

Framework Approach to Orthopaedics Part 1: Trauma

Mok Ying Ren



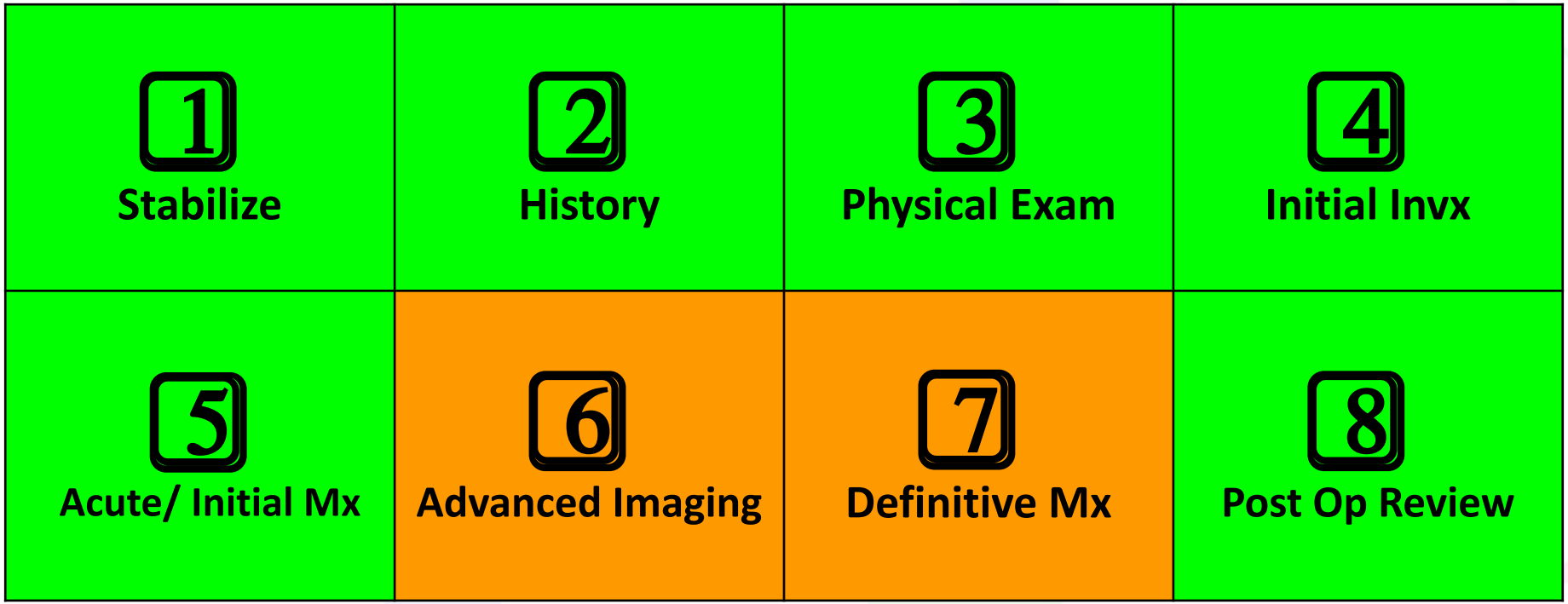
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Why this series?

- **Systematic** - Teach you to think systematically like a orthopaedic surgeon
- **Broad** - Provide a helicopter view on the entire scope of Orthopaedics Surgery
- **Clarity** - Be clear about knowledge you need to know and what you do not need to know
- **Safety** - Safety net to rely on for exams and future career.



Ortho Made Simple Framework





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Our Goal



- Apply the same framework in 3 scenarios:

- **Trauma** (Closed Isolated, Polytrauma, Spine, Open)
- **Chronic Pain** (Joint, Spine)
- **Infection** (Soft Tissue, Joint, Bone)

- If it gets boring, it means you are getting it

OMS Framework - Trauma

Closed Isolated Fractures/ Polytrauma/ Spine Fractures/ Open Fractures

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1. Stabilize

- "Patient must stay alive"
- **ATLS** Principles
- If patient is able to communicate and walk into the clinic, less likely required





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2. History

Mechanical fall = No medical reasons for the fall after checking for pre-fall, intra-fall, post-fall symptoms

General History

- Age, Gender, Race
- Occupation
- Smoking/ Drinking
- Sports/ Recreation
- Handedness (for UL injuries)
- Past Medical History
- Past Surgical History
- Drug Allergy

Specific History

- Condition History
  - Mechanism - "Mechanical fall"
  - Red flags - "Prodromal pain"
  - Severity of Pain - SOCRATES (not as crucial as in a chronic pain)
- Risk Factor History
  - Elderly - Osteoporosis
  - Any other PMHx that can result in brittle bones

Prodromal Pain = Pain before the fall

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3. Physical Examination

1. Open Fracture
    - "Tenting" as a feature of impending open fracture
2. Neurovascular Involvement
    - Be specific with the nerve and how you test
    - Be specific with the artery you checking
    - *Concept of a downstream river
3. Compartment Syndrome
4. Secondary Survey





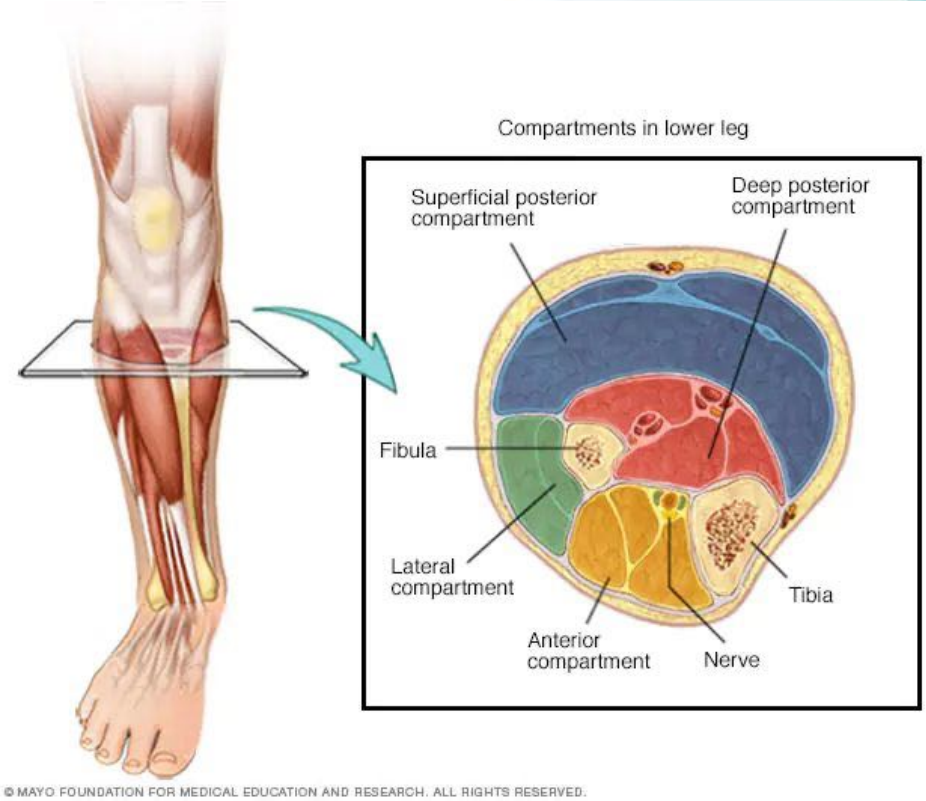
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Compartment Syndrome - MUST KNOW

“ A condition in which increased pressure within a limited osseo-fascial space compromises the perfusion and function of the tissues within that space.”

- Elevated tissue pressure within a closed fascial space
  - Reduces tissue perfusion - **ischemia**
  - Results in cell death - **necrosis**
    - Irreversible damage of muscles and nerves in 8 hours! (Urgent!!)
- Even in Open Fractures!
- An Orthopaedic Emergency



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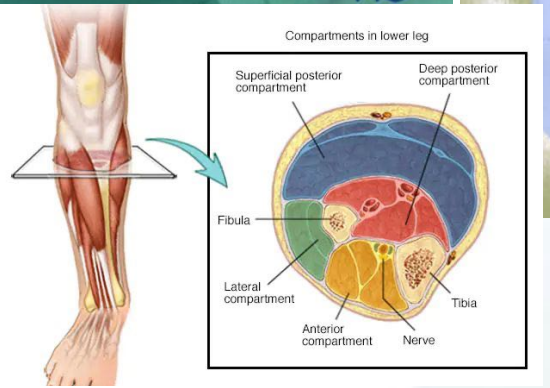
How do you know there is compartment syndrome?

"6 P's"

- ***** Pain out of proportion *****
- Paresthesia
- Paralysis
- Pulselessness
- Pallor
- Perishingly Cold







Examination finding:

"Pain and the aggravation of pain by passive stretching of the muscles in the compartment in question"

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What should you do immediately?

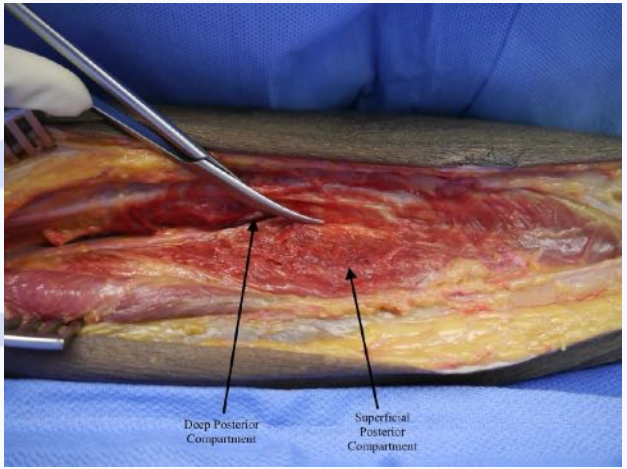
- Remove cast or dressing
- Place at level of heart (DO NOT ELEVATE) → you want blood to flow there!
- Alert senior

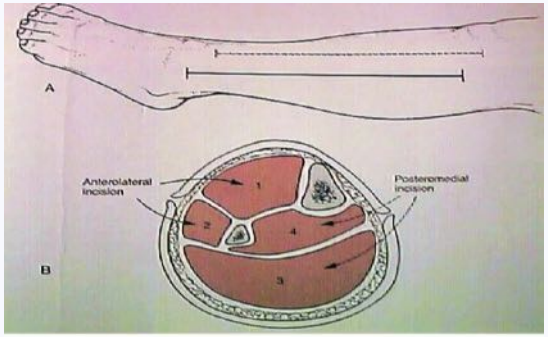


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Compartment Syndrome - Surgical Treatment

- **Fasciotomy**
  - -otomy = cut only
  - Fasciotomy = Cut the fascia (not remove)
- (not Fasiectomy)
  - -ectomy = remove







Double-Incision Fasciotomy of the Leg for Decompression in Compartment Syndromes

MUBARAK, SCOTT J.; OWEN, CHARLES A.

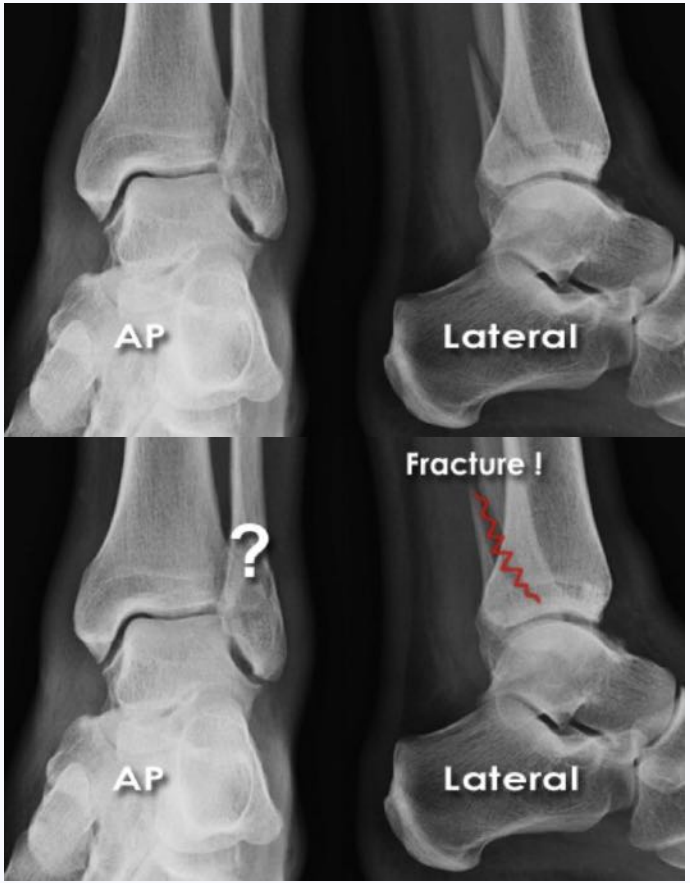
Author Information

The Journal of Bone & Joint Surgery 59(2):p 184-187, March 1977.

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4. Initial Investigations

- **Imaging**
  - Orthogonal views
  - "XR of entire bone"
  - "One joint above, one joint below"
  - Special views are bonus
  -



- Bloods
  - Pre Op - FBC, RP, PT/ INR, ECG, CXR
  - Risk factors - Vit D, Calcium panel, TFT, LFT
  - Stability - Lactate, ABG (mention if polytrauma)

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5. Acute Management (A)

“What will you do as the primary care doctor?”

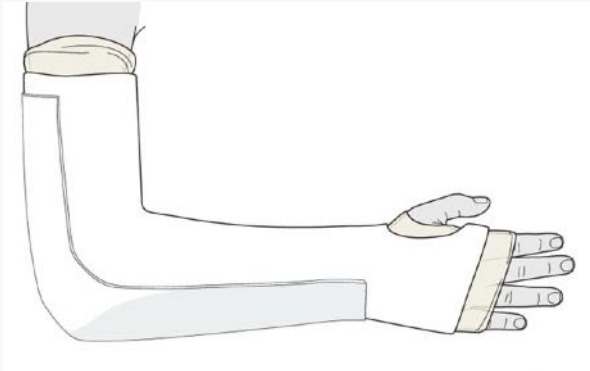
- **Address Pain**
  - Analgesia as per WHO pain ladder [ALL]
- **Address Fracture**
  - Manipulation and Reduction (MnR) under sedation (Not all injuries require this)
  - Temporary Stabilization
    - See annex for options. May need Ex Fix.
  - Re-check NV after MnR and Temp Stabilization



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Backslab vs Full Cast

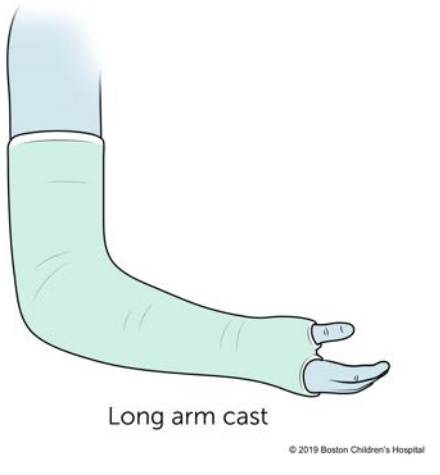
- Back slab = **half** circumference
  - Less Stable



- Full Cast = **Full** circumference
  - More stable

Which will you choose for Temporary Stabilization?

Back Slab - To allow space for swelling and prevent compartment syndrome!



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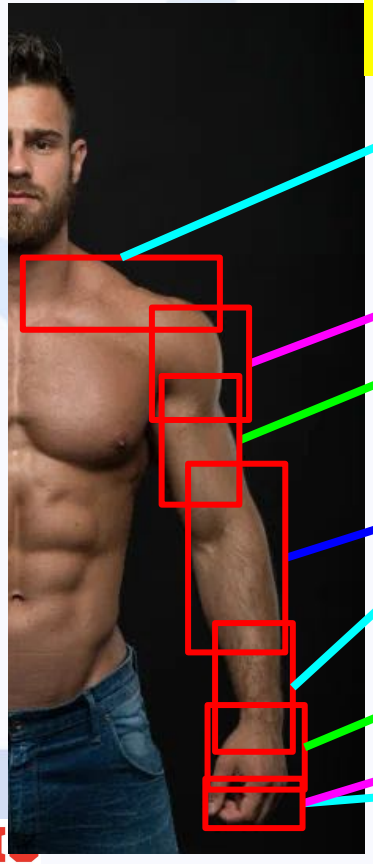
How Long Should it be?

- Roughly the fracture or injured area should be in the middle of the back slab
- Common sense!





Temp. Stabilization for UL Trauma



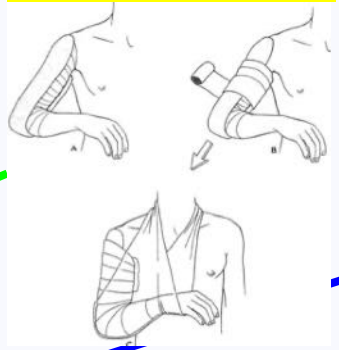
Arm Sling
E.g. Clavicle #, GHJ dislocation, ACJ Dislocation



Collar and Cuff
E.g. Proximal Humerus #



U-Slab
E.g. Humeral Shaft #



Above Elbow Backslab
E.g. Distal humerus #, Elbow dislocation, Other elbow #, Forearm shaft #





Below Elbow Backslab
E.g. Distal Radius #





Intrinsic Plus Splint
Ulnar Gutter Splint
Thumb Spica Splint
E.g. Metacarpal #

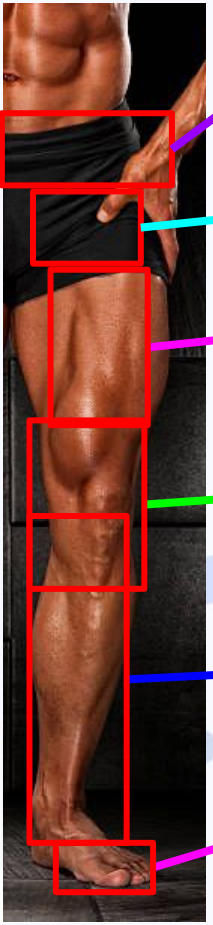


Buddy Splint
E.g. Prox, Middle Phal. #

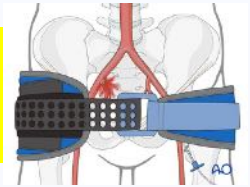


Zimmer Splint
E.g. Middle, Distal Phal. #

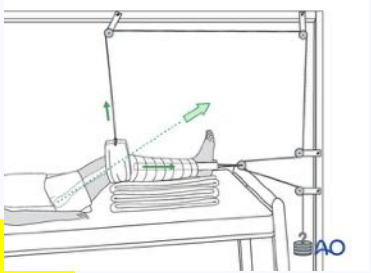
Temp. Stabilization for LL Trauma



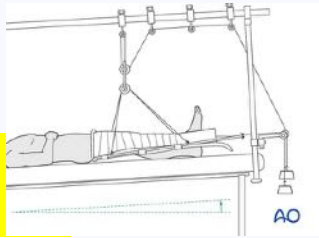
Pelvic Binder
E.g. Specific Pelvic fractures e.g. open book



Traction/ Bed Rest
E.g. Proximal Hip fractures



Thomas Splint
E.g. Femur Shaft #

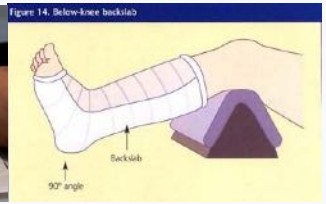


Above Knee Back Slab
E.g. Distal Femur #, Patella #, Proximal Tibia #



Below Knee Backslab
E.g. TIbia Shaft #, Distal Tibia #, Ankle #, Foot fractures other than phalanges





Buddy Splint
E.g. Toe Middle, Proximal phalanges #



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5. Acute Management (B)

“What will you do as the primary care doctor?”

- Monitor for and Prevent Important **Complications**
  - **Compartment syndrome** - watch for 6Ps, “Pain out of Proportion”.
    - Mx = remove back slab, do not elevate, Fasciotomy
  - **Deep Vein Thrombosis** when NWB esp. in elderly hip fractures
    - Pharmacological - e.g. Clexane
    - Non-P - Calf pumps



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6. Advanced Imaging?

