


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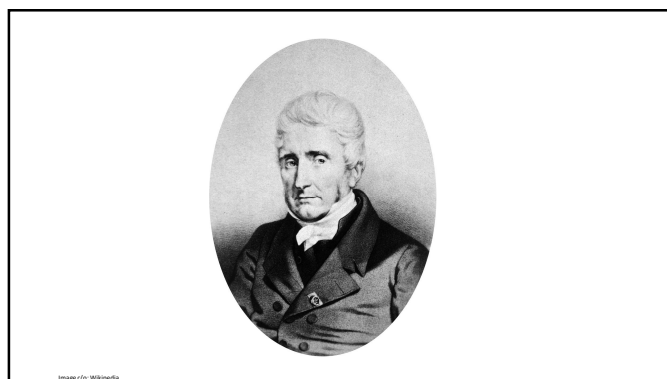
Lisfranc Injury

- A confusing injury because of terminology
- A tarsometatarsal fracture dislocation
- Disruption between the articulation of the medial cuneiform and base of second metatarsal

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Lisfranc Injury

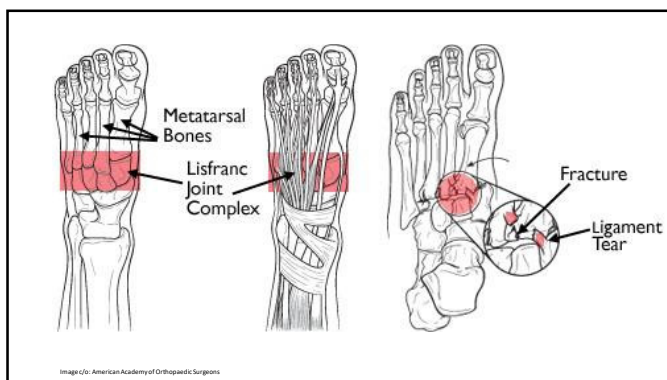
- The Lisfranc joint is named after Dr. Jacques Lisfranc (1790-1847), a field surgeon (trained gynecologist) in Napoleon's army
- Described an amputation through this joint because of gangrene that developed after an injury when a soldier fell off a horse

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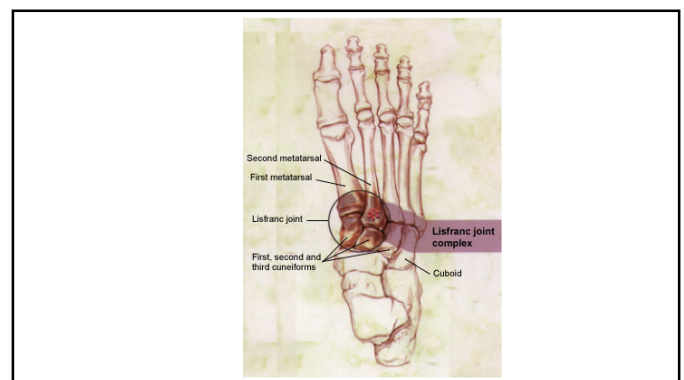
Terms

- Lisfranc joint complex
 - Tarsometatarsal articulations
- Lisfranc joint
 - Medial articulation involving first and second metatarsals with medial and middle cuneiforms
- Lisfranc ligament
 - A large band of plantar collagenous tissue that spans the articulation of the medial cuneiform and second metatarsal base

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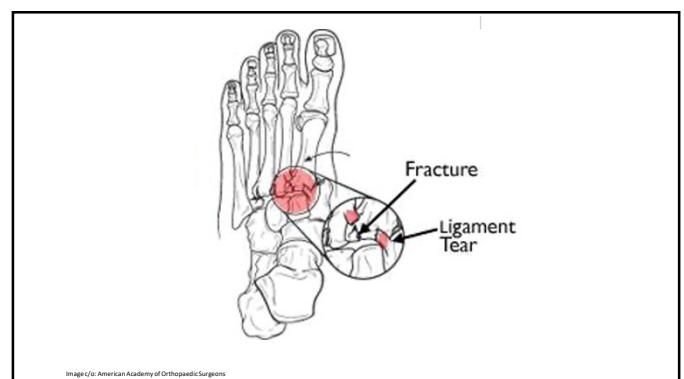