- Computed Tomography (CT) Scan
  - See bony anatomy
  - Able to undergo 3D reconstruction
- Magnetic Resonance Imaging (MRI) Scan
  - Look for soft tissue injury

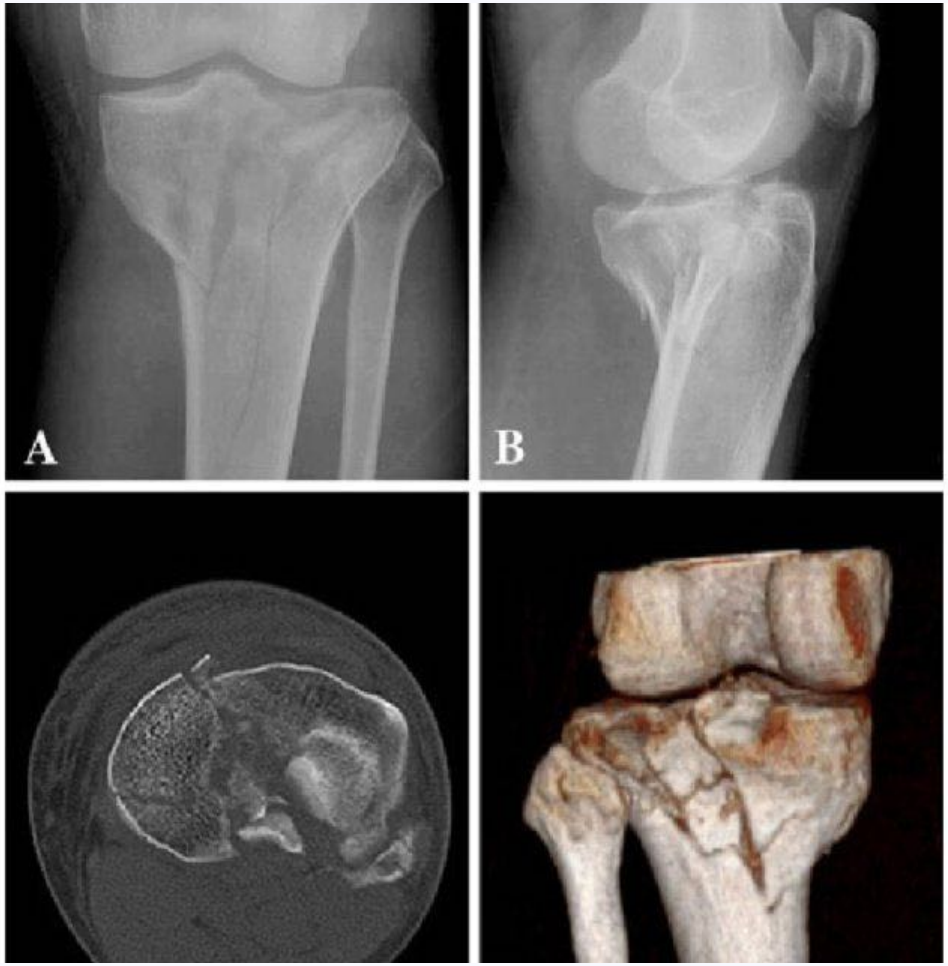


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CT Scan - When?

"XR can see a fracture, but not sure severity"

- Intra-articular fractures that require more precise pre-op planning
- Example:
  - Patient in Road Traffic Accident
  - **XR** - Comminuted Intra-articular Proximal Tibia (Tibial plateau) Fracture
  - **CT** scan to evaluate fracture patterns
  - Provides 3D Reconstruction (Fig. D)

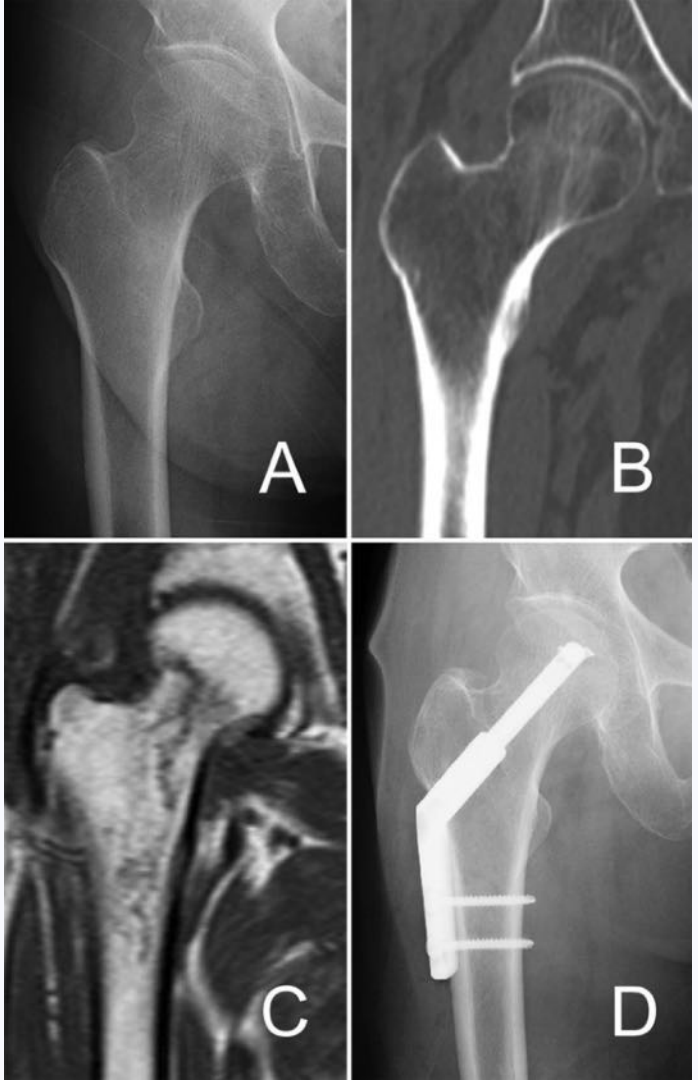


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MRI Scan - When?

"XR cannot see fracture, want TRO soft tissue injury or occult fracture"

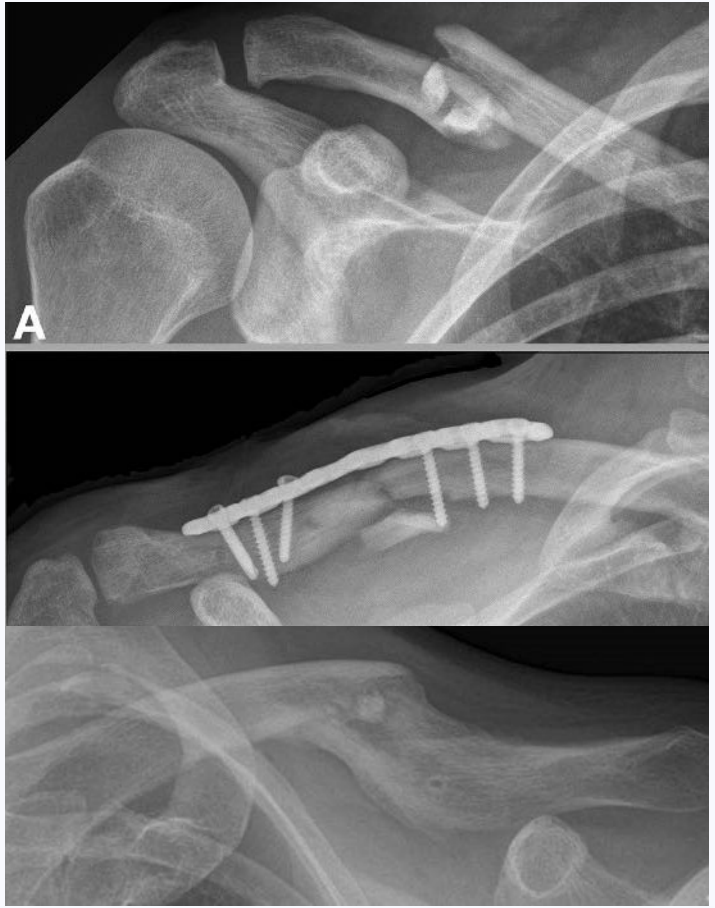
- Picks up injury by the presence of edema (increased water content)
- Example
  - Elderly ➔ Fell on buttock
    - **XR** of hips normal (Fig A)
    - **CT** scan of hips normal (Fig B)
    - **MRI** to look for occult fracture (Fig C)
  - Young Patient ➔ Soccer ➔ "Pop" ➔ XR normal (expected) ➔ MRI to look at ACL, meniscus tears



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7. Definitive Management

- Operative vs Non Operative
  - **Patient factors** e.g. Co-morbids, function.
  - **Injury factors** e.g. Classification
  - **Surgeon factors** e.g. choice of implants influenced by surgical training



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8. Post Op Review

1. Assess Patient
   a. Vitals
2. Assess Operated limb/ site
   a. Dressings
   b. Neurovascular status (be specific)
   c. Drain output (if present)
3. Review Post Op Notes
   a. **Prophylactic** Antibiotics
   b. Weight bearing status
   c. Order post op XR
   d. Consider DVT **Prophylaxis** if lower limb op
4. Subsequent Multidisciplinary team to optimize outcomes
   a. Rehab - PT/ OT, Rehab Med
   b. Social - MSW, CH, TCF
   c. Polytrauma - Psych for PTSD



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Op Notes

4 Components in Every Op Note

1. Surgery Performed
2. Surgical findings
3. Operative Procedure
4. Post Operative Orders and Instructions

Surgery Performed

Procedure(s):
surgical fixation of right patellar fracture keep in view transosseous repair 1

Surgery Findings

Right patellar inferior pole comminuted fracture 2

Operative Procedure

3

GA
Supine positioning
Clean and drape
Midline incision over right patella
Patella tendon exposed
Interlocking stitches to patella tendon with Ethibond 5
0.9 K wires X3 used as guidewire followed by 2.7 cannulated drill to create tunnels x3 over patella
Beath pin used to bring through Ethibond 5
Fracture reduced with patellar clamp
Checked under II - acceptable alignment
ethibond sutures tied over superior border of patella
Acceptable reduction with knee in extension, but fracture gap noted when flex to 90 degrees
Decision of figure of 8 cerclage wire with 20 G cerclage wire
Checking II done
Stable in flexion 90 degrees
Retinaculum repaired with vicryl 1-0
Closed in layers Vicryl 1-0 ; Vircyl 2-0; Staples to skin
LA given
Dressings applied

Post Operative Orders & Instructions

To GW
Para hrly *6 then para 4hrly 4
Allow diet when awake
Routine Analgesia
IV Cefazolin 2 more doses post op
Knee ranger brace locked in full Extension for 1 week, then allow flexion to 30 degrees in 2nd week
Start PT Cm
Allow partial weight bear right LL
Discharge planning
Right LL NV charting
postop Xray: right knee Xray ap lat

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What is the journey of the Fracture?



- **1. Reduce** the Fracture
- **2. Maintain** the reduction
- **3. Healing**

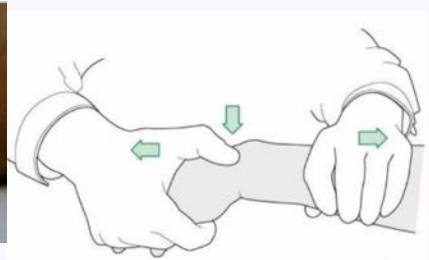


- **Complications (Hopefully not!)**

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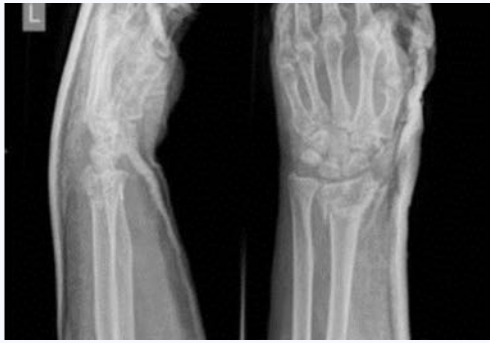
Step 1: **Reduce** the Fracture





- Reduce by **manipulation** - ““Manipulation and Reduction” “MnR”
  - **Closed** - no cutting of skin ***[Closed Reduction - CR]***
    - **Traction** to pull fracture apart
    - **Manipulate** it in the direction you need to reduce
  - **Open** - cut open ***[Open Reduction - OR]***
    - This can only be done in operating theatre
- Same terminologies for dislocations







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Step 2: **Maintain** the Reduction

- ***Think in 2 phases***
- **Acute (Phase 5) Temporary Maintenance of Reduction** - External only
  - Back slab (to accommodate swelling), Traction
  - External Fixation - metal outside the body
- **Definitive (Phase 7) Maintenance of Reduction**
  - Externally
    - Full Cast (circumferential)
    - External ring fixators (rare)
  - Internal Fixation **["IF"]**
    - Metal implants inside - nails, plates, screws
    - Hybrid - Percutaneous Pinning (Metal inside but sticking out)
    - Therefore, "ORIF" = Open reduction, Internal Fixation











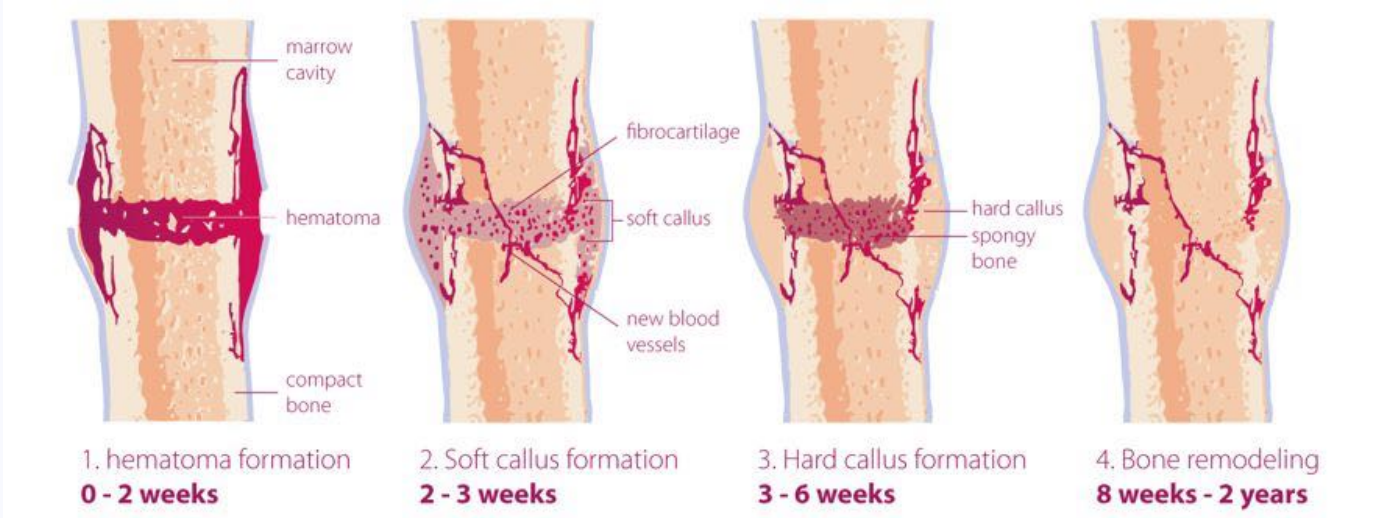




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Step 3: God **heals** in 4 Observable Phases

- Hematoma
- Soft Callus
- Hard Callus
  - (XR Changes)
- Remodelling









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Fracture Complications

- Nonunion, Malunion (all)
  - Nonunion - Why?
    - Unstable fixation - too much movement
    - Poor Biology - smoker
  - Malunion - leads to deformity
- Internal Fixations
  - Infection
  - Implant failure
  - Peri-implant fractures
    - Adjacent bone next to implant is point of weakness
- Fractures in/ near joints
  - Secondary Osteoarthritis





Real Life Case

Closed Wrist Fracture

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2. History

1. Stabilize

- ***ATLS*** Principles - ABC

2. History

- **General History (for all patients)** - Biodata, PMHx, Smoking, Drinking, Drug Allergy, Occupation, Sports, Handedness (UL)
- **Condition History**
  - Mechanism of injury - ***"Mechanical Fall"***
  - Ask red flags such as ***"Prodromal Pain"***
- **Risk Factor History**
  - Osteoporosis in elderly
  - Other PMHx that can result in frequent falls, brittle bones

52M
PMH: BPH

Biodata

Hide copied text
Hover for details

Came in today with Right FOOSH
Was skateboarding at home, loss his balance and fell to his right
Broke his fall with his right hand
Denies any head trauma or LOC
No nausea or vomiting
Denies any ARI Sx or fever
Otherwise well

"Mechanical Fall"

No Red Flags

What will you examine for?

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3. Physical Examination

3. Physical Exam

- Check for ***open fracture***
- Check ***neurovascular (NV) status***
  - Be specific how you check and what nerve/ vessel.
    - UL = MUR nerves, Radial Pulse
    - LL = Foot drop, DP and PT Pulses
- Check for ***compartment syndrome*** (even for Open fractures)
  - Especially for fractures at risk e.g., tibia plateau, shaft, pilon fractures.
- ***Secondary Survey*** "head to toe" for other injuries - facial, chest, pelvic compressions, other long bones.

O/e

Vital signs:

	29/08/22 21:08
BP:	105/70
Pulse:	(!) 55
Resp:	20
Temp:	36.8 °C
SpO2:	98%

Right hand dorsal angulation
No tethering of skin
Closed deformity
Sensation intact
Pulse present
Mobility of fingers intact



How will you investigate?

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4. Initial Invx

4. Initial Investigations

- ***Imaging***
  - ***Orthogonal*** views, "one joint above, one joint below"
  - Full length of fractured bone
  - Special XR views

- ***Bloods*** (only when for admitted)
  - ***Pre-Op Bloods*** - FBC, RP, PT/INR, GXM, ECG, CXR
  - ***Risk Factors*** - Vit D, Ca Panel, TFT, LFT osteoporosis)



How will you acutely manage this patient?

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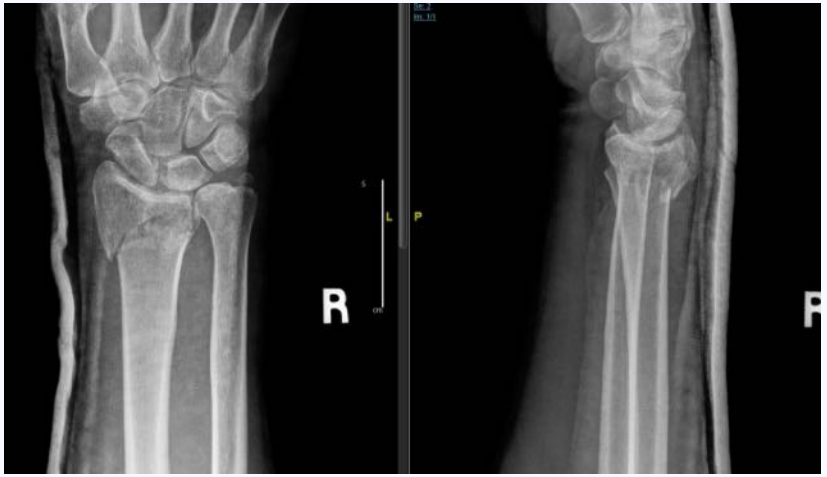
5. Acute Mx

5. Acute Management

- ***Address Pain*** = ***Analgesia*** as per WHO pain ladder [ALL]
- ***Address Fracture***
  - ***Manipulation and Reduction*** under sedation
    - *Not all injuries require this
  - ***Temporary Stabilization***
    - See annex for options. May need Ex Fix.
  - ***Re-check*** NV after MnR and Temp Stabilization
- **Monitor for and Prevent Important Complications**
  - **Compartment syndrome** - watch for 6Ps, "Pain out of Proportion". Mx = remove back slab, do not elevate, Fasciotomy
  - **Deep Vein Thrombosis** when NWB esp. in elderly hip fractures - Pharmacological and Non-P

Etoricoxib Tablet

Omeprazole Capsule



Patient discharged to Ortho clinic in 1 week

Will you do advanced imaging?

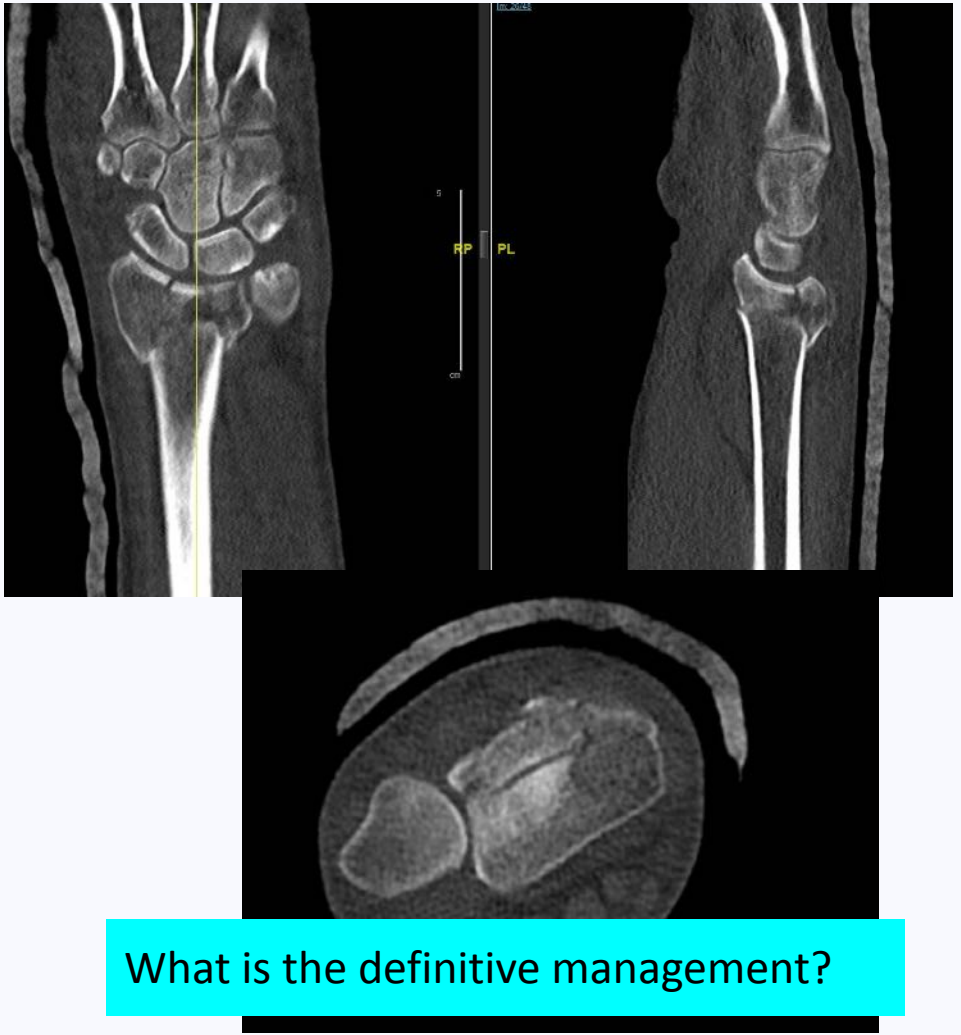
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6. Advanced Imaging

6. Advanced Imaging

- ***CT scan***
  - Indicated when XR shows fracture near a joint = "periarticular fracture"
  - Useful for surgical planning and 3D reconstruction
- ***MRI scan*** without contrast
  - Indicated when XR is normal
  - Concerns of soft tissue injury (meniscus, cartilage, ligaments) or occult fracture
- MRI scan ***with contrast***
  - Concerns of tumor/ infection



What is the definitive management?

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7. Definitive Mx

7. Definitive Management

- **"Operative vs Non-Operative"** depending on
  - **Patient** factors e.g. Co-morbids, function.
  - **Injury** factors e.g. Classification e.g. Spine Trauma TLICS, SLICS score
  - **Surgeon** factors e.g. choice of implants influenced by surgical training
- ***Non-Operative***
  - Continue immobilization until fracture healing
  - Convert back slab to full cast
- ***Operative***
  - Closed or Open Reduction
  - With internal fixation - screws, plates, nails, wires → Dependant on each injury
  - If peri-articular fractures → Fix vs Replace



How will you assess post op?

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8. Post Op Review

8. Post Op Review

- Assess **patient**
  - Stability and vitals
  - GA Complications
- Assess **operated limb/ site**
  - Dressings - ensure not soaked
  - Chart drain outputs (be specific)
  - Distal neurovascular
- Follow **Post Op instructions** for:
  - IV Antibiotics for ***Prophylaxis***
  - Analgesia as per WHO
  - ***DVT prophylaxis***
  - Weight bearing status
  - Range of motion
  - STO timing - usually 14 days
- Subsequent ***Multidisciplinary*** team to optimize outcomes
  - Rehab - PT/ OT, Rehab Med
  - Social - MSW, CH, TCF

pt well
having some pain over op site but manageable
keen to go home today

☐ Hover for details

OE
right hand
- dressings dry and intact
- numbness over right MF (present pre op) - pt says improving
- sensation over rest of hand normal

plan
as per Post op notes



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Op Notes

4 Components in Every Op Note

1. Surgery Performed
2. Surgical findings
3. Operative Procedure
4. Post Operative Orders and Instructions

Surgery Performed

Procedure(s):
OPEN REDUCTION AND INTERNAL FIXATION OF RIGHT DISTAL RADIUS, RIGHT CARPAL TUNNEL RELEASE

Surgery Findings

right intra articular distal radius fracture, AOC2
median nerve inspected, healthy
2x full thickness skin lesions at volar ulnar aspect of wrist

Operative Procedure

GA + forearm block
Supine
Cleaned and draped
Trans FCR approach
PQ incised
Fracture site exposed and taken down
Callus debrided
Orbay extended FCR approach done
Fracture reduced with using the implant and reduction clamps with traction
Fracture fixed with 2.4mm synthes variable angle plate
Check II done - reduction satisfactory
Thenar crease incision over right carpal tunnel
TCL and distal antebrachial fascia divided
Irrigation with saline
Hemostasis
PQ repaired with PDS 3-0
Skin closure in layers, vicryl 4-0 to subcut and monocryl 5-0 to skin
full thickness skin lesions excised and skin closed with ethilon 5-0
Steristrips
Dressings
Volar slab

Post Operative Orders & Instructions

home today
analgesia
TCU Dr Sandeep 2/9/22

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Wrist Fracture Add-ons

1. ATLS if required	**2. Hx**
	• Same
	  • Condition hx
	  • Risk Factor Hx
	• If UL → Handedness
		3. PE
		Same – open, NV, compartment
			4. Initial Invx
			• Imaging – same
			• Bloods – Usually not required in the EMD as can be sent to Outpatient Ortho Clinic

5. Acute Mx
• Analgesia – WHO
• MnR, Temp Stabilize – Below elbow back slab
	6. Advanced Imaging
	CT scan if intra-articular
		7. Definitive Mx
		(Think of Classification here)
		• Depends on function
		  • Elderly, low demand → non op
		  • High demand → ORIF
			8. Post op
			Same

YMS

1 Stabilize | 2 History | 3 Physical Exam | 4 Initial Invx
5 Acute/ Initial Mx | 6 Advanced Imaging | 7 Definitive Mx | 8 Post Op Review

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Wrist Fracture OSSE!

1. What will you examine for?
2. How will you investigate?
3. How will you acutely manage this patient?
4. Will you do Advanced Imaging?
5. What is the definitive management?
6. How will you assess post op?



Stem: 55 Year old male with a wrist injury

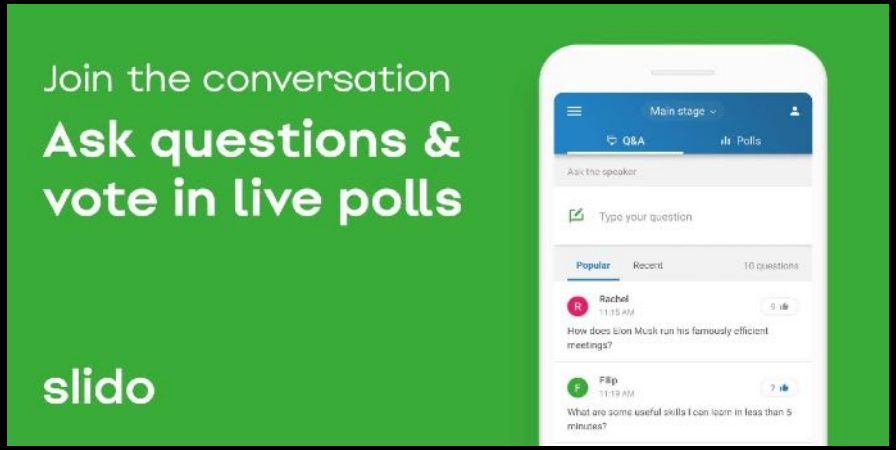


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Quiz Time!

- **Live Audience** – Submit your answer on SLIDO to enhance your learning through immediate feedback.

- **Recording Audience** – Refer to the slides for the exact questions and options.





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Trauma Framework Quiz Q1

25 **What is the first step in managing any trauma patient?**

- Take History
- Stabilize with ATLS Principles
- Examine Patient
- Do XR



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Trauma Framework Quiz Q2

26 **What does MECHANICAL FALL mean?**

- Patient did not fall from height
- Patient hit by a mechanism
- No precipitating symptoms
- Patient was pushed from the side



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Trauma Framework Quiz Q3

27 **What does PRODROMAL pain mean?**

- Pain after the fall
- Pain that goes away with rest
- Pain before the fall
- Pain that is significant



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Trauma Framework Quiz Q4

25 **What are the 4 crucial things to examine for in any trauma patient?**

- Neurovascular Status
- Range of Motion
- Open Wounds
- Impingement symptoms
- Compartment Syndrome
- Secondary Survey

OMS Framework - Trauma

Closed Isolated Fractures/ **Polytrauma**/ Spine Fractures/ Open Fractures

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Polytrauma - What's Different?





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Polytrauma - A Spectrum of Injuries

- Many definitions - ISS score, AIS score, Berlin,
- Most simple accepted definition:
  - **“Multiply injured patient who sustained injury to more than 1 organ system”**
    - Head / Neck
    - Face
    - Chest / Thorax
    - Abdomen and Pelvis
    - Extremities and Spine
    - External wounds and Burns
- Huge Spectrum of severity

The quest for a universal definition of polytrauma:
A trauma registry-based validation study

Nerida E. Butcher, MD, Catherine D’Este, PhD,
and **Zsolt J. Balogh, MD, PhD,** *Newcastle, New South Wales, Australia*

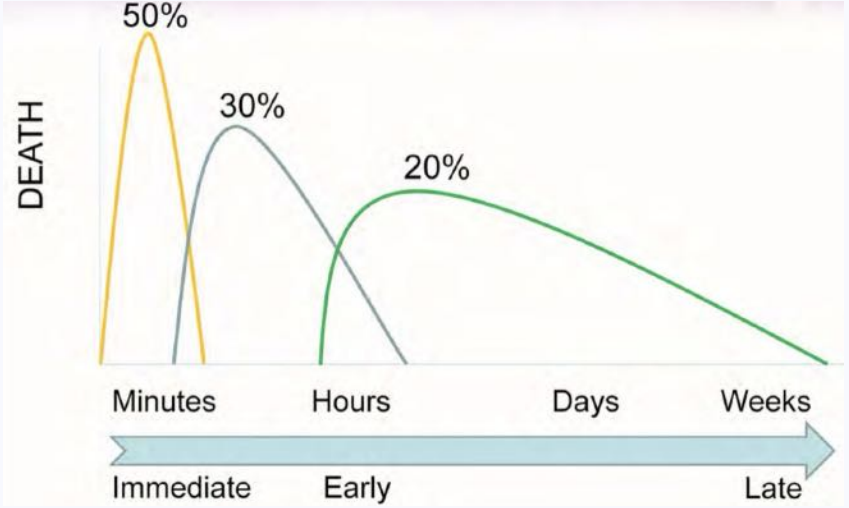


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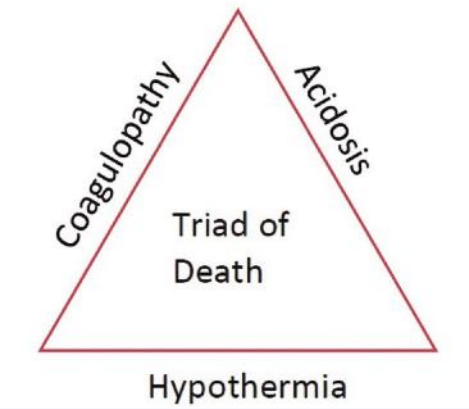
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Polytrauma - Reasons for Death

- **Trimodal** distribution. Of all who die from polytrauma:
  - 50% die from Traumatic Brain injury
  - 30% from ***Bleeding*** (within 6 hrs)
  - 10% from Multi-organ dysfunction (MOF) and sepsis
- **Triad of death** = Coagulopathy, Acidosis, Hypothermia
- Concept of "Golden Hour" - window of opportunity soon after injury to stabilize patient using **ATLS Principles**



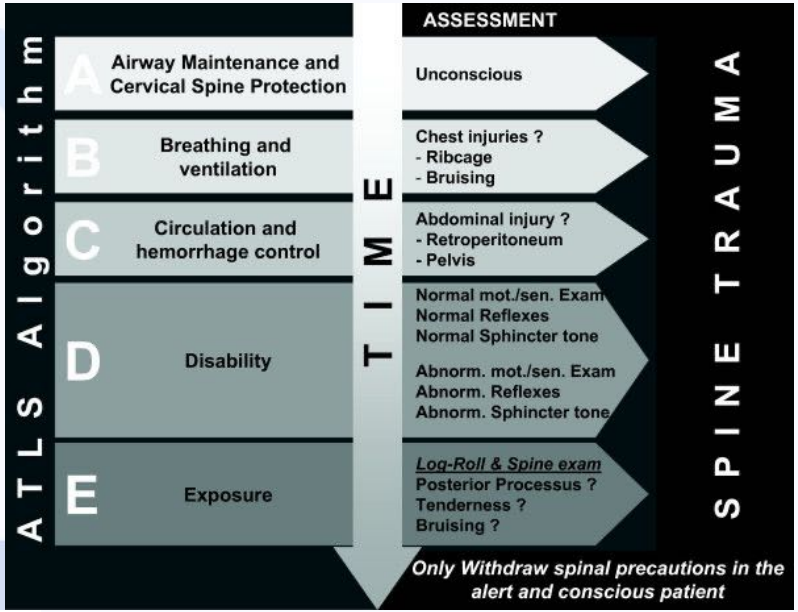
Which of this can the ortho surgeon manage?

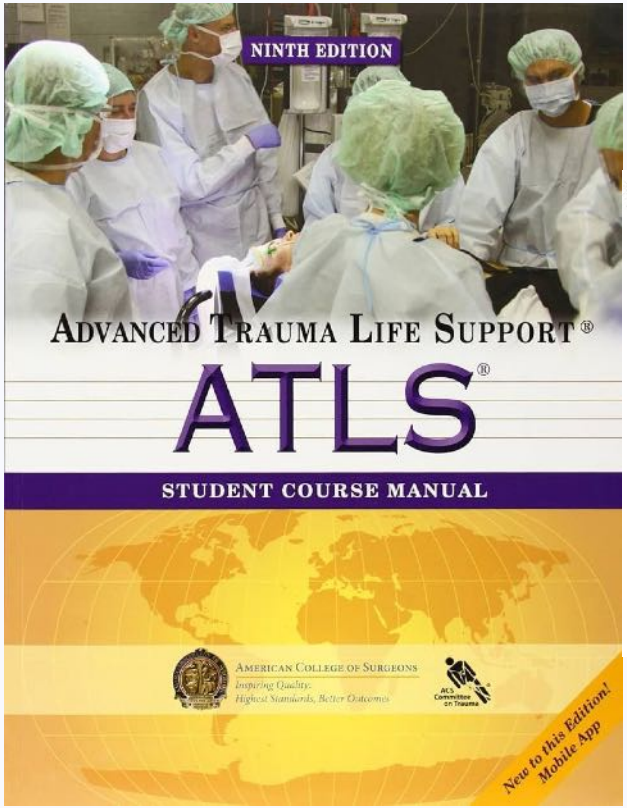


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ATLS

- Comprehensive, multidisciplinary approach to stabilize the patient. “Stabilize the ABCs”





Course Outline

- Module 0: ATLS Overview
- Module 1: Initial Assessment and Management
- Module 2: Airway and Ventilatory Management
- Module 3: Shock
- Module 4: Thoracic Trauma
- Module 5: Abdominal and Pelvic Trauma
- Module 6: Head Trauma
- Module 7: Spine and Spinal Cord Trauma
- Module 8: Musculoskeletal Trauma
- Module 9: Thermal Injuries
- Module 10: Pediatric Trauma
- Module 11: Geriatric Trauma
- Module 12: Trauma in Pregnancy and Intimate Partner Violence
- Module 13: Transfer to Definitive Care
- Post-Module Assessment
- Course Evaluation

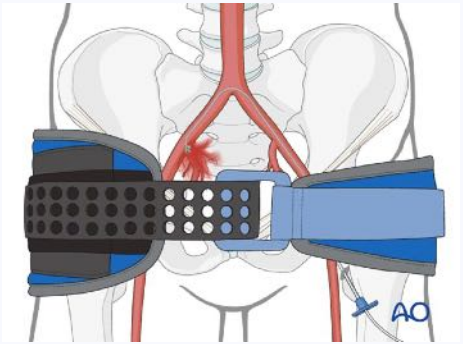
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ATLS - Advanced Trauma Life Support

- Secure ABCs, institute necessary adjuncts
  - **Airway** - Intubate
  - **Breathing** - Chest Tubes
  - **Circulation** - 2 large IV cannula, Massive Transfusion Protocol (MTP), Urine Catheter, Pericardiocentesis,
    - Ortho: Pelvic Binder/ C-Clamp
  - **Disability** - Prevent further injuries
    - Ortho: C-Collar, Spinal Nursing
- Multidisciplinary Team
  - Emergency Doctors
  - General Surgeons
  - Allied health
    - Nurses
    - Radiographers
- Requirements of the above depends on the severity





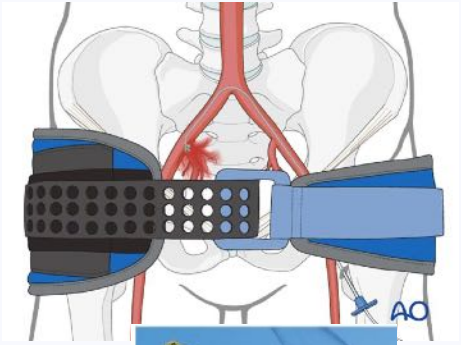
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Pelvic Binder and C-Clamp

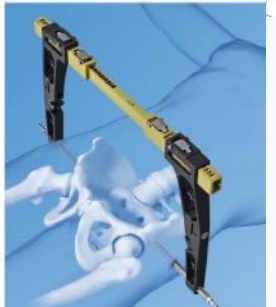


Organ/area	Estimated blood loss [ml]
Pelvis	3000–5000
Spleen	2000
Liver	2000
Femoral fracture	1500–2000
Lungs	1000–1500
Tibia/fibula fracture	1000
Humerus fracture	800
Radius/ulna fracture	400
Rib	125

- Addressing the **Circulation** by limiting blood loss from pelvic injuries
  - Majority is from **venous** bleeding
  - 10% Arterial bleed
  - 3 to 5 Litres!
- How to reduce blood loss?
  - ***Venous*** - Reduce pelvic volume to stabilize blood clot. How?
    - Pelvic Binder (in EMD) - centered on **Greater Trochanters**
    - C-Clamp (in EMD)
    - Ex-fix (in OT) - allows packing of pelvis by GS
  - ***Arterial*** - Need angiogram and embolization







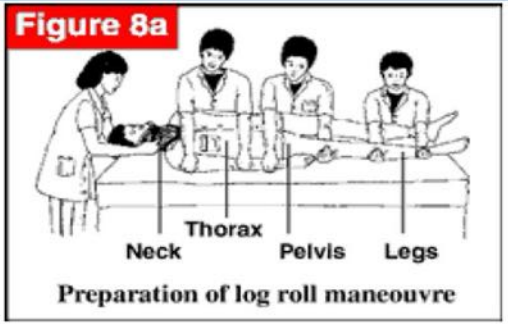


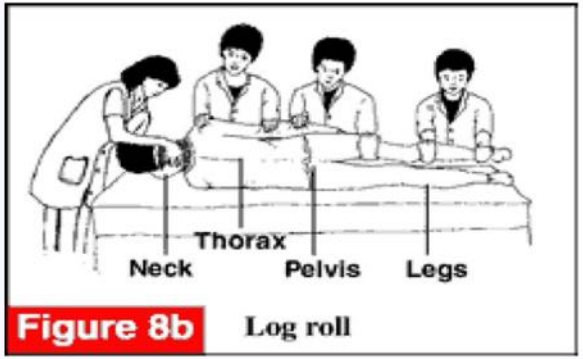
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Protect the Spine

- Expecting the worse (based on the patient's presentation)
- **Cervical Spine** - Presence of Spinal cord!
  - Apply Rigid C-Collar
- **ThoracoLumbar Spine** - Presence of cord and nerve roots
  - Spinal Nursing - no sitting up in bed, immobilising whole spine
- How to evaluate the spine when in spinal nursing?
  - Log roll: 4 people to do the roll.
    - 1 at the head to provide **in-line traction**.
    - Other 3 at Thorax, Pelvis and Leg
    - Turn like a log
  - Once Turned - Look for wounds, palpate for steps along spine, digital rectal exam

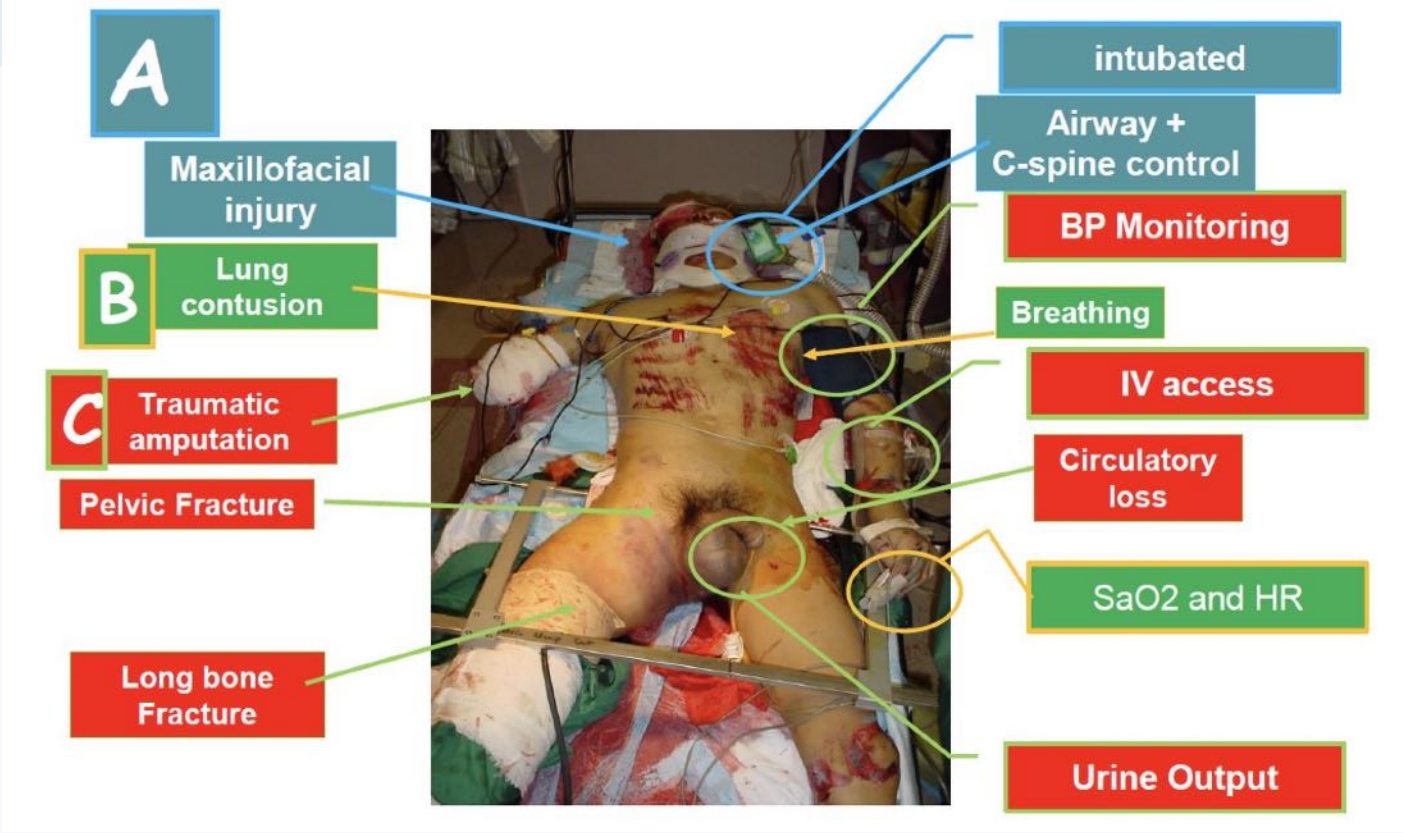






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What ATLS Stabilization will look like - Messy and Chaotic



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Philosophies in Surgical Management

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Early versus Delayed Stabilization of Femoral Fractures

A Prospective Randomized Study*†

BY LAWRENCE B. BONE, M.D.‡, KENNETH D. JOHNSON, M.D.§, JOHN WEIGELT, M.D.#, AND ROBERT SCHEINBERG, M.D.#, DALLAS, TEXAS

- 2 Early Extreme Philosophies
  - **Early Total Care (ETC)** (Bone et al. 1989)
    - Internally **fix all** fractures at the first surgery
  - **Damage Control Surgery (DCS)** (Pape et al. 2002)
    - Temporarily stabilization with External Fixators
    - Stabilize further in SHD, ICU
    - Definitive Management when stable
- Reality is somewhere in the middle, dependant on multiple factors - **Early Appropriate Care (EAC)** (Vallier 2011)
  - **Patient** - Physiological stability to undergo long surgery
  - **Injuries** - Number and location of injuries, presence of open fractures
  - **Surgeon** - need multiple specialists?
  - **Resource** - OT availability?