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Lisfranc Injury

- A spectrum of injuries varying from mild sprains to fracture-dislocations
- A fracture dislocation caused by a disruption between the articulation of the medial cuneiform and base of the second metatarsal

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Lisfranc Injury

- Generally high energy mechanisms
 - MVAs, falls from height, athletic injuries
- Rotational forces and axial loading through hyper-plantarflexed forefoot

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Lisfranc Injury

- Importance

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Lisfranc Injury

- High risk of secondary disability
- The Lisfranc ligament is critical to stabilizing the 1st and 2nd tarsometatarsal joints which maintains the midfoot arch
- Lisfranc ligament tightens with pronation and abduction of the forefoot

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Lisfranc Injury

- The Metatarsals are head together by connective tissue EXCEPT between the first and second metatarsal

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Lisfranc Injury

- High clinical suspicion needed for diagnosis
- Weight bearing films needed

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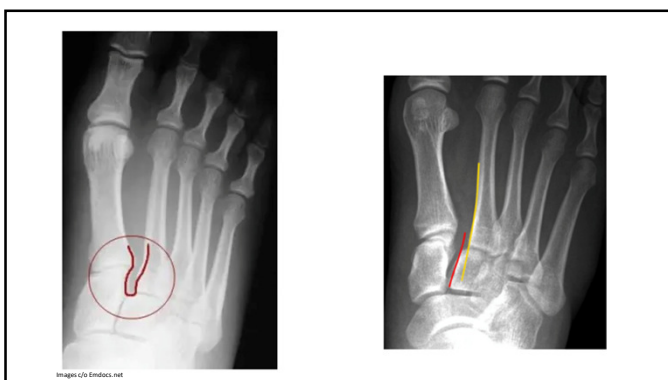


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Lisfranc Injury

- AP films should show the 2nd metatarsal collinear with medial border of intermediate cuneiform

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In an oblique plain film, evaluation of the lateral midfoot becomes possible. A normal oblique X-ray shows alignment of the 2nd through 4th TMT joints:

Image (c) EndoDoc.net

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An abnormal oblique film notes disalignment of the TMT joints (circle below)

Image (c) American Academy of Family Practice

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Lisfranc Injury

- Weight bearing films needed
 - Sensitivity of plain film: 84.4%
 - Specificity of plain film: 53.3%
- CT if unsure; MRI likely best imaging though data on CT/MRI limited

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What do Radiologists Recommend?

- Correlate with clinical findings

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What do Radiologists Recommend?

Variant 5: Adult or child older than 5 years of age. Acute trauma to the foot. Suspect Lisfranc injury, tendon injury, or occult fracture or dislocation. Radiographs are normal or equivocal. Next imaging study.

Procedure	Appropriateness Category	Relative Radiation Level
CT foot without IV contrast	Usually Appropriate	☻☻
MRI foot without IV contrast	Usually Appropriate	○
US foot	May Be Appropriate	○
CT foot with IV contrast	Usually Not Appropriate	☻☻
CT foot without and with IV contrast	Usually Not Appropriate	☻☻
MRI foot without and with IV contrast	Usually Not Appropriate	○

Image (c): American College of Radiologists

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Lisfranc Injury

- Treatment
 - Controversial, but generally surgical
 - Should be done in the first 12-24 hours after injury (though some wait for swelling to resolve)

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Case 2

- A 75 year old male presents after a horse struck him in the left knee
- Minimal pain unless standing
- Left knee has an effusion but is neurovascular intact

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Case 2

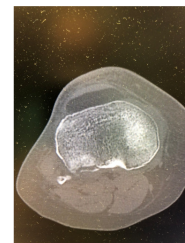
- Images read by radiology as “moderate knee effusion, no acute fracture”

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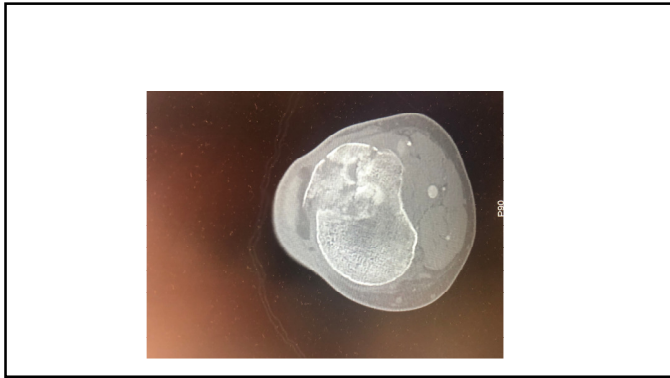
Case 2

- After analgesia, patient unable to bear weight

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Tibial Plateau Fracture

- Some are obvious...