Excerpta Medica

The American Journal of Surgery

The American Journal of Surgery 183 (2002) 622–629

Review

The timing of fracture treatment in polytrauma patients: relevance of damage control orthopedic surgery*

Hans-Christoph Pape, M.D.[a,*,†], Peter Giannoudis, M.D.[b], Christian Krettek, M.D.[a]

ORIGINAL ARTICLE

Timing of Orthopaedic Surgery in Multiple Trauma Patients: Development of a Protocol for Early Appropriate Care

Heather A. Vallier, MD, Xiaofeng Wang, PhD, Timothy A. Moore, MD, John H. Wilber, MD, and John J. Como, MD



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What the DCS component of EAC looks like



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Waiting for Definitive Mx - Prevent Complications

- Patient may be admitted to Intensive Care Unit or High Dependency Unit to further stabilize
  - Multidisciplinary care - ICU anaesthetists, General Surgeons, Ortho
- Period of immobility
  - Prevent **pressure sores** with regular turning
  - Prevent **DVT**
    - Pharmacological
    - Non- P - calf pumps
- Prevent **Infection**
  - **Prophylactic** Antibiotics
  - External Fixation Pin Tract care
  - Wound care in open fractures
- Monitor for **compartment syndrome**









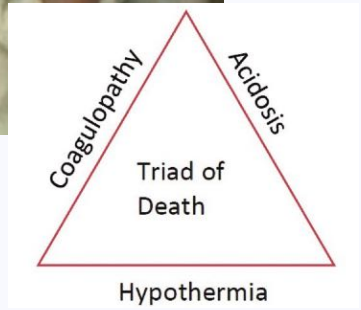


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When is patient ready for Definitive Mx?

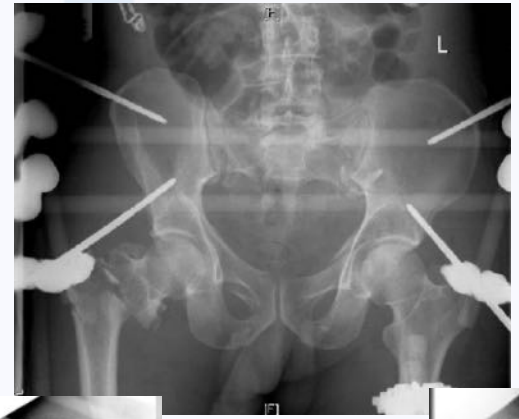
- No **Triad of death**
  - Not acidotic
  - Not Hypothermic
  - No Coagulopathy
- Physiologically stable in other organ systems
- Multidisciplinary decision - ICU anaesthetists, General Surgeons, Ortho





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Definitive Management Completed











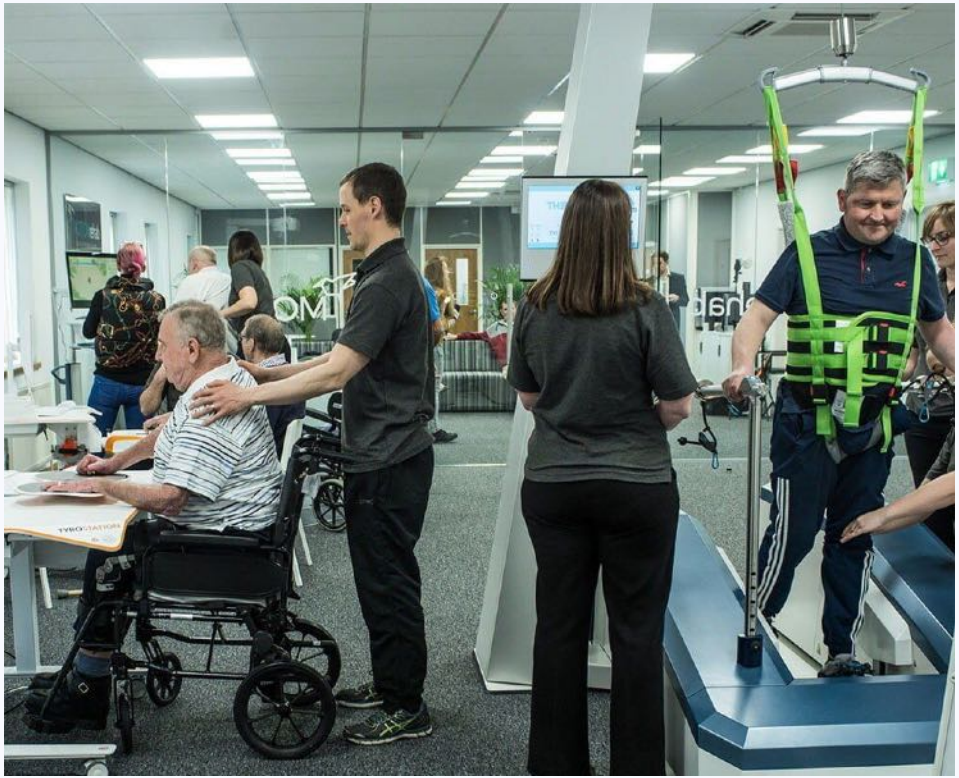


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Surgery = Half the Battle won

- **Multidisciplinary** involvement still crucial!

- Physiotherapists - Function, mobility
- Occupational Therapists - ADL
- Rehabilitation Physicians
- Social Worker
- Community/ Rehab placement
- Psychiatrist for PTSD



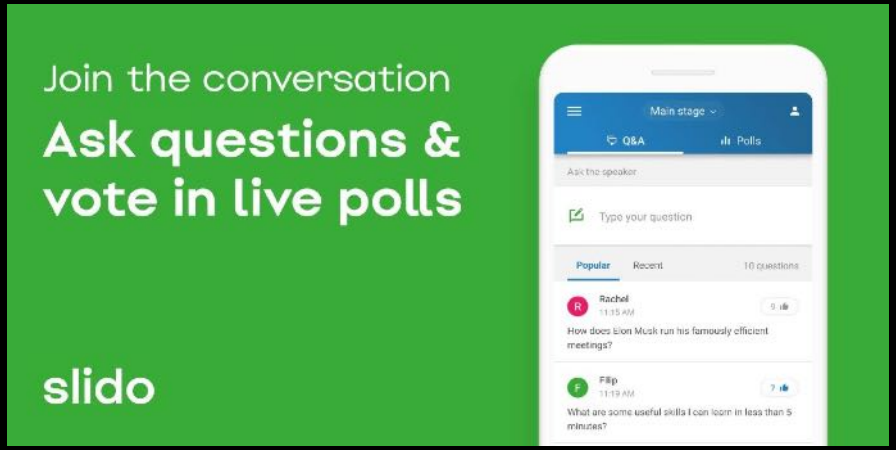


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Quiz Time!

- **Live Audience** – Submit your answer on SLIDO to enhance your learning through immediate feedback.

- **Recording Audience** – Refer to the slides for the exact questions and options.





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Trauma Framework Quiz Q5

18 **Which of these adjuncts applied to a polytrauma patient is aimed to reduce blood loss?**

- C-collar
- Log Roll
- Pelvic Binder
- External Fixation



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Trauma Framework Quiz Q6

17 **Which of these constitute the triad of death?**

- Hypothermia
- Hypoglycemia
- Hyperlactatemia
- Acidosis
- Coagulopathy

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Trauma Framework Quiz Q7



18

How would you temporarily stabilize a distal humerus fracture?

- Above elbow back slab
- Intrinsic Plus Splint
- Below elbow back slab
- Sugar Tong splint

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Trauma Framework Quiz Q8

18 **Which of these injuries are at high risk of compartment syndrome?**

- Hip Fracture
- Shoulder Fracture
- Tibia shaft fracture
- Toe Fracture
- Ankle Fracture

OMS Framework - Trauma

Closed Isolated Fractures/ Polytrauma/ **Spine Fractures**/ Open Fractures

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Spine Fracture - What's Different?

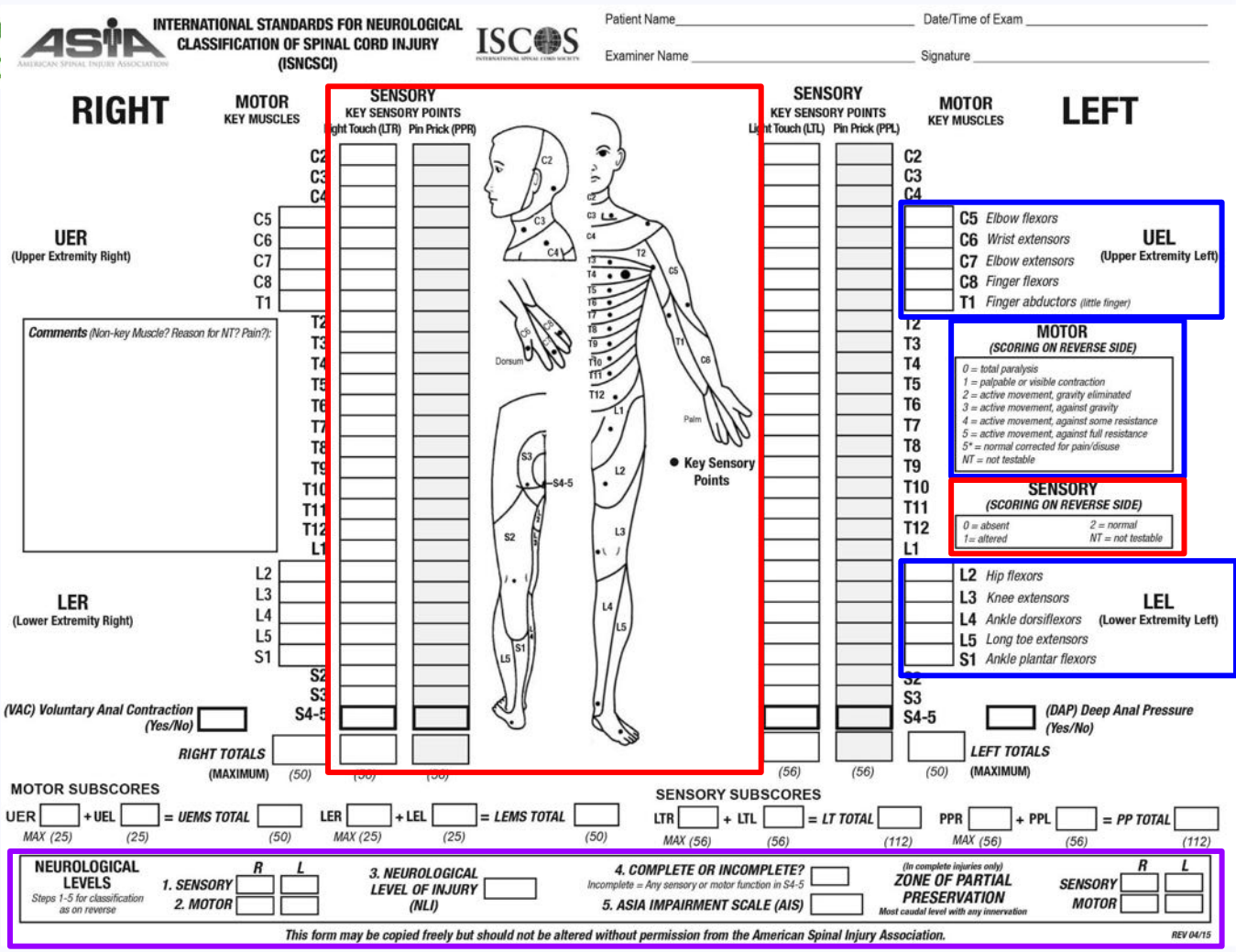




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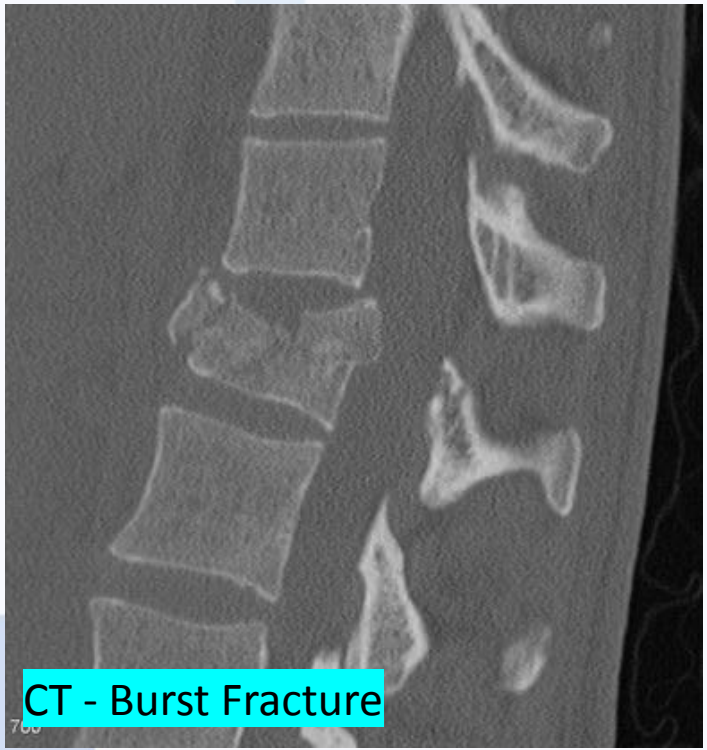
Neurology in Spine Trauma

- ASIA Score
- Assess **myotomes**
  - Grades 0 - 5
- Assess **dermatomes**
- Determine **ASIA Impairment Scale**
  - **A** = Complete injury (totally no motor or sensory)
  - **B** = Incomplete Sensory (motor all 0)
  - **C** = Incomplete Motor (> 50% myotomes < G3)
  - **D** = Incomplete Motor (≥ 50% myotomes ≥ G3)
  - **E** = Normal



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6. Advanced Imaging



CT - Burst Fracture



MRI - Burst Fracture



MRI - Epidural hematoma

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7. SLICS and TLICS scores

SLIC 3 Independent Predictors

1	**Morphology** Immediate stability	• Compression • Burst • Translation/rotation • Distraction	1 2 3 4	**Radiographs CT**
2	**Discoligamentous Complex** Longterm stability	• Intact • Suspected • Injured	0 1 2	**MRI**
3	**Neurological status**	• Intact • Nerve root • Complete cord • Incomplete cord • Incomplete cord Injury with ongoing cord compression	0 1 2 3 4	**Physical examination**
Predicts need for surgery			3 4 >5	**Non-surgical** **Surgeon's choice** **Surgical**

Subaxia**L** **I**njury **C**lassification and **S**everity Scale (SLICS)

Thoraco**L**umbar **I**njury **C**lassification and **S**everity Score (TLICS)

TLICS 3 independent predictors

1	**Morphology** immediate stability	- Compression - Burst - Translation/rotation - Distraction	1 2 3 4	- Radiographs - CT
2	**Integrity of PLC** longterm stability	- Intact - Suspected - Injured	0 2 3	- MRI
3	**Neurological status**	- Intact - Nerve root - Complete cord - Incomplete cord - Cauda equina	0 2 2 3 3	- Physical examination
Predicts		- **Need for surgery**	0 – 3 4 > 4	- nonsurgical - surgeon's choice - surgical

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OMS Framework - Trauma

Closed Isolated Fractures/ Polytrauma/ Spine Fractures/ **Open Fractures**

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Open Fracture - What's Different?





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The importance of Antibiotics ASAP!

- Risk of infection 4.7% vs 7.4%

infection (<3hrs vs >3hrs)

Clin Orthop Relat Res. 1989 Jun;(243):36-40.

Factors influencing infection rate in open fracture wounds

M J Patzakis [1], J Wilkins

Affiliations
PMID: 2721073

Abstract

Seventy-seven infections in 1104 open fracture wounds were evaluated to identify those factors that predisposed to infection. Factors could be placed into three categories: (1) increased risk, (2) no effect, and (3) inconclusive. The single most important factor in reducing the infection rate was the early administration of antibiotics that provide antibacterial activity against both gram-positive and gram-negative microorganisms. In this study, surgical debridement was performed on all open fracture wounds.

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Real Life Case

Open Tibia Fracture

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1. Stabilize

1. Stabilize

- ***ATLS*** Principles - ABC
- Polytrauma - expecting the worse
  - Reduce Pelvic Volume = Pelvic binder/ C-Clamp
  - Prevent spinal cord injuries = C-collar and spinal nursing
- Spine Trauma
  - Immediate application of C-collar and institute spinal nursing
- Open fractures
  - Intramuscular Anti-Tetanus Toxoid (IM ATT)
  - Immediately start IV ***Prophylactic*** Antibiotics (IV Cefazolin; if allergic give IV Clindamycin)
  - If presence of biocontamination
    - Marine - + doxycycline [Vibrio]
    - Freshwater - + Cipro [Aeoromonas]
    - Soil/ Faeces - + Flagyl [Anaerobes]

O/E

Alert, conversant, coherent
Speaking in full sentences
Obeying commands appropriately

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2. History

2. History

- **General History (for all patients)** - Biodata, PMHx, Smoking, Drinking, Drug Allergy, Occupation, Sports, Handedness (UL)
- **Condition History**
  - Mechanism of injury - ***"Mechanical Fall"***
  - Ask red flags such as ***"Prodromal Pain"***
- **Risk Factor History**
  - Osteoporosis in elderly
  - Other PMHx that can result in frequent falls, brittle bones
- Polytrauma
  - "AMPLE" history - Allergies, Medications, Past medical history, Last meal or other intake, and Events leading to presentation

History

51 y.o./Chinese/male
No Known Allergies

RTA
Motorcyclist travelling at 60kmh side swiped by truck
Flung, unable to recall what happened ?LOC

What will you examine for?

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3. Physical Examination

3. Physical Exam

- Check for ***open fracture***
- Check ***neurovascular (NV) status***
  - Be specific how you check and what nerve/ vessel.
    - UL = MUR nerves, Radial Pulse
    - LL = Foot drop, DP and PT Pulses
- Check for ***compartment syndrome*** (even for Open fractures)
  - Especially for fractures at risk e.g., tibia plateau, shaft, pilon fractures.
- ***Secondary Survey*** "head to toe" for other injuries - facial, chest, pelvic compressions, other long bones.
- Spine Trauma
  - Log roll with in-line traction
  - Use ASIA score for neurological exam
  - DRE TRO cauda equina syndrome

Deformity of right tibia with puncture wounds x 3
Anteriorly, medially and posteriorly over mid right leg

Large degloving injury over posterior right ankle extending proximally with exposed TA

Open Fracture

Puncture wound over anterior distal thigh with depth extending to distal femur bone.
Quadriceps tendon cut

Compartment syndrome

No tense compartments in right lower limb
Nil increase in pain on passive stretch of toes
Sensation intact in distribution of SPN, DPN, tibial saphenous, sural nerves
DP2+, PT1+

NV

Pelvic and chest compression -ve
Nil midline cervical spine tenderness
Nil tenderness over clavicles and scapula bilateral

Secondary Survey



How will you investigate?

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4. Initial Invx

4. Initial Investigations

- ***Imaging***
  - ***Orthogonal*** views, "one joint above, one joint below"
  - Full length of fractured bone
  - Special XR views
  - Polytrauma
    - XR Trauma Series - C-spine Lateral, CXR, Pelvis AP
    - CT - CTTAP, CT Brain, CT Cervical spine
- ***Bloods*** (only when for admitted)
  - ***Pre-Op Bloods*** - FBC, RP, PT/INR, GXM, ECG, CXR
  - ***Risk Factors*** - Vit D, Ca Panel, TFT, LFT osteoporosis)
  - Polytrauma ***Stability*** - Lactate, ABG

Bloods

POCT Arterial/Capillary Blood Gas

POCT Arterial/Capillary Blood Gas

Assess Stability

POCT Blood Gases & Lactate - Venous

Type & Screen (ABO/Rh & Antibody Screen)

Coagulation Panel (PT/INR, APTT)

Glucose, Serum, Random

Renal Panel Extended - Na, K, Cre, Ure, Cl, HCO3

Full Blood Count

Pre Op

ECG

ECG

ECG

Pre Op

CT Thorax Abdomen and Pelvis

CT Cervical Spine

CT Brain

Trauma Scans

XR Chest AP / PA

Imaging



How will you acutely manage this patient?

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5. Acute Management for Open Fracture

5. Acute Management

- ***Address Pain*** = ***Analgesia*** as per WHO pain ladder [ALL]
- ***Address Fracture***
  - ***Manipulation and Reduction*** under sedation
    - *Not all injuries require this
  - ***Temporary Stabilization***
    - See annex for options. May need Ex Fix.
    - Remove pelvic binder where necessary
    - Spine Trauma - C-collar & Spinal nursing
  - ***Re-check*** NV after MnR and Temp Stabilization
- **Address and Prevent Important Complications**
  - **Compartment syndrome** - watch for 6Ps, "Pain out of Proportion". Mx = remove back slab, do not elevate, Fasciotomy
  - **Deep Vein Thrombosis** when NWB esp. in elderly hip fractures - Pharmacological and Non-P
- Polytrauma - Early Appropriate Care (EAC) in 3 phases
  - Phase 1: 1st Surgery - Damage Control with Ex fix
  - Phase 2: Stabilize Physiologically in ICU/ HD
- Open fracture
  - Address ***Wound*** - take pic, moist dressing.
  - Address ***Fracture*** - as above
  - ***Inform*** Ortho senior for 1st Surgery - Debride wound, negative pressure dressing, KIV Ex Fix

Plan
Keep NBM
Open fracture pathway
C collar

IV cefazolin
IM ATT
Analgesia

Abx Abx Abx

Analgesia

XR R hip lat
XR R femur ap/lat
XR R Knee
XR R Tib/fib
XR R Ankle
XR R Foot lat/oblique/DP
XR R hand
XR R elbow

Temporary Stabilization

Backslab R LL long limb backslab extending to MTPJ

Trace CT TAP and CT C spine

Refer HRM for soft tissue coverage in view of large soft tissue defect over posterior right ankle

Will require debridement of R lower limb wounds KIV surgical fixation of R femur and tibia KIV external fixation KIV application of negative pressure dressing KIV repair of cut structures

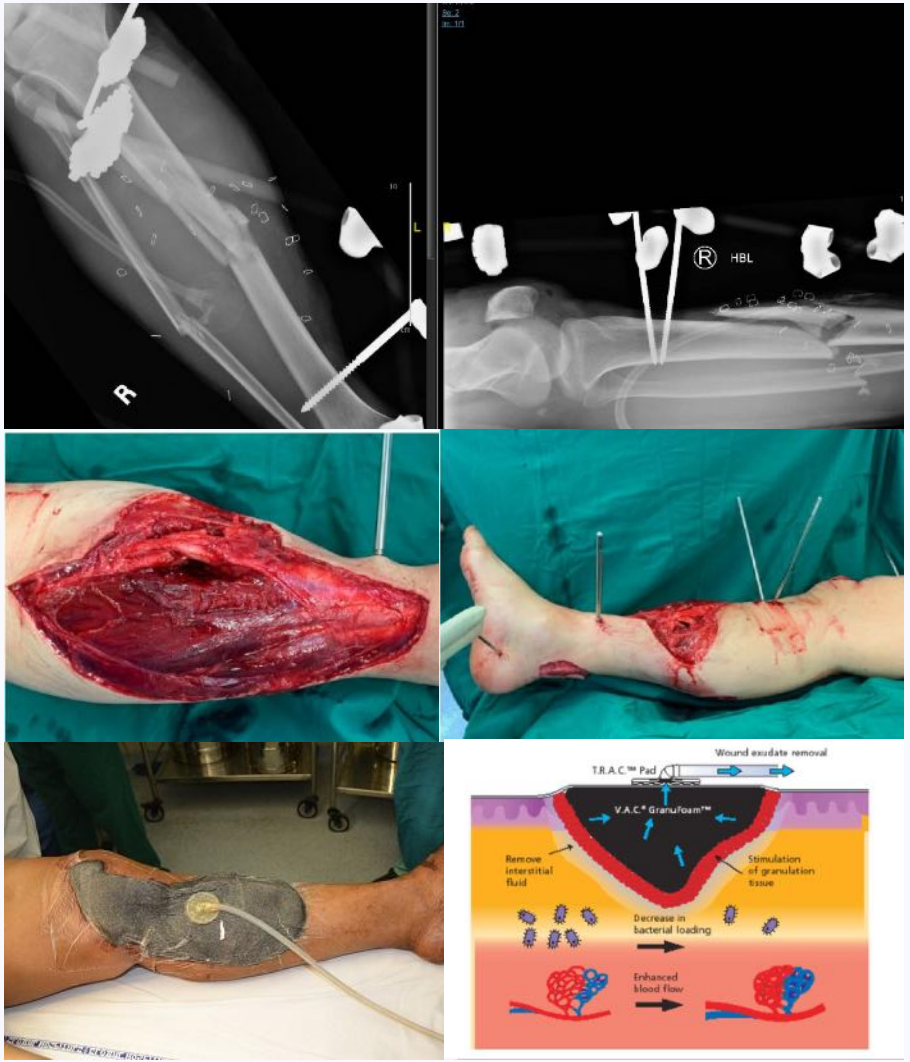
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1st Surgery

- Wound debridement
  - Debridement = removal of all unviable and unhealthy tissue
  - Wound often covered with a "negative pressure dressing"while waiting for definitive fixation and coverage
- Temporary Stabilization
  - If Back slab sufficient for stability, ok to continue back slab
  - External fixation is occasionally required to maintain temporary stability

Will you do advanced imaging?



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6. Advanced Imaging - No

6. Advanced Imaging

- ***CT scan***
  - Indicated when XR shows fracture near a joint = "periarticular fracture"
  - Useful for surgical planning and 3D reconstruction
- ***MRI scan*** without contrast
  - Indicated when XR is normal
  - Concerns of soft tissue injury (meniscus, cartilage, ligaments) or occult fracture
- MRI scan ***with contrast***
  - Concerns of tumor/ infection
- Spine Trauma
  - MRI whole spine to look for ***contiguous*** fractures, epidural hematomas
  - CT spine for fracture pattern and surgical planning



What is the definitive management?

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7. Definitive Management



7. Definitive Management

- **"Operative vs Non-Operative"** depending on
  - **Patient** factors e.g. Co-morbids, function.
  - **Injury** factors e.g. Classification e.g. Spine Trauma TLICS, SLICS score
  - **Surgeon** factors e.g. choice of implants influenced by surgical training
- ***Non-Operative***
  - Continue immobilization until fracture healing
  - Convert back slab to full cast
- ***Operative***
  - Closed or Open Reduction
  - With internal fixation - screws, plates, nails, wires → Dependant on each injury
  - If peri-articular fractures → Fix vs Replace
- Polytrauma - Early Appropriate Care (EAC) in 3 phases
  - Phase 3: 2nd Surgery - Definitive fixation
- Open fractures - Typically 2 Phases
  - 2nd Surgery - Internalization of fixation and achieve wound coverage with skin **graft** or **flap**.

How will you assess post operatively?

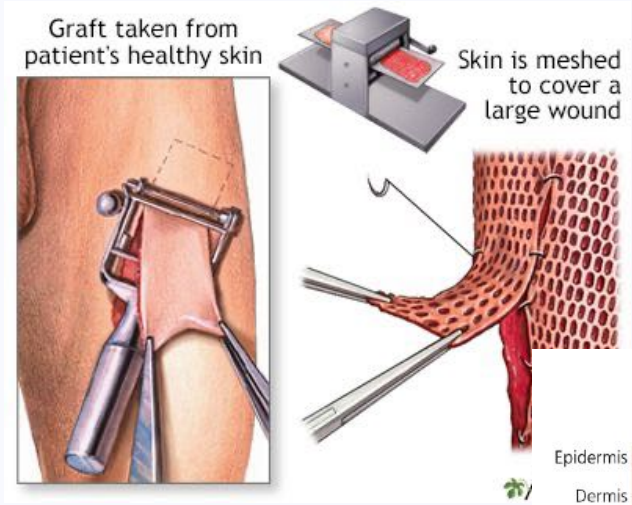


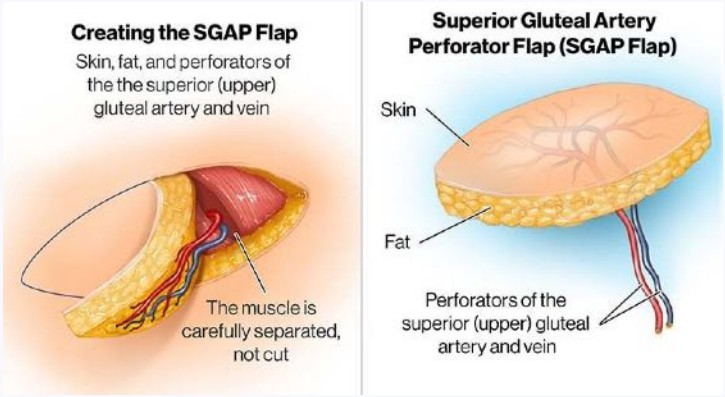
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Skin Graft vs Skin Flap

- **Skin Graft** - Does not have its own blood supply
  - For areas with viable soft tissue
  - (+) Easy, no need microscope
  - (-) More contractures
  - Use for areas with no bone exposed
- **Skin Flap** - Has its own blood supply
  - For areas with exposed bone
  - (+) Less contractures
  - (-) Technically difficult, need microscope
  - Use for areas over joints, bone exposed





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8. Post Op Review

8. Post Op Review

- Assess **patient**
  - Stability and vitals
  - GA Complications
- Assess **operated limb/ site**
  - Dressings - ensure not soaked
  - Chart drain outputs (be specific)
  - Distal neurovascular
- Follow **Post Op instructions** for:
  - IV Antibiotics for ***Prophylaxis***
  - Analgesia as per WHO
  - ***DVT prophylaxis***
  - Weight bearing status
  - Range of motion
  - STO timing - usually 14 days
- Subsequent ***Multidisciplinary*** team to optimize outcomes
  - Rehab - PT/ OT, Rehab Med
  - Social - MSW, CH, TCF
  - Polytrauma - Psych for PTSD

POD0 S/P Removal of right lower limb external fixation, right leg wound debridement, intramedullary nailing of right tibia open fracture

Hide copied text
Hover for details

> IOF:
Right tibia/fibula open fracture
-Gustilo 3B
-Comminuted fracture at midshaft of right tibia with large butterfly fragment
-Butterfly fragment attached to soft tissue
-Anterior, lateral and posterior compartment muscles swollen but healthy

===Objective===

Vital Signs

O/E
Alert and comfortable
Not in respiratory distress
Not toxic looking

Heart S1S2
Lungs clear anteriorly
Abdo SNT BS+
Calves supple, non-edematous

Dressings clean, not soaking through
Moving 4 limbs equally

===Plans===

As per op notes

- to trace FBC tonight at 10pm, keep Hb>8, plt >50. Transfuse as required. If platelet transfusion required, to give FFP as well - SN kindly inform me when FBC out as well, thanks

Post Operative Orders & Instructions

To ward
Para q1hx6 then q4h if stable
Can allow diet from HRM point of view
Chart VAC output
Plan for R LL skin graftingpossible local flap and negative pressure wound therapy this friday in MCOT 2 PM
Cont IV abx

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Open Fracture OSSE!

1. What will you examine for?
2. How will you investigate?
3. How will you acutely manage this patient?
4. Will you do Advanced Imaging?
5. What is the definitive management?
6. How will you assess post op?



Stem: 55 Year old male with a injury to leg

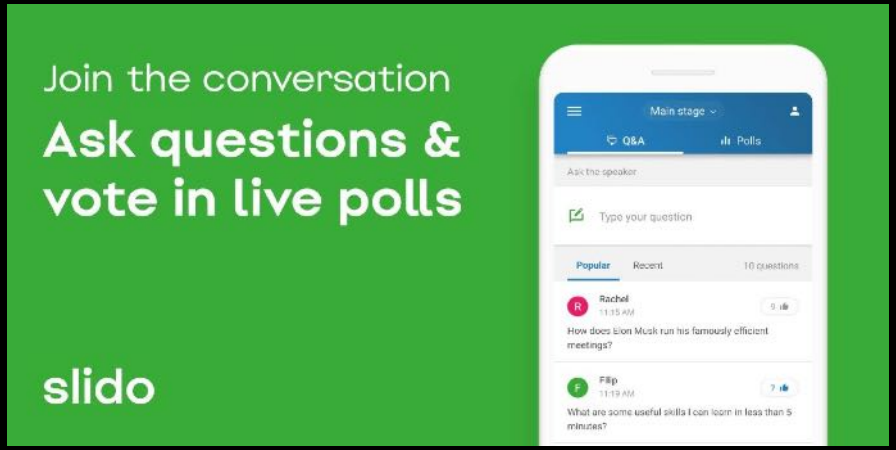


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Quiz Time!

- **Live Audience** – Submit your answer on SLIDO to enhance your learning through immediate feedback.

- **Recording Audience** – Refer to the slides for the exact questions and options.





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Trauma Framework Quiz Q9

2

What is the most concerning neurological complication following a lumbar spine injury?

- Myelopathy
- Cauda Equina Syndrome
- Lumbar Spondylosis
- Radiculopathy



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Trauma Framework Quiz Q10

8 **What are antibiotics for a patient with an OPEN fracture called?**

- Empirical Antibiotics
- Culture directed Antibiotics
- Prophylactic Antibiotics
- Preventive Antibiotics

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Trauma Framework Quiz Q11

18 **Which of the following is suitable for open wound coverage over a joint?**

- Skin Graft
- Synthetic Material
- Skin Flap
- Dermal allograft

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Trauma Framework Quiz Q12

16

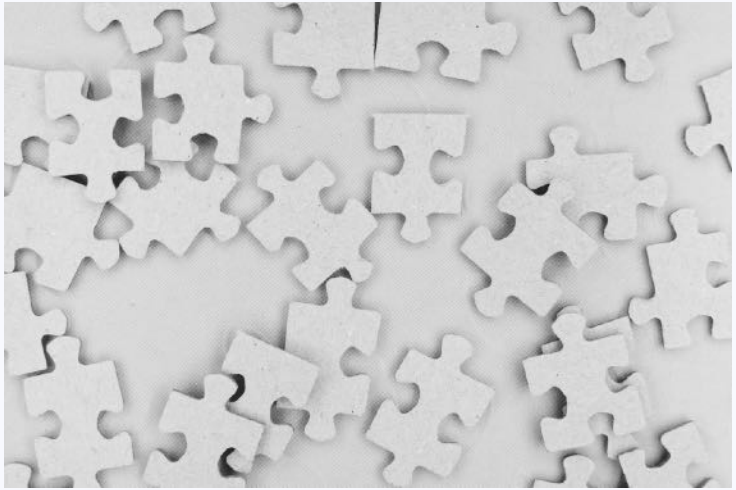
Which factor is the most significant determinant of a patient developing an infection after an open fracture?

- Time to initial surgery
- Time to orthopaedic review
- Time to starting antibiotics
- Time to hospital

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What should you do next? - Test, Ask, Add

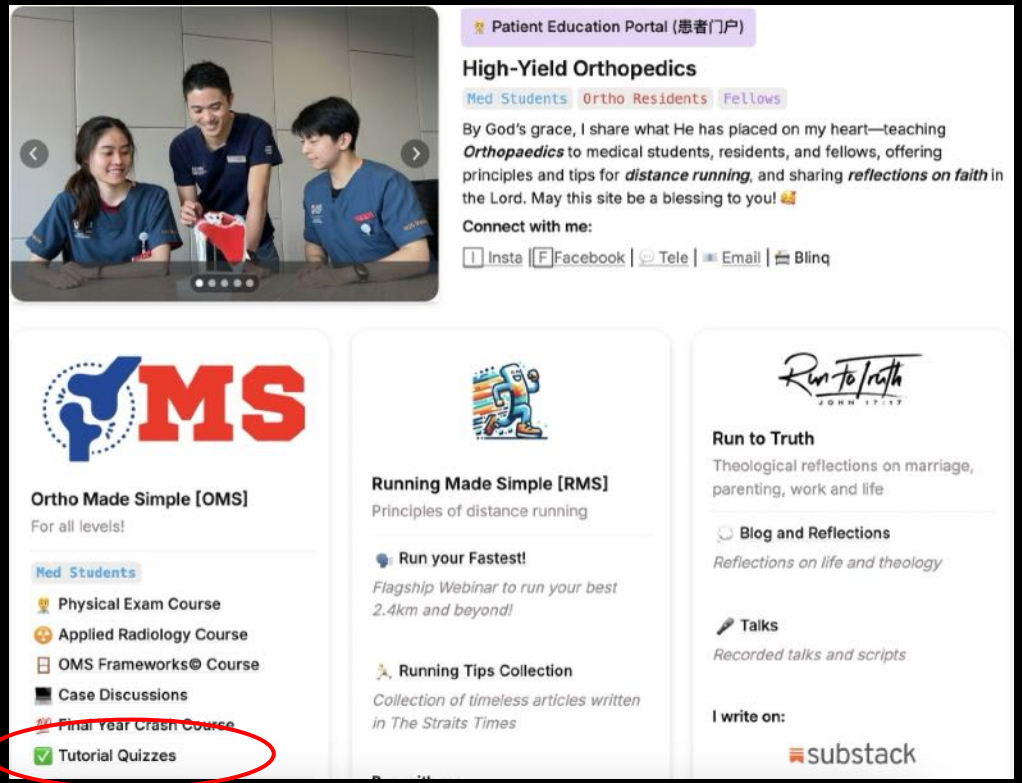
- **Test** yourself: Most inpatients in the wards are trauma cases admitted from Emergency Department, either waiting for definitive surgery or post surgery.
    - At which stage is the patient in now? Will advanced Imaging be ordered? How did they decide Definitive management?
    - What was being done for this patient at each stage? Check your answers against the case notes
- **Ask** when you see something is not as expected. (Deviation from framework)
- **Add** - When studying, add in what is unique for each injury at each stage - you will find that there is minimal variation!



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Maximising our Time!

- Post lecture Quizzes available on website mokyingren.sg!

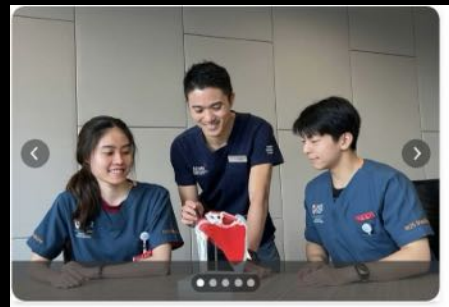


1 Stabilize | 2 History | 3 Physical Exam | 4 Initial Invx
5 Acute/ Initial Mx | 6 Advanced Imaging | 7 Definitive Mx | 8 Post Op Review

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Case Discussions

- Step by step case discussions based on the OMS Frameworks
- You will learn how to answer Viva questions in a safe and guided manner while reinforcing what you have learnt in this series!



Patient Education Portal (患者门户)

High-Yield Orthopedics

Med Students | Ortho Residents | Fellows

By God's grace, I share what He has placed on my heart—teaching ***Orthopaedics*** to medical students, residents, and fellows, offering principles and tips for ***distance running***, and sharing ***reflections on faith*** in the Lord. May this site be a blessing to you!

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  Flagship Webinar to run your best 2.4km and beyond!
- Running Tips Collection

Run to Truth

Theological reflections on marriage, parenting, work and life

- Blog and Reflections
  Reflections on life and theology
- Talks
  Recorded talks and scripts

All | Trauma | Paeds Ortho

Neck of Femur Fracture	Tibia Tuberosity Fracture	Pediatric Wrist Fracture	Tibia Shaft Fracture
Trauma	Trauma	Trauma	Trauma
Sep 15, 2025 4:57 AM	Paeds Ortho Sep 3, 2025 8:56 AM	Paeds Ortho Sep 3, 2025 8:12 AM	Sep 3, 2025 8:09 AM



Framework Approach to Orthopaedics Part 2: Chronic Pain/ Arthritis

Mok Ying Ren

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~~1. Stabilize~~

- Typically not required in the clinic setting!
- Do not mention!





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2. History

General History

- Age, Gender, Race
- Occupation
- Sports/ Recreation
- Handness (for UL injuries)
- Past Medical History
- Past Surgical History
- Drug Allergy

Specific History

Must know what is Mechanical pain!