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Tibial Plateau Fracture

- Periarticular injuries of the proximal tibia

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Tibial Plateau Fractures

- Generally occur from high speed mechanisms
 - But injuries occur in a bimodal distribution
 - Males in 40s and females in 70s (falls)

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Tibial Plateau Fractures

- Radiographs
 - First line imaging choice
 - Sensitivity as low as 79% for 2 views and 85% with 4 view series
 - Lipohearthrosis indicates an occult fracture

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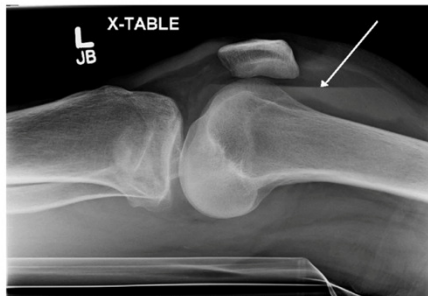


Figure 5. Lipohearthrosis: The arrow points to the radiolucent fat layering above the radiopaque blood. This can be the only indication to a distal femur, tibial plateau, or, less commonly, a patellar fracture. (From James Helman, MD [CC BY SA 3.0], from Wikimedia Commons)

Image © © Academic Life in Emergency Medicine

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Tibial Plateau Fractures

- CT or MRI indicated for fractures OR if high suspicion exists
 - Help identify articular depression and comminution
 - MRI may also identify ligamentous injuries and may be superior
- Consider angiogram if abnormal neurovascular exam exists

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Tibial Plateau Fractures

- Need an orthopedic consultation
 - Nonweight bearing, knee immobilizer

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Tibial Plateau Fractures

- Need an orthopedic consultation
- Not all require admission and/or urgent surgery
 - But beware of compartment syndrome

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Case 3

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Case 3

- A 35 year old male presents as a polytrauma
- Images all negative
- Unable to bear weight on right knee

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Case 3

- The knee exam reveals laxity with valgus/varus stress along with anterior drawer/posterior drawer
- Complains of decreased sensation and inability to dorsiflex ankle

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Knee Dislocation

- Tibiofemoral dislocation

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Knee Dislocation

- Up to 50% spontaneously reduce prior to presentation

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Knee Dislocation

- Up to 50% spontaneously reduce prior to presentation

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Knee Dislocation

- Associated Injuries
 - About 33% have an associated vascular injury
 - 16-40% have associated nerve injuries
- Neurovascular exam is of utmost importance

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Knee Dislocation

- Vascular injury
- Nerve injury
- Ligamentous injury

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Knee Dislocation

- Vascular injury
 - Popliteal artery most common injury (due to it being tethered in popliteal space)
- Nerve injury
- Ligamentous injury

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Knee Dislocation

- Vascular injury
- Nerve injury
 - Peroneal nerve most commonly injured
 - Sensation to dorsal foot
 - Motor dorsiflexion of ankle
- Ligamentous injury



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Knee Dislocation

- Vascular injury
- Nerve injury
- Ligamentous injury
 - Usually ACL and PCL
 - MCL 50%
 - Posterolateral complex 28%

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Knee Dislocation

- Imaging

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Knee Dislocation

- Imaging
 - Start with radiograph

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Knee Dislocation

- Imaging
 - Start with radiograph
 - Any injury or concern for injury needs post reduction angiogram

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Knee Dislocation

- Management
 - Reduce
 - Image
 - Admit

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Knee Dislocation

- Management
 - If hard signs of vascular injury present, consult vascular surgery
 - **Observed pulsatile bleeding.**
 - **Arterial thrill (ie, vibration) by manual palpation.**
 - **Bruit over or near the artery by auscultation.**
 - **Signs of distal ischemia.**
 - **Visible expanding hematoma.**

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Knee Dislocation

- Always consider if significant mechanism or obese patient can't bear weight
 - Laxity of 2 or more ligaments should raise suspicion for dislocation with spontaneous reduction
- ABI is a good screening tool, though sensitivity is unknown
 - Presence of pulse is 80% sensitive

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Case 5

- A 25 year old male presents with a laceration over his left knee after falling on his knee while dirtbiking
- The left leg is neurovascular intact
- There is a 3cm laceration over the patella
- Complains of tenderness with bearing weight

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Case 5

- Repair and discharge?