- Condition History
  - Pain - SOCRATES, Mechanical vs Inflammatory Pain
  - Joint Specific Symptoms - e.g.
    - Knee - instability, locking
    - Shoulder - instability, stiffness, weakness
  - Red flags
    - Tumor - Night pain, Rest pain, Constitutional, LOW, LOA
    - Infection - Fever, night sweats
  - Function
    - Home, Occupation, Community, Recreation
- Risk Factor History
  - Previous trauma
  - Condition specific - e.g. Hip OA (AVN), Frozen Shoulder (DM)

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Mechanical vs Inflammatory Pain

Mechanical

- No rest pain
- No morning stiffness
- Pain gets worse with increased activity
- Pain goes away with rest after activity

Inflammatory

- Presence of throbbing pain at rest
- Presence of morning stiffness
- Pain gets better with increased activity and warm up
- Pain gets worse after resting from a period of increased activity

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3. Physical Examination

- Specific Joint Exam
- Look at Physical Exam Notes
- Must always look at neurovascular involvement

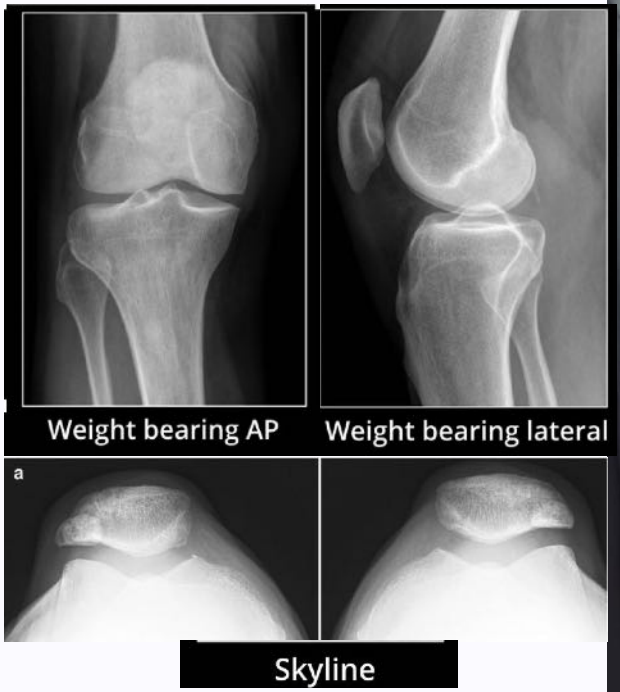




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4. Initial Investigations

- Imaging
  - Orthogonal views
  - Considerations
    - E.g. Weight bearing views for knee
  - Special views - e.g. skyline (knee), long films (knee for mechanical alignment)
- Bloods
  - Not required unless concerned of inflammatory conditions
  - Inflammatory markers - TW, CRP, ESR kiv RF, anti-CCP





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5. Initial Management

"What will you do at the first clinic visit?"

- Pharmacological
  - Analgesia based on WHO ladder
- Non-Pharmacological
  - Lifestyle modifications - reduce painful activities
  - Physiotherapy for muscle strengthening
  - Walking aids



For most patients, this is the definitive management and they need no further treatment

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6. Advanced Imaging?

- Typically not required if obvious OA changes in XR
- When to consider MRI scan?
  - **Normal XR** with significant/ long duration of symptoms, concern of soft tissue injury (cartilage, meniscus, ligaments, muscles)
  - **MRI scan with contrast** if concerns of tumor/ infection
- When to consider CT scan?
  - Specialist decision for pre op planning in certain joint replacements e.g. shoulder

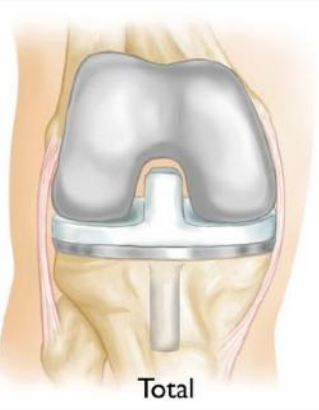


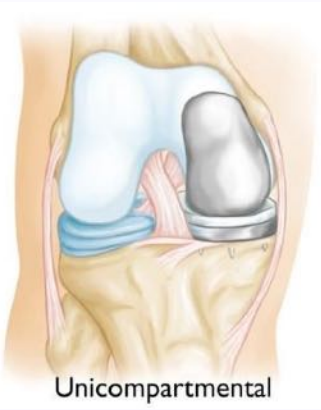
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7. Definitive Management

- Operative vs Non Operative
  - **Patient factors** e.g. Co-morbids, function.
  - **Disease factors** e.g. Classification, Severity
  - **Surgeon factors** e.g. choice of implants influenced by surgical training
- Operative options - Learn the common options for OA of each joint - **<u>Joint Preserving</u>** or **<u>Joint Sacrificing</u>** - E.g.
  - Shoulder - TSA, RTSA
  - Elbow - TEA
  - CMCJ - Fusion, Excision (Trapeziectomy)
  - Hip - THA
  - **Knee - HTO, UKA, TKA**
  - Ankle - Osteotomy, TAR, Fusion
  - Hallux Valgus - Osteotomy, Fusion
  - Spine - Decomp, Fusion, ADR













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8. Post Op Review

1. Assess Patient
   a. Vitals
2. Assess Operated limb/ site
   a. Dressings
   b. Neurovascular status (be specific)
   c. Drain output (if present)
3. Review Post Op Notes
   a. Prophylactic Antibiotics
   b. Weight bearing status
   c. Order post op XR
   d. Consider DVT Prophylaxis if lower limb op
4. Subsequent Multidisciplinary team to optimize outcomes
   a. Rehab - PT/ OT, Rehab Med
   b. Social - MSW, CH, TCF



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OMS Framework - Chronic Pain

Joints/ Cervical Spine/ Lumbar Spine

Real Life Case

OA Knee



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2. History

2. History

- **General History (for all patients)** - Biodata, PMHx, Smoking, Drinking, Drug Allergy, Occupation, Sports, Handedness (UL)
- **Condition History**
  - **Pain (SOCRATES)** - Mechanical vs inflammatory type of pain
  - **Joint Specific Symptoms** - e.g.,
    - Knee (locking, instability)
    - Shoulder - instability, stiffness, weakness
  - **Red flags**
    - ***Tumor*** red flags - LOW, LOA
    - ***Infection*** red flags - fever, night sweats
- **Risk Factor History**
  - Previous Trauma
  - Condition risk factors e.g., Hip - AVN; Frozen shoulder - DM

What will you examine for?

70 y.o./female
NKDA
ADL-I, Comm ambulant
From home with husband

Past Med Hx:
1. HLD - on diet control

General Hx for all patients

Pain SOCRATES

Bilateral knee pain x 10 years
No injury or trauma
Walking distance reducing
Anterior and medial and lateral knee pain
?mild swelling occasionally
R=L

"Mechanical"

Pain with stairs
No locking/instability
No fever

Knee Joint Specific

Red flags

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3. Physical Examination

3. Physical Exam

- Specific Joint examination
- Always check distal ***neurovascular*** status

OE
Alert
BMI high normal
Leg large
ROM 10-110 both knees
Medial and lateral JLT
PGT-ve
Stable knee
Pulses ok
SKin ok

How will you investigate?

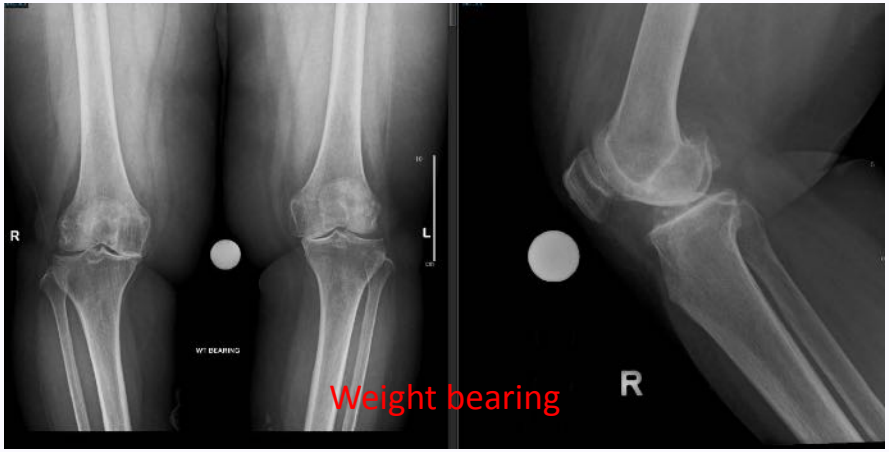
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4. Initial Investigations

4. Initial Investigations

- Imaging
  - ***Orthogonal*** views
  - Features - ***LLOSS***
  - Special XRs e.g.Knee - Weight bearing XR, skyline
- ***Bloods*** (if concerned inflammatory/ infection)
  - Inflammatory - CRP, ESR, RF, Anti-CCP
  - Infection - FBC, CRP, ESR

How will you initially manage this patient?





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5. Initial Management

5. Acute/ Initial Management

"What will you do at the first consult?"

- ***Pharmacological***
  - Analgesia as per WHO pain ladder
- ***Non-pharmacological***
  - Lifestyle modifications - change sports
  - ***Multidisciplinary*** - Physiotherapy, Podiatry
  - Walking aids

For many patients, this ends up being the definitive management as their symptoms improve.

Discussed dx with patient and reviewed X-rays and explained with knee model
Options
1) Conservative - activity modification, weight management, analgesia, physiotherapy, joint supplements
2) Intra-articular injections - H and L (procedure, risks and temporary nature explained), Viscosupplementation (procedure, risks, temporary nature, current evidence explained)
3) Surgery - Joint replacement: surgery procedure discussed and explained in brief

All questions answered

Patient tried synvisc early this year no effect

P

PT and Meds

Will you do advanced imaging?

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6. Advanced Imaging

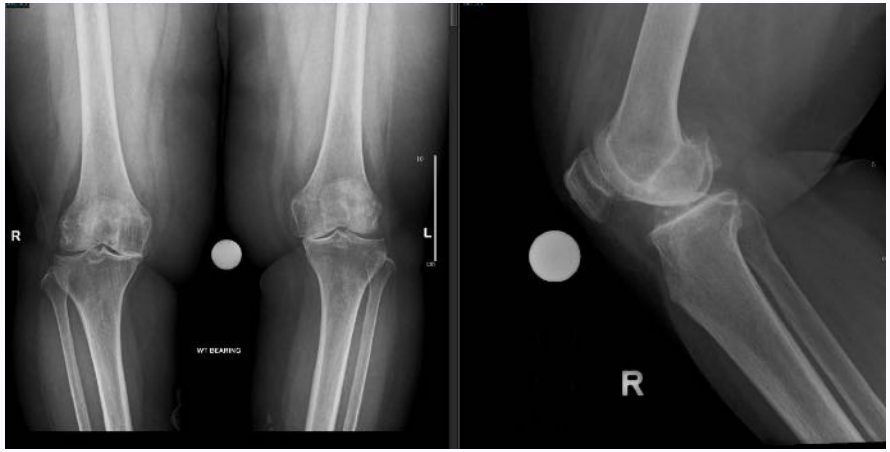
6. Advanced Imaging

- Typically, not required if there are obvious OA changes on XR

- Consider ***MRI scan without contrast*** if
  - Normal XR with significant/ long duration of symptoms, concern of soft tissue injury (cartilage, meniscus, ligaments, muscles)
  - Presence of unexpected neurovascular deficits
- ***MRI scan with contrast*** if concerns of tumor/ infection
- ***CT scan*** typically only for pre-op planning for complex replacements

- Cervical and Lumbar Spine
  - Consider order ***MRI scan*** at first consult if significant neurology/ myelopathic features
  - C-Spine - ***CT scan*** if for op to look for OPLL as cause of myelopathy
  - L-Spine - ***CT scan*** if for op for surgical planning (e.g., length of pedicle screws)

What can you offer if patient fails non operative management?



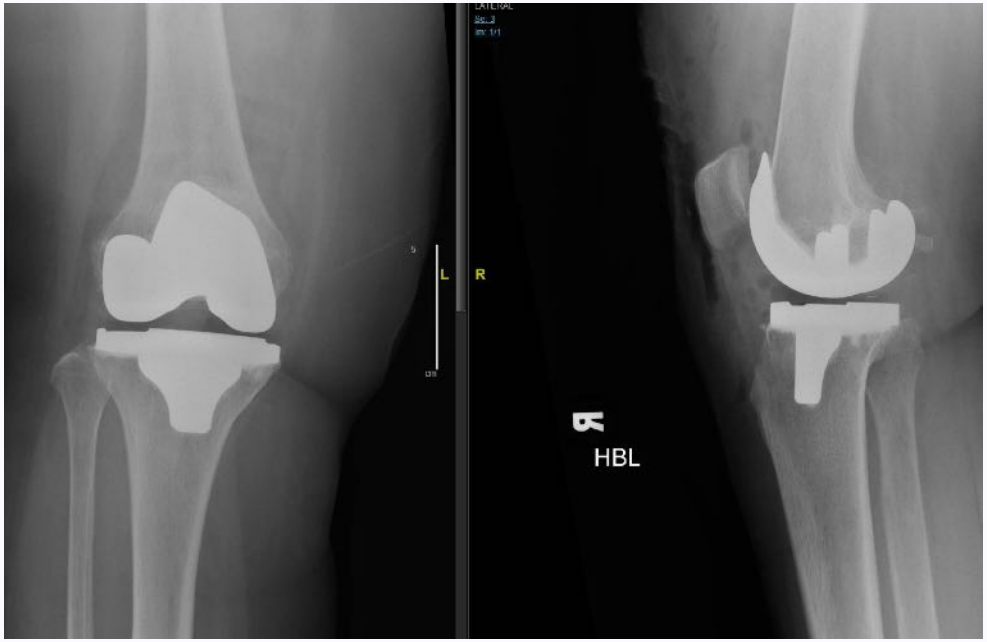


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7. Definitive Management

7. Definitive Management

- ***"Operative vs Non-Operative"*** depending on
  - **Patient** factors e.g. Co-morbids, function.
  - **Disease** factors e.g. Classification, Severity (e.g.
- ***Non-Operative***
  - Analgesia, PT, Injections, Other adjuncts
- ***Operative*** options - Learn the common options for OA of each joint - Joint Preserving or *Joint Sacrificing* - E.g.
  - Shoulder - *TSA, RTSA*
  - Elbow - *TEA*
  - CMCJ - *Fusion, Excision (Trapeziectomy)*
  - Hip - *THA*
  - Knee - HTO, *UKA, TKA*
  - Ankle - Osteotomy, *TAR, Fusion*
  - Hallux Valgus - Osteotomy, *Fusion*
  - Spine - Decomp, *Fusion, ADR*



How will you assess the patient post op?

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8. Post Op Review

8. Post Op Review

- Assess **patient**
  - Stability and vitals
  - GA Complications
- Assess **operated site**
  - Dressings - ensure not soaked
  - Chart drain outputs
  - Distal neurovascular (be specific)
- Follow **Post Op instructions** for:
  - IV Antibiotics for ***prophylaxis***
  - Analgesia as per WHO
  - DVT ***prophylaxis***
  - Weight bearing status
  - Range of motion
  - STO timing - usually 14 days
- Subsequent ***Multidisciplinary*** team to optimize outcomes
  - Rehab - PT/ OT, Rehab Med
  - Social - MSW, CH, TCF

PORV

POD0 R TKR

Subjective S
Nil nausea/vomiting/giddiness/headache
Nil SOB/chest pain
Nil pain at op site
Well otherwise
Nil other complaints
A

Vitals
Temp: [36.7 °C] 36.7 °C
Pulse: [78] 78
Resp: [17] 17
BP: (127)/(79) 127/79

OE O
Alert, comfortable, conversant
Not toxic looking
Wound dressings over R knee clean and dry
Able to wiggle toes on R foot
CRT < 2s
DP 2+
P

Dressings and NV

Surgery Performed

Operative Procedure

GA
Supine position
IV cefazolin and TXA
Thigh tourniquet

Plans
As per op note
1st dose of cefazolin to serve at 10pm
Aim home with helper

Post Operative Orders & Instructions

Hourly parameters for 6 hours then 4 hourly if well
Allow diet when awake
LL neurovascular monitoring
Calf pumps on and activated at all times while in bed and sitting in chair please
Sit up in bed today
Ice pack 1 hr on 2 hr off strictly

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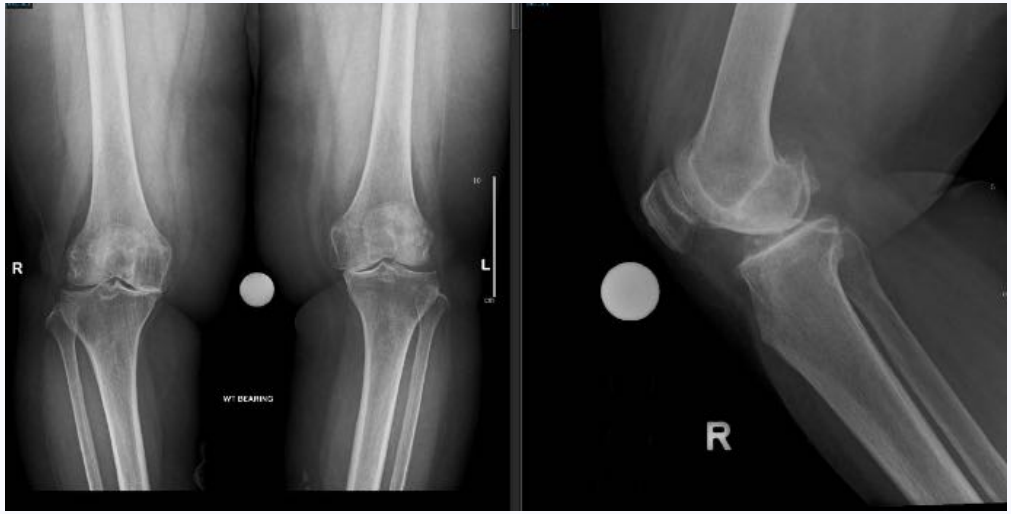
Tricompartmental OA "Add-ons"

~~1. Stabilize~~	**2. Hx** • General hx • Red flags • Function - HOCR • Pain SOCRATES. Mechanical vs Inflammatory • Risk Factor Hx • Knee Specific– locking, instability	**3. PE** Standard knee, NV!	**4. Initial Invx** • Imaging – weight bearing! • AP, Lateral, skyline
5. Initial Mx • Pharm - Analgesia – WHO • Non Pharm - PT, lifestyle	**6. Advanced Imaging** Usually no need for obvious OA Knee	**7. Definitive Mx** (Think of Classification here) • Non op vs Op • TKR if tricompartmental OA	**8. Post op** Same

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Knee Osteoarthritis OSSE!

1. What will you examine for?
2. How will you initially manage this patient?
3. What is the definitive management if patient fails non-operative?
4. How will you assess post op? What will you watch for?



Stem: 55 Year old male with knee pain

1 Stabilize | 2 History | 3 Physical Exam | 4 Initial Invx
5 Acute/ Initial Mx | 6 Advanced Imaging | 7 Definitive Mx | 8 Post Op Review
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LLOSS in Every Arthritic Joint!













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LLOSS in Every Arthritic Joint!









OMS Framework - Chronic Pain

Joints/ **Cervical Spine**/ Lumbar Spine

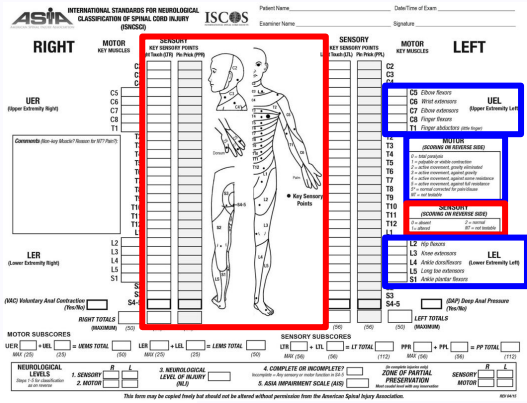
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Neck Pain - What's Different?

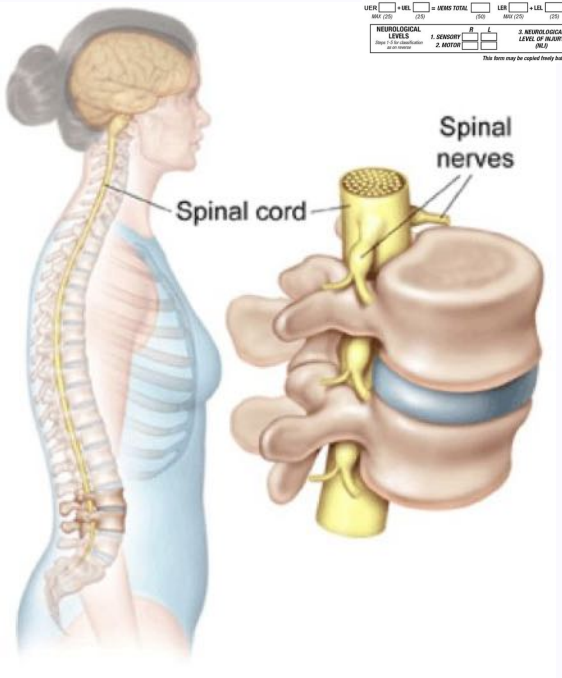


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Cervical Spine - Radiculopathy & Myelopathy



- Radiculopathy = **Nerve Root** Pathology
  - History
    - Shooting pain like electric shock
    - Numbness in the dermatome
    - Weakness in the myotome
  - Physical Examination
    - Numbness in the Dermatome (ASIA score)
    - Weakness in the Myotome (ASIA Score)
    - Abnormal Reflexes
- Myelopathy = **Spinal Cord** Pathology
  - History
    - Poor coordination in the UL
    - Unsteadiness in the LL
  - Physical Examination
    - Hoffmann, Grip Release +
    - Romberg, Tandem Gait +



OMS Framework - Chronic Pain

Joints/ Cervical Spine/ **Lumbar Spine**

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Back Pain - What's Different?



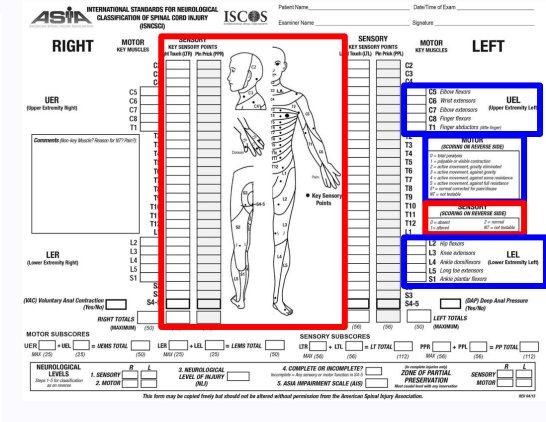
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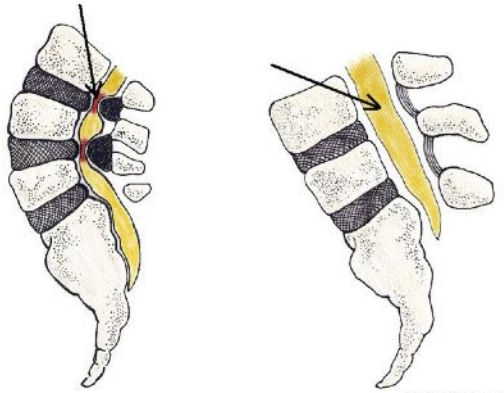
Lumbar Spine - Radiculopathy and Claudication

- Radiculopathy = **Nerve Root** Pathology
  - History
    - Shooting pain like electric shock
    - Numbness in the dermatome
    - Weakness in the myotome
  - Physical Examination
    - Numbness in the Dermatome (ASIA Score)
    - Weakness in the Myotome (ASIA Score)
    - Abnormal Reflexes
    - Nerve tension tests +
- Claudication - worsening pain in LL as patient walks.

  Differentiate from Vascular Claudication from
  - History (For Neurogenic)
    - Park bench to Park bench
    - Better when going up stairs/ hills
    - No
  - Physical Examination
    - Pulses







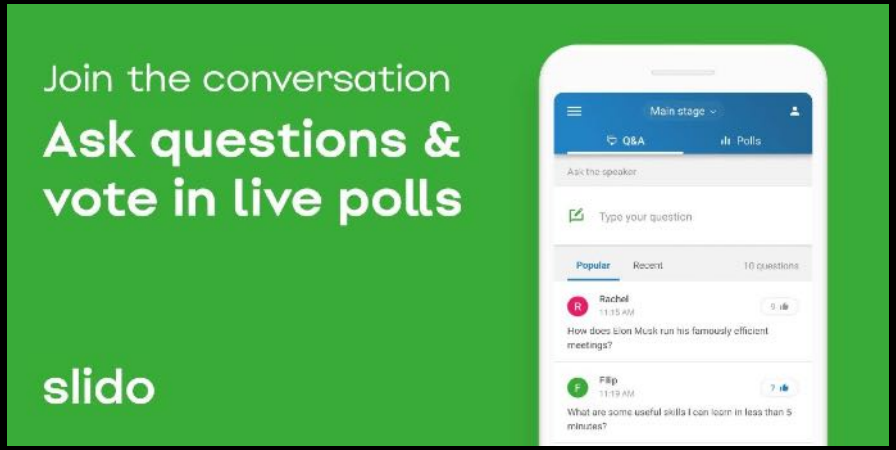


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Quiz Time!

- **Live Audience** – Submit your answer on SLIDO to enhance your learning through immediate feedback.

- **Recording Audience** – Refer to the slides for the exact questions and options.





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Pain and Infection Frameworks Quiz Q1

18 **What does MECHANICAL Pain mean?**

- Pain after prolonged rest
- Pain with morning stiffness
- Pain worse on activity
- Pain similar to a mechanic
- Pain better with activity



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Pain and Infection Frameworks Quiz Q2

19 **What are the special symptoms to ask for in the neck pain?**

- Radiculopathy
- Cauda Equina Syndrome
- Myelopathy
- Claudication



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Pain and Infection Frameworks Quiz Q3

17 **In which conditions are weight bearing XR useful for evaluation?**

- Shoulder Arthritis
- Knee Arthritis
- Flat foot/ Pes Planus
- Elbow Arthritis



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Pain and Infection Frameworks Quiz Q4

8 **How will you initially manage a patient with shoulder osteoarthritis in your clinic?**

- Analgesia
- Offer shoulder replacement
- Refer pain team
- Physiotherapy



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Pain and Infection Frameworks Quiz Q5

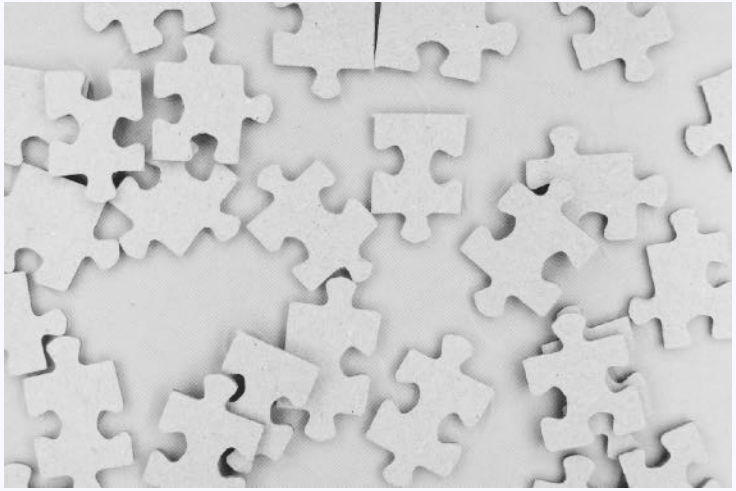
6 **How can you prevent deep vein thrombosis after a surgery?**

- Early mobilization
- Pharmacological - clexane
- Calf pumps
- Compression stocking

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What should you do next? Test, Ask, Add

- **Test** yourself: View every case in clinic through the lens of the framework.
  - At which stage is the patient in now? What is next?
    - How did the doctor perform Phase 2-5?
    - When was Advanced Imaging ordered? (Phase 6)
    - See how they counsel for Phase 7 if op fails
  - Check your own answers with the case notes
- **Ask** when you see something is not as expected. (Deviation from framework)
- **Add** - When studying, add in what is unique for each injury at each stage - you will find that there is minimal variation!





Framework Approach to Orthopaedics Part 3: Infection

Mok Ying Ren



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1. Stabilize

- "Patient must stay alive"
- If in **septic shock** - resuscitate and start antibiotics

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2. History

General History

- Age, Gender, Race
- Occupation
- Sports/ Recreation
- Handness (for UL infection)
- Past Medical History
- Past Surgical History
- Drug Allergy

Specific History (Infection)

- Condition History
  - Severity - SOCRATES, systemic symptoms (fever, chills, rigors)
  - Source - hematological, direct inoculation, adjacent spread
- Risk Factor History
  - Diabetes mellitus
  - Peripheral Vascular Disease
  - Other Immunocompromised states

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3. Physical Examination

- Condition Exam
  - Local severity
    - Extent of collection
    - Involvement of adjacent joint (septic arthritis)
    - Special signs e.g., Kanavel's signs for finger
  - Systemic severity
    - Vitals; chills and rigors
- Risk Factors Assessment
  - Diabetic Dermopathy, peripheral neuropathy
  - Poor pulses (peripheral vascular disease)







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4. Initial Investigations

- Bloods
  - Severity - FBC for TW, CRP, ESR
  - Pre Op - FBC, RP, PT/ INR, ECG, CXR
  - Risk factors - HBA1c, Vascular studies
- Imaging
  - XR to look for osteomyelitis
  - Arterial Duplex to evaluate PVD may decide definitive management [Lower Limb infections]





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1 Stabilize | 2 History | 3 Physical Exam | 4 Initial Invx
5 Acute/ Initial Mx | 6 Advanced Imaging | 7 Definitive Mx | 8 Post Op Review

5. Acute Management

"What will you do as the primary care doctor?"

1. Analgesia based on WHO ladder
2. Start "Empirical" Antibiotics
    - In certain situations, we want to withhold antibiotics until we obtain good cultures e.g. Septic arthritis, Prosthetic joint infection
3. Prepare for surgery - Keep NBM



**Note some cases that are deemed as superficial infections can be treated with oral antibiotics and close follow up (not in exams.)

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6. Advanced Imaging?

- Imaging of choice: **MRI scan with contrast**
- Most do not need advanced imaging. But can be considered in the following scenarios
  - **Unsure** if infection - e.g., differentiating acute Charcot's vs Osteomyelitis
  - **Delineate** extent of infection for surgical planning
  - **Evaluate** adjacent joints for septic arthritis



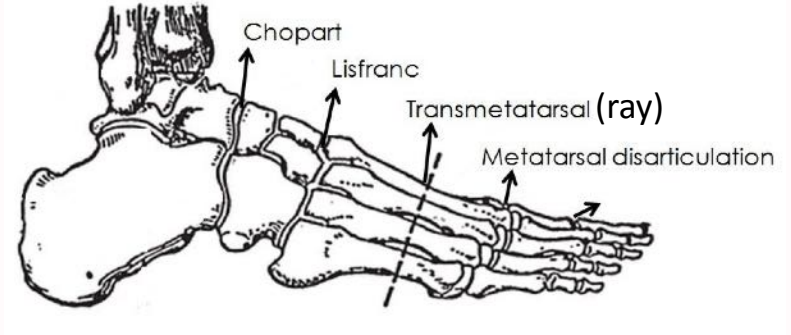
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7. Definitive Management

- **<u>"Operative vs Non-Operative"</u>** depending on
  - **Patient** factors e.g. Co-morbids, function.
  - **Disease** factors e.g. Severity
- Non-Operative (Rare)
  - Long term antibiotic suppression
- **Operative** general options
  - **Debridement** (= removal of unhealthy tissue)
    - Incision and drainage for abscess
    - Saucerization for carbuncles
    - Amputation - DDD







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8. Post Op Review

1. Assess **patient**
   a. Stability and vitals
   b. GA Complications
2. Assess **operated site**
   a. Dressings - ensure not soaked
   b. Chart drain outputs
   c. Distal neurovascular (be specific)
3. Follow **post Op instructions** for:
   a. Continue empirical antibiotics
   b. Trace cultures and convert to **culture directed** antibiotics
   c. May need **multidisciplinary** ID on board for PICC, OPAT.
   d. **Analgesia** as per WHO

Aerobic and anaerobic culture — (Moderate) Staphylococcus aureus !

No growth of anaerobes.

Resulting Agency: NUH Laboratory Medicine

Susceptibility

	Staphylococcus aureus MIC	
Clindamycin	<=0.25 mg/L	Sensitive
Cloxacillin	<=0.25 mg/L	Sensitive
Minocycline	<=0.5 mg/L	Sensitive
Trimethoprim-sulfamethoxazole	<=10.0 mg/L	Sensitive



Figure 1. Postoperative BKA stump before NPWT/ROCF dressing.

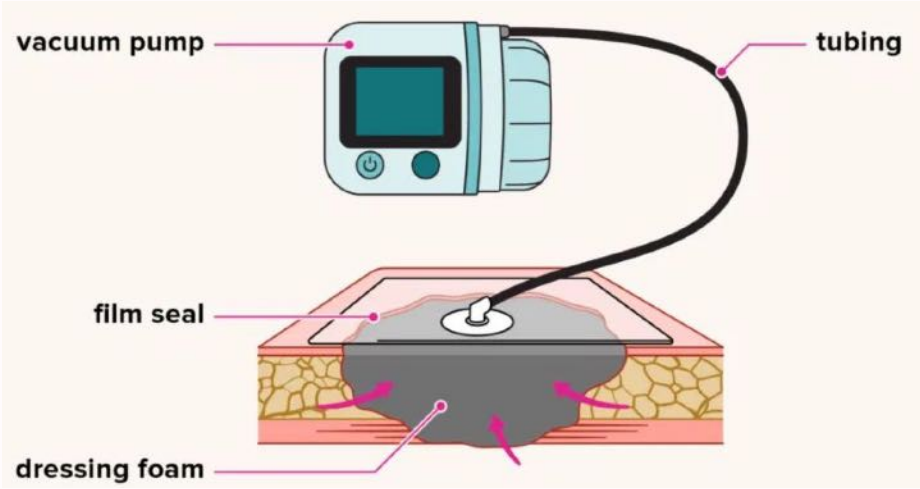


Figure 2. BKA stump with NPWT/ROCF dressing.

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Negative Pressure Dressing



- Negative pressure dressing/ Vac Dressing

- 2 Main roles in Orthopaedics
  - Temporary Closure if skin defect is large
  - Aid in secondary closure of large wounds



Real Life Case

Soft Tissue Infection

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2. History

2. History

- **General History** (for all patients) - Biodata, PMHx, Smoking, Drinking, Drug Allergy, Occupation, Sports
- **Condition History**
  - **Severity** of infection - Pain (SOCRATES), duration, systemic symptoms
  - **Source** of infection - direct inoculation/ hematological from other sites
- **Risk Factor History**
  - Diabetes, peripheral vascular disease
  - Immunosuppression

2 yo child
Nil PMHX
Well
thrived

General History

Condition History

Presented for worsening R toe cellulitis and rashes
1. Right toe pain x 2/7
- first started yesterday
- possible trauma yesterday afternoon- might have placed stool on her toe during shower
- noted pt complaining of pain over toe, initially still active and running around
- subsequently pain and skin changes (redness initially, then noted dark discolouration) worsened
> pt started limping, and now declining to ambulate
- a/w fever starting this morning, Tmax 39+
- also noticed onset of rashes over body with fever, started this morning
> feels that rash is worsening, initially discrete patches but now whole body is red

Severity

What will you examine for?

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3. Physical Examination

3. Physical Exam

- **Condition** Examination
  - Local severity
    - Extent of collection
    - Involvement of adjacent joint (septic arthritis)
    - Special signs e.g., Kanavel's signs for finger
  - Systemic severity
    - Vitals; chills and rigors
- **Risk Factors** Assessment
  - Diabetic Dermopathy, peripheral neuropathy
  - Poor pulses (peripheral vascular disease)

O/E:
Alert, comfortable
Not toxic looking
Peripheries warm and well perfused, CRT < 2s
Mucous membranes moist
No conjunctival injection
No red lips
No oral ulcers
Diffuse erythematous maculopapular rash with areas of pinpoint petechiae (mother reports more confluent) involving face, chest, back and bilateral UL/LL
- blanchable and pruritic (pt noted to be scratching), no blistering noted
- no lesions over bilateral palms and soles
Heart S1 S2, apex beat not displaced
Lungs air entry good and equal bilaterally, nil creps/wheeze
Noted R 5th toe erythema and diffuse swelling, with areas of necrotic changes over medial aspect of dorsum, slightly warm and tender++ on palpation, CRT <2s
R foot swelling noted, DP well felt
No obvious open wounds noted over R foot

Condition PE

Neurovascular



How will you investigate?

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4. Initial Investigations

4. Initial Investigations

- Imaging
  - ***Orthogonal*** views
  - To look for ***osteomyelitis***
- Bloods
  - ***Pre-Op*** Bloods - FBC, RP, PT/INR, GXM, ECG, CXR
  - ***Severity*** - FBC, CRP, ESR, Blood c/s
  - ***Stability*** - Lactate, ABG
  - ***Risk factors*** - HBA1c, Arterial studies

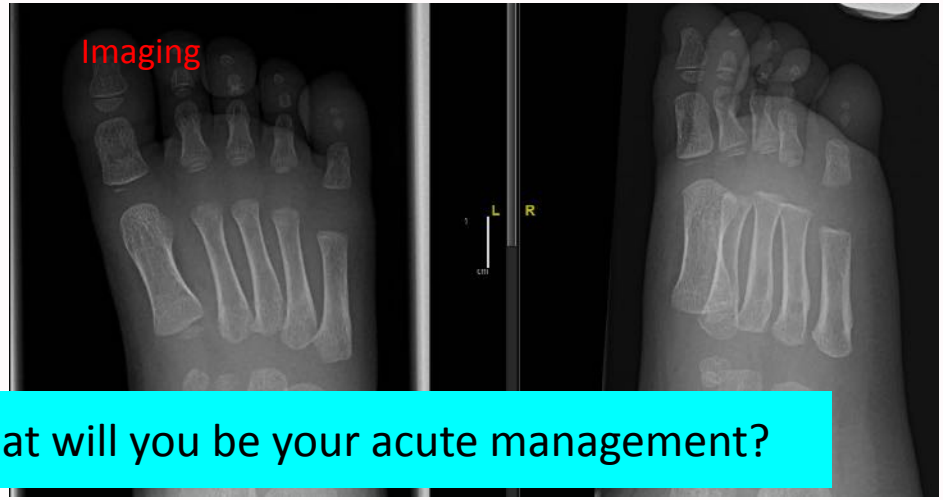
High Sensitive C-Reactive Protein

Severity Bloods

Erythrocyte Sedimentation Rate

Full Blood Count

Patient 2yo,
So no pre op bloods
or DM screen



What will you be your acute management?

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5. Acute Management

5. Acute Management

- ***Analgesia*** as per WHO pain ladder
- Diet - Keep ***NBM*** as per discussion with senior
- ***Empirical*** Antibiotics can be started if does not compromise cultures (check with senior)

Plan

Nursing

Vitals Q4H

- inform if T>38, HR>140 or <95, SBP<74, SpO2<95% RA

IO charting

Allow DOC for now — Diet Plans

Investigations

Trace blood c/s 9/8/22 — Empirical Abx

Management

IV Cloxacillin 200 mg/kg/day q6H

IV Clindamycin IV clindamycin 40 mg/kg/day q6H

Cont IV maintanence drip

Antipyretics — Analgesia

Surgical plans as per ortho

Analgesia

Will you do advanced imaging? Why?

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6. Advanced Imaging?

6. Advanced Imaging

- Imaging of choice: ***MRI scan with contrast***
- Most do not need advanced imaging. But can be considered in the following scenarios
  - **Unsure** if infection - e.g., differentiating acute Charcot's vs Osteomyelitis
  - **Delineate** extent of infection for surgical planning
  - **Evaluate** adjacent joints for septic arthritis





What is your definitive management?

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7. Definitive Management

7. Definitive Management

- ***"Operative vs Non-Operative"*** depending on
  - **Patient** factors e.g. Co-morbids, function.
  - **Disease** factors e.g. Severity
- **Non-Operative**
  - Long term antibiotic suppression
- **Operative general options**
  - ***Debridement*** (= removal of unhealthy tissue)
    - ***Incision and drainage*** for abscess
    - ***Saucerization*** for carbuncles
    - ***Amputation*** - DDD

What will you assess for post op?

Explained to both parents regarding diagnosis
Treatment options explained
Surgery - total nail avulsion and debridement
Conservative - Abx, but may not be curative
Risks and benefits explained
Surgical risks: Recurrence of infection, bleeding, damage to nailbed with resultant toenail deformity, injury to surrounding structures
They understand
Keen for surgery
Consent signed by mother





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8. Post Op Review

8. Post Op Review

- Assess **patient**
  - Stability and vitals
  - GA Complications
- Assess **operated site**
  - Dressings - ensure not soaked
  - Chart drain outputs
  - Distal neurovascular (be specific)
- Follow **post Op instructions** for:
  - Continue ***empirical*** antibiotics
  - Trace cultures and convert to ***culture directed antibiotics***
    - May need **multidisciplinary** ID on board for PICC, OPAT.
  - Analgesia as per WHO

Surgery Performed

Procedure(s):
Right fifth toe toenail avulsion and drainage of paronychia -

Surgery Findings

right little toe lateral paronychia
epidermal blister with pus
nail bed intact
no exposed bone
not extending into the pulp

Operative Procedure

Informed parental consent
GA
Supine
Cleaned and draped
Epidermal blister deroofed
Nail plate avulsed
Pus sent for c/s through swab
Floor curetted and washed
No extension into the pulp from lateral nail fold
Washed and dressed with TG+bactroban
marcaine as digital block - 1%;3ml

Post Operative Orders & Instructions

Post OP Instructions

to GW
Hrly paras till stable
Allow diet
Elevate right foot
Monitor toe colour, perfusion, sensation and movements
Trace OT c/s
Cont Abx
W/I POD 2/3
Avoid dressing soakage

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Culture Directed Antibiotics

8. Post Op Review

- Assess **patient**
  - Stability and vitals
  - GA Complications
- Assess **operated site**
  - Dressings - ensure not soaked
  - Chart drain outputs
  - Distal neurovascular (be specific)
- Follow **post Op instructions** for:
  - Continue ***empirical*** antibiotics
  - Trace cultures and convert to ***culture directed antibiotics***
    - May need **multidisciplinary** ID on board for PICC, OPAT.
  - Analgesia as per WHO

Aerobic and anaerobic culture

(Moderate) Staphylococcus aureus !

No growth of anaerobes.

Culture Directed Abx

Resulting Agency: NUH Laboratory Medicine

Susceptibility

	Staphylococcus aureus MIC	
Clindamycin	<=0.25 mg/L	**Sensitive**
Cloxacillin	<=0.25 mg/L	**Sensitive**
Minocycline	<=0.5 mg/L	**Sensitive**
Trimethoprim-sulfamethoxazole	<=10.0 mg/L	**Sensitive**

Multidisciplinary

Management

Oralise to cefalexin 15mg/kg TDS (as d/w ID) to complete 10 days of antibiotics today if continues to improve and is afebrile

Analgesia PRN

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1 Stabilize	2 History	3 Physical Exam	4 Initial Invx
5 Acute/ Initial Mx	6 Advanced Imaging	7 Definitive Mx	8 Post Op Review

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Infection OSSE!

1. What will you examine for?
2. How will you investigate?
3. How will you initially manage this patient?
4. What is the definitive management?
5. How will you assess post op? What will you watch for?