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Open Fractures

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Open Fractures

- Fractures that communicate with outside world

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Open Fractures

- Fractures that communicate with outside world
- Risk of osteomyelitis

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Open Fractures

- Management
 - Recognize!
 - Rule out neurovascular injuries/compartament syndrome
 - Antibiotics
 - Tetanus
 - Irrigate
 - Immobilize

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Open Fractures

- Management
 - Recognize!
 - Some are easier to miss than others
 - Rule out neurovascular injuries/compartament syndrome
 - Antibiotics
 - Tetanus
 - Irrigate
 - Immobilize

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Open Fractures

- Management
 - Recognize!
 - Rule out neurovascular injuries/compartiment syndrome
 - Compartment syndrome can still occur and can be missed
 - Antibiotics
 - Tetanus
 - Irrigate
 - Immobilize

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Open Fractures

- Management
 - Recognize!
 - Rule out neurovascular injuries/compartiment syndrome
 - Antibiotics
 - Depends on wound size, institution, etc
 - Tetanus
 - Irrigate
 - Immobilize

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Classification system for open fracture and related infection rates

Fracture type	Definition	Historical infection rates (percentage)
I	Wound <1 cm; minimal contamination, comminution and soft-tissue damage	0-2
II	Wound >1 cm; moderate soft-tissue damage; minimal periosteal stripping	2-5
III	Severe soft-tissue damage and substantial contamination; coverage adequate	5-10
IV	Severe soft-tissue damage and substantial contamination; coverage inadequate	10-50
V	Arterial injury requiring repair	25-50

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Open Fractures

- Management
 - Recognize!
 - Rule out neurovascular injuries/compartiment syndrome
 - Antibiotics
 - Cefazolin for smaller, lower risk; Broad spectrum for larger, higher risk
 - Tetanus
 - Irrigate
 - Immobilize

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Open Fractures

- Management
 - Recognize!
 - Rule out neurovascular injuries/compartiment syndrome
 - Antibiotics
 - Tetanus
 - Easy to forget!
 - Irrigate
 - Immobilize

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Open Fractures

- Management
 - Recognize!
 - Rule out neurovascular injuries/compartiment syndrome
 - Antibiotics
 - Tetanus
 - Irrigate
 - How much volume? How much pressure? What fluid? What additives?
 - Immobilize

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Irrigation Strategies for Open Fractures

- Low pressure is adequate
- Sterile saline probably best
- Volume dependent on wound size
 - But for pre-OR care, not well studied
- Do not add antiseptics

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Open Fractures

- Management
 - Recognize!
 - Rule out neurovascular injuries/compartment syndrome
 - Antibiotics
 - Tetanus
 - Irrigate
 - Immobilize
 - Splint after covering open portion

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Open Fractures

- Previous recommendations were that these needed irrigation/debridement within 6 hours of injury
- Current recommendations have lengthened that to 24 hours

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Open Fractures

- Major Exception
 - Minor hand and finger lacerations can we washed out
 - Very low rates of infection due to vascular supply

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Case 6

- A 12 year old female presents with left knee pain after crashing a dirtbike
- Pain mild, neurovascular intact

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Traumatic Arthrotomy

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Traumatic Arthrotomy

- A wound that extends into the joint capsule
- Can be very subtle
- Knee is the most common joint
- Risk of septic arthritis

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Traumatic Arthrotomy

- Diagnosis
 - Local Exploration
 - X-ray
 - Saline Load Test
 - CT?

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Traumatic Arthrotomy

- Diagnosis
 - Local Exploration
 - Visualization of bubbles or joint fluid (yellow, oily viscous substance)
 - X-ray
 - Saline Load Test
 - CT?

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Traumatic Arthrotomy

- Diagnosis
 - Local Exploration
 - X-ray
 - Intra-articular air or foreign body
 - Saline Load Test
 - CT?

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Traumatic Arthrotomy

- Diagnosis
 - Local Exploration
 - X-ray
 - Saline Load Test
 - Volume dependent on joint and controversial even within each joint
 - For knee, volumes of 50-195mL described with sensitivities ranging from 46-95%
 - Methylene blue not needed
 - CT?

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[\[Computerized Study\]](#) | J Orthop Trauma. 2015 Nov;29(10):488-504.
doi: 10.1097/JOT.0000000000000229.

Computed tomography scan to detect traumatic arthrotomies and identify periarticular wounds requiring surgical intervention: an improvement over the saline load test

Sergi R Kundra ¹, Roy T Dendelovich, Kenneth A Egol

J Orthop Trauma. 2015;29(10):488-504.

PMID: 2587770 DOI: 10.1097/JOT.0000000000000229

Abstract

Objective: To report our experience with computed tomography (CT) scans to detect traumatic arthrotomies of the knee (TKA) joint based on the presence of intra-articular air.

Design:

 Retrospective review.

Setting:

 Level I trauma center.

Patients: Only two consecutive patients (22 knees) underwent a CT scan of the knee in the emergency department and had a minimum of 14 days follow-up. Cohort of 33 patients (33 knees) from the original 42 patients who underwent a saline load test (SLT).

Intervention:

 CT scan and SLT.

Main outcome measurements: Positive traumatic arthrotomy of the knee (TKA) was defined as operating room (OR) confirmation of an arthrotomy or no intra-articular air on CT scan (iACCT) and SLT performed with follow-up revealing a positive knee. Periarticular wound requiring knee traumatic arthrotomy (ie, TKA) was defined as OR evaluation revealing no arthrotomy or iACCT and SLT performed with follow-up revealing no arthrotomy.

Results: All 32 knees with intra-articular air on CT scan (iACCT) had OR confirmation of a TKA and none of these patients had a knee infection at a mean follow-up of 1652 ± 238.6 days. None of the 33 patients with iACCT had a knee infection at a mean follow-up of 2912 ± 548.3 days. Based on these results, the sensitivity and specificity of the CT scan to detect TKA and knee iACCT was 100%. In a subgroup of 33 patients that received both CT scan and the conventional SLT, the sensitivity and specificity of the CT scan was 100% compared with 93% for the SLT (P < 0.001).

Conclusion: CT scan performs better than the conventional SLT to detect traumatic knee arthrotomies and identify periarticular knee wounds that do not require surgical intervention and should be considered a valid diagnostic test in the appropriate clinical setting.

Level of evidence: Diagnostic Level II. See Instructions for Authors for a complete description of levels of evidence.

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Traumatic Arthrotomy

- Diagnosis
 - Local Exploration
 - X-ray
 - Saline Load Test
 - CT?
 - Can detect intra-articular air
 - A small study found that it is up to 100% sensitive for joint violation

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Potpourri

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Beware of Kids

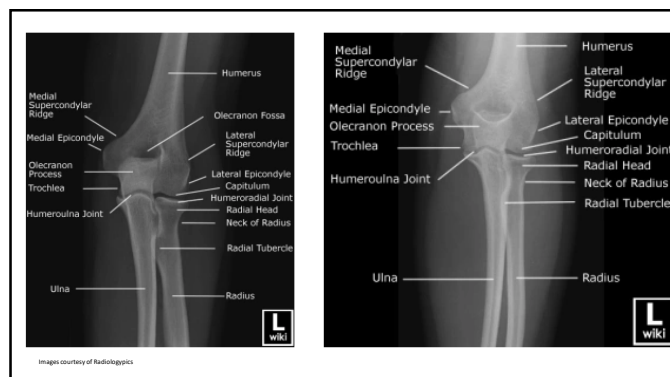
- Pediatric elbow and ankle injuries can be easily missed and result in significant morbidity
- If tenderness is present over a growth plate, consider splinting even if plain films are reassuring

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Pediatric Elbow

- Could be an entire lecture

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Pediatric Elbow

- Pathologic Findings
 - Sail sign
 - Posterior fat pad

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Pediatric Elbow

- Helpful Lines
 - Radiocapitellar line
 - Anterior humeral line

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Radiocapitellar Line: line through the radial neck bisects the capitellum



Image c/o emDoc.net

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Anterior Humeral Line: a line drawn along the anterior margin of the humerus should run through the middle third of the capitellum.

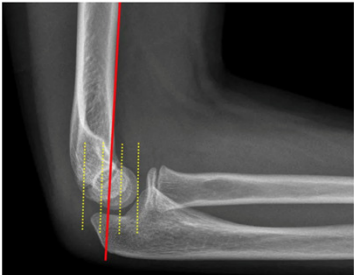


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Pediatric Ankle

- Beware of the Tillaux Fracture

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Tillaux Fracture




Image c/o Kennedy MA, Sama AE, Padavan S. The Tillaux fracture: a case report. J Emerg Med. 1998 Jul-Aug;16(4):603-6

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Tillaux Fracture




Image c/o Kennedy MA, Sama AE, Padavan S. The Tillaux fracture: a case report. J Emerg Med. 1998 Jul-Aug;16(4):603-6

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Tillaux Fracture



Image © Kennedy MA, Sama AJ, Policansky S. The Tillaux Fracture: a case report. J Emerg Med. 1998 Jul-Aug;16(4):603-6

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Tillaux Fracture

- An avulsion fracture in kids 12- 15 years old
- The anterior talofibular ligament pulls the growth plate off
 - Ligaments are generally stronger than bones in kids

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Tillaux Fracture

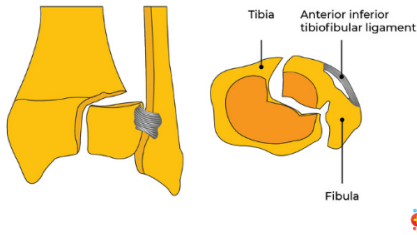


Image © Doortforgethethibbles.com

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Tillaux Fracture

- Easily missed on plain films
 - Particularly the degree of displacement
- Can have minimal swelling

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Tillaux Fracture

- Orthopedic consultation needed
- A "perfect reduction" and casting is necessary
- Post reduction CT with 3D recon is often requested
- Generally, these are treated conservatively, with reduction only if 2mm or more
 - But fraught with complications
 - Osteonecrosis of distal tibial epiphysis, premature growth arrest, compartment syndrome, early-onset arthritis

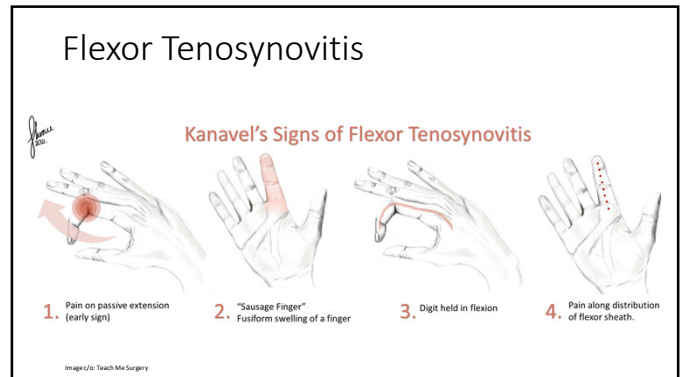
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High Pressure Injection Injury

- Frequently look like minimal injury initially
- High pressure (water, paint, etc) can dissect along planes and result in vascular injury
- If not promptly debrided, can result in amputation
- Orthopedic consultation and admission (at minimum) needed

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Occult Scaphoid Fractures

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Occult Scaphoid Fractures

Journal of Medical Radiation Sciences

ORIGINAL ARTICLE

Early MRI versus conventional management in the detection of occult scaphoid fractures: what does it really cost? A rural pilot study

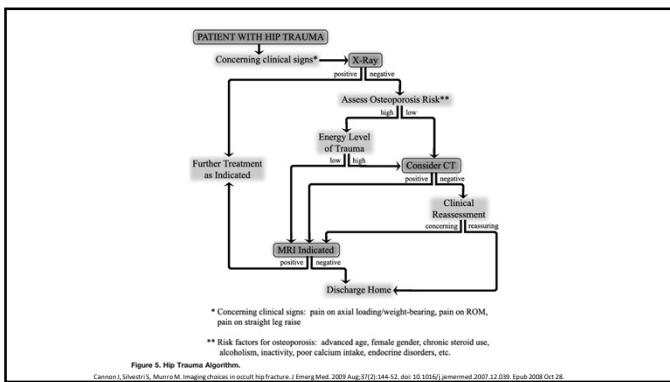
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Imaging of the Hip

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Images/Videos

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