Stem: xx Year old male with toe infection

OMS Framework - Infection

Soft Tissue/ **Osteomyelitis**/ Joint/ Nec Fas/ Peri-Implant

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Osteomyelitis - What's Different?



Clinical (A) and radiographic (B) pictures





Osteomyelitis - Diagnosed on XR





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What is Osteomyelitis?

- Osteomyelitis is infection in bone and its marrow

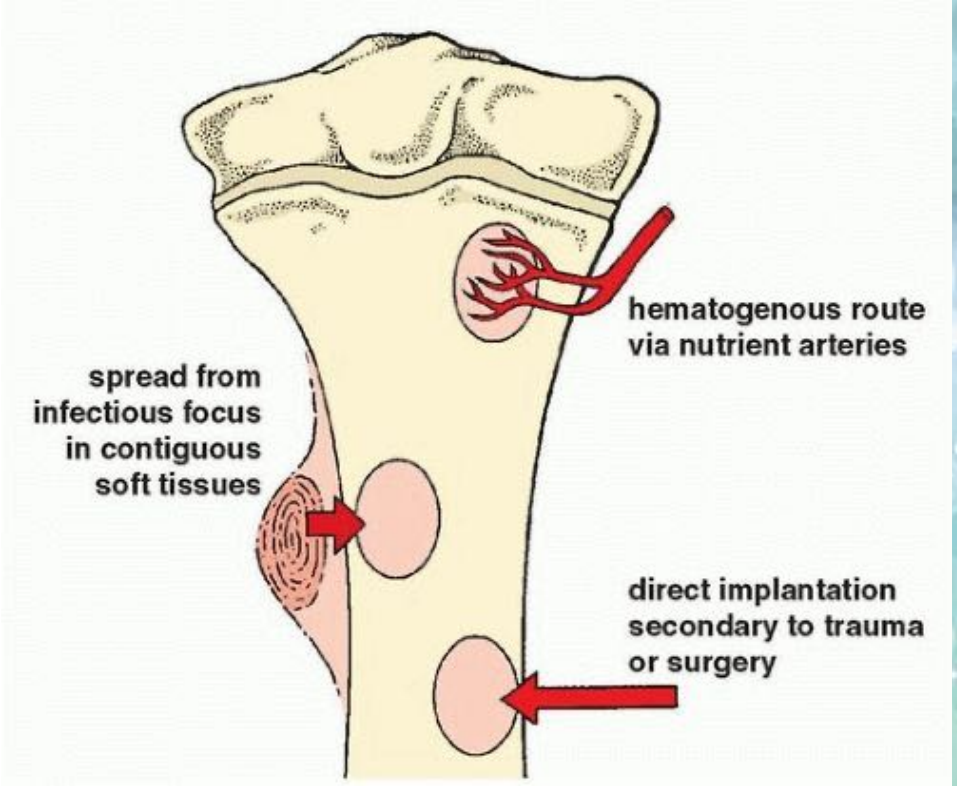
- Pyogenic (Bacterial)
- Non-pyogenic
  - TB, syphilis and fungal



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Where can the infection come from?

- 1) **Haematogenous**
  - Involves the metaphysis of the long bones of children
  - Vertebral bodies of adults
- 2) **Direct** inoculation
  - Penetrating injuries, surgical contamination, open fractures
- 3) **Contiguous** spread from local infection
  - OM in diabetic foot, spinal infection from retropharyngeal abscess



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Classification of Osteomyelitis

Location [Part of Cierny-Mader]

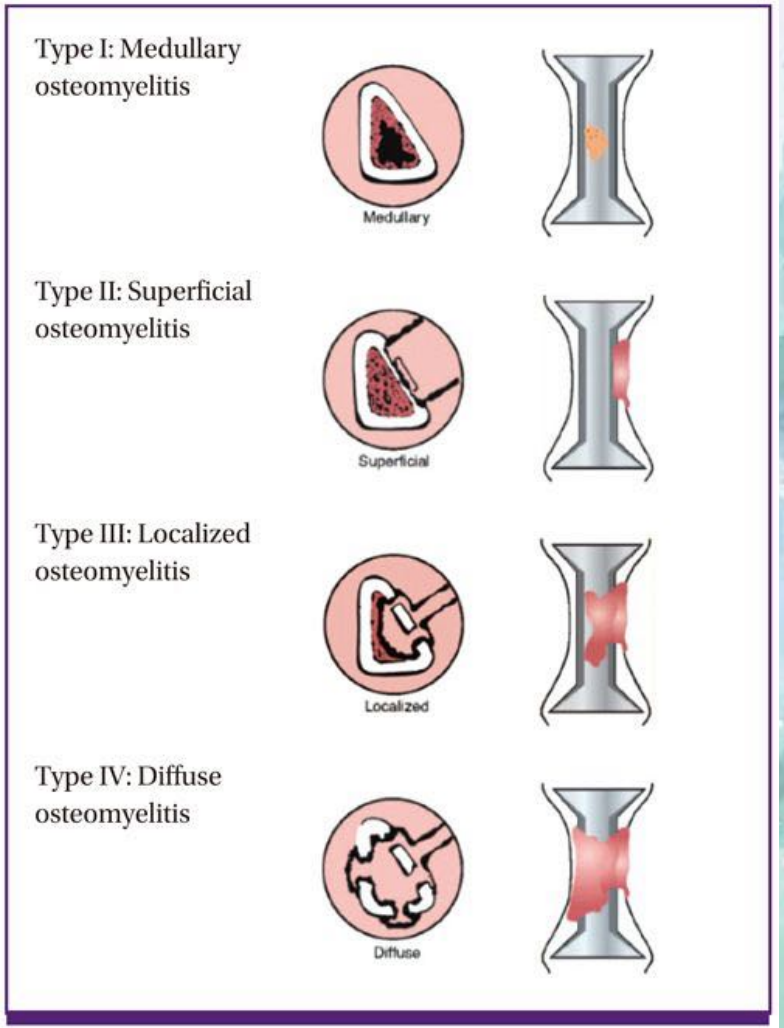
- Type I - Medullary
- Type II - Superficial
- Type III - Localised
- Type IV - Diffuse

Host [Part of Cierny-Mader]

- A: Normal immune system, non-smoker
- B: Local or mild systemic deficiency, smoker
- C: Major nutritional or systemic disorders

Timing

- Acute - < 2 weeks
- Subacute - 1-few months
- Chronic - After several months

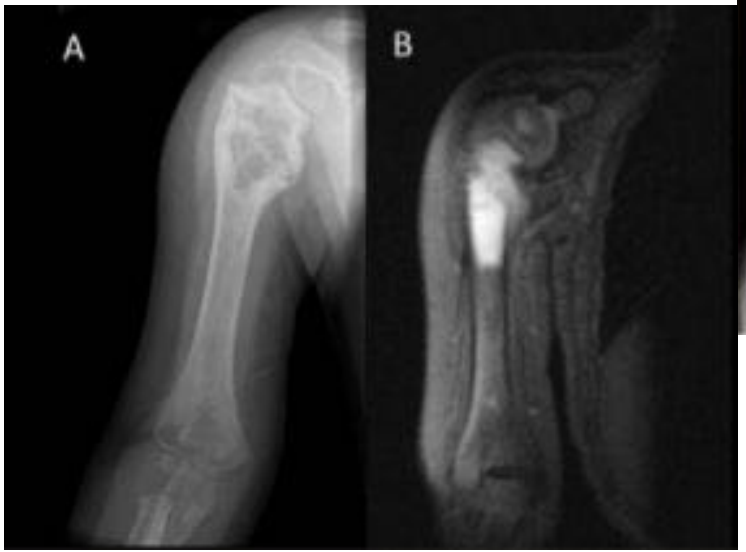


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Other conditions that look like OM

Cancer







Charcot Foot

OMS Framework - Infection

Soft Tissue/ Osteomyelitis/ **Joint**/ Nec Fas/ Peri-Implant

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Joint Monoarthritis - What's Different?







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Monoarthritis Differentials - GHOST

- Gout
- Hemarthrosis
- Osteoarthritis
- Septic arthritis
- Trauma







In a Tertiary Hospital, we need to rule out the most severe cause of Monoarthritis = **Septic Arthritis**

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Bugs and Severity

- Predominant causative organisms are **gram positive** - either **staphylococci** or **streptococci** (up to 90% of all cases).
- Gram negative organisms
  - Neisseria Gonorrhoeae - STD
  - Others - E coli, proteus, klebsiella, enterobacter
- **Severity**
  - Mortality up to 11%
  - Irreversible Joint damage
    - Loss of proteoglycans from articular cartilage by 5 days





1 Stabilize | 2 History | 3 Physical Exam | 4 Initial Invx
5 Acute/ Initial Mx | 6 Advanced Imaging | 7 Definitive Mx | 8 Post Op Review

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Knee Aspiration - What do you send fluids for?

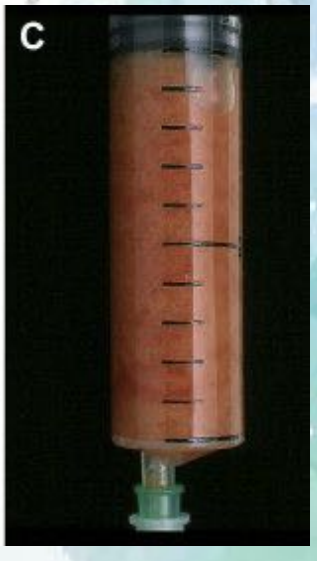


Which is most helpful in the acute setting? Why?

- Gram stain
- Cell count
- Crystal analysis
- Bacterial Cultures - Aerobic and Anaerobic
- Fungal Cultures







What would be your post-aspiration instructions?

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What instructions after joint aspiration?

- “NBM until gram stain and cell count results out”
- Diagnosis of Septic Arthritis
  - Gram stain +
  - Cell Count > 50,000



OMS Framework - Infection

Soft Tissue/ Osteomyelitis/ Joint/ **Nec Fas**/ Peri-Implant

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Necrotising Fasciitis - What's Different?







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What is Necrotising Fasciitis?

- Definition: Aggressive infection of **fascia**
- How to differentiate from severe cellulitis?
  - Difficult
  - Based on History, Physical Exam, Investigations



Table 1. **Definitions of Skin and Soft Tissue Infections**

Cellulitis	Acute infection of skin involving deep dermis and subcutaneous fat
Erysipelas	More superficial infection of the skin, involving the lymphatics; characterized by a tender, erythematous plaque with well-demarcated borders
Folliculitis	Superficial infection of the hair follicle with purulence in the epidermis
Furuncle	Infection of the hair follicle with associated small subcutaneous abscess
Carbuncle	A cluster of furuncles
Cutaneous abscess	Localized collection of pus within the dermis and deeper skin tissues
Pyomyositis	Purulent infection of skeletal muscle, often with abscess formation
Impetigo	Superficial infection of the skin characterized by pustules or vesicles that progress to crusting or bullae
Ecthyma	A deeper variant of impetigo; begins as vesicles/pustules and evolves into "punched-out"-appearing ulcers
Gas gangrene	Necrotizing infection involving muscle; also known as clostridial myonecrosis
Necrotizing fasciitis	Aggressive infection of the subcutaneous tissue that spreads along fascial planes

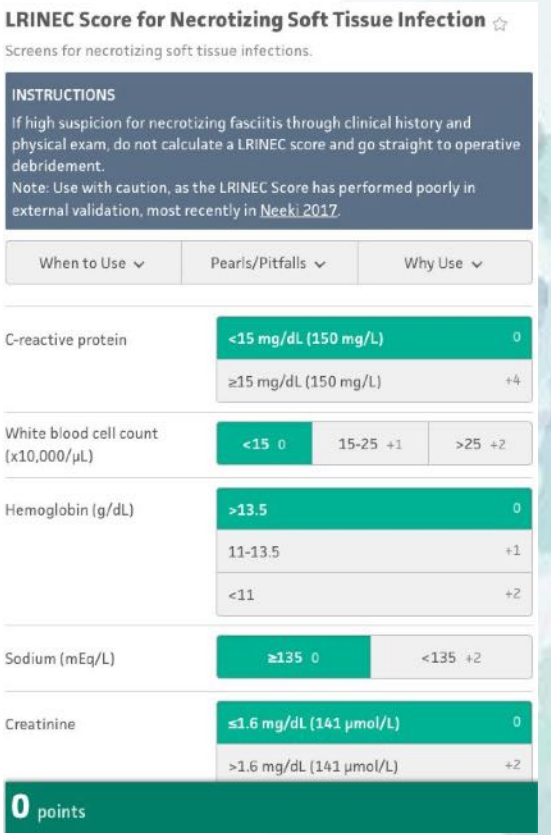
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LRINEC Score - Attempt to Help With Difficult Diagnosis

- Widely used but never properly validated
- Not a diagnostic test but yet often used

Variable	Value	Score
C-reactive protein	150 mg/l	4
Hemoglobin (gm/dl)	>13.5	0
	11-13.5	1
	<11	2
Total leucocyte count (thousand/cumm)	>15	0
	15-25	1
	>25	2
Serum sodium (mmol/L)	<135	2
Serum creatinine (mmol/L)	<1.4	0
	≥1.4	2
Blood glucose level	<100	0
	≥100	1

A score of is considered positive for necrotizing fasciitis.

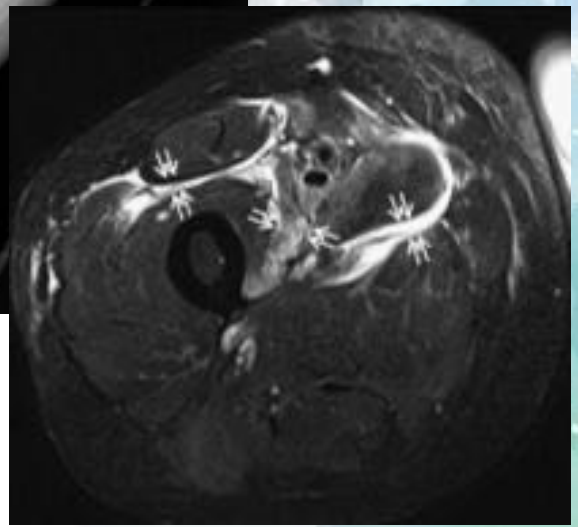


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Imaging

- **Nec Fas is a Clinical Diagnosis**
- XR?
  - Often normal
  - Soft tissue gas only seen in minority of cases
- MRI?
  - Characteristic findings
    - Deep fascial thickening > 3 mm
    - Abnormal deep fascial signal intensity
    - Extensive multi-compartment involvement
  - Limitations
    - Signal abnormalities not always specific, may be mistaken as cellulitis





OMS Framework - Infection

Soft Tissue/ Osteomyelitis/ Joint/ Nec Fas/ **Peri-Implant**

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Peri-Implant Infection - What's Different?







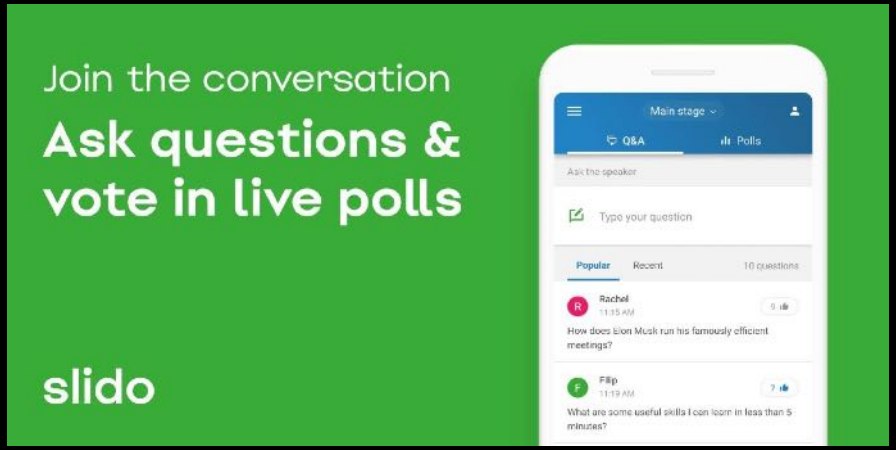


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Quiz Time!

- **Live Audience** – Submit your answer on SLIDO to enhance your learning through immediate feedback.

- **Recording Audience** – Refer to the slides for the exact questions and options.



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Pain and Infection Frameworks Quiz Q6



14

What kind of antibiotics would you start for this patient at the emergency department?

- Prophylactic Antibiotics
- Culture Directed Antibiotics
- Empirical Antibiotics
- Targeted Antibiotics

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Pain and Infection Frameworks Quiz Q7



15

What is concerning for this patient with this XR finding?

- Gangrene
- Open wound
- Osteomyelitis
- Tumor



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Pain and Infection Frameworks Quiz Q8

What is the role of joint aspiration in a patient with monoarthritis?

Allows injection of steroids
0%

Dry needling is helpful for pain
0%

Therapeutic and Diagnostic
0%

Simulates blood flow
0%



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Pain and Infection Frameworks Quiz Q9

18 **Which of these results should be traced urgently after a joint aspiration?**

- Cultures
- Cell Count
- Crystals
- Acid Fast Bacilli
- Gram stain

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Pain and Infection Frameworks Quiz Q10



18

Which of the following is false for this condition?

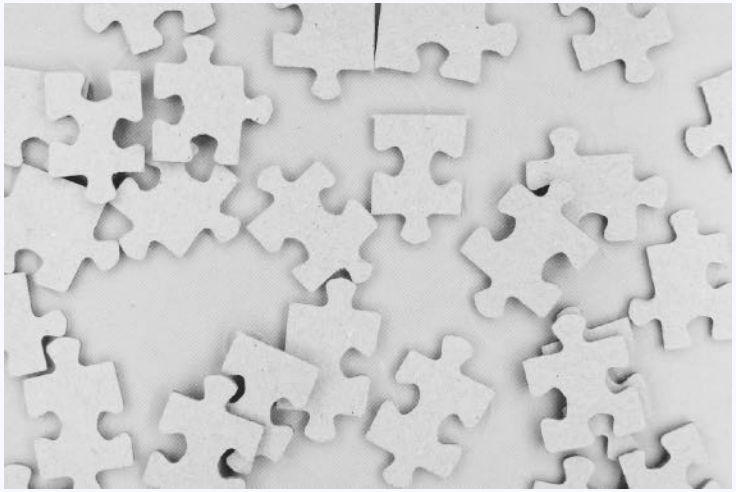
- Treatment is fasiectomy
- Patient may need intensive care
- Requires MRI for diagnosis
- May need multiple surgeries

MS

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What should you do next? Test, Ask, Add

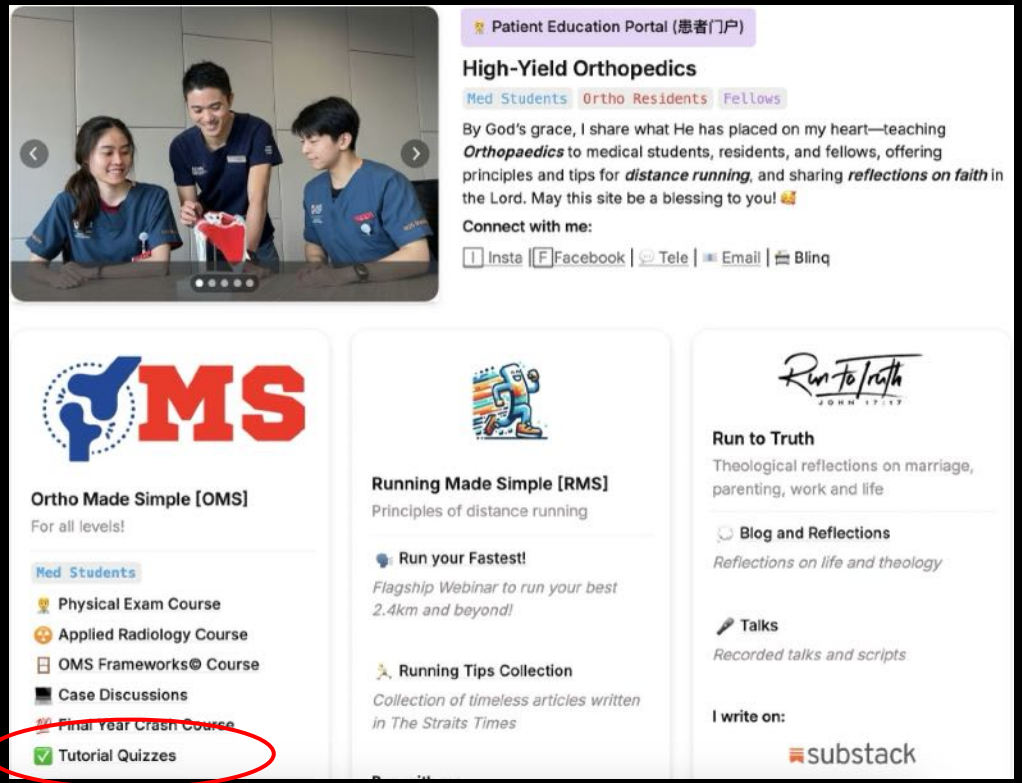
- **Test** yourself: Most infection cases will be seein the wards
  - At which stage is the patient in now? What is next?
    - How did the doctor perform Phase 2-5?
    - When was Advanced Imaging ordered? (Phase 6)
    - See how they counsel for Phase 7 if op fails
  - Check your own answers against the case notes
- **Ask** when you see something is not as expected. (Deviation from framework)
- **Add** - When studying, add in what is unique for each injury at each stage - you will find that there is minimal variation!



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Maximising our Time!

- Post lecture Quizzes available on website mokyingren.sg!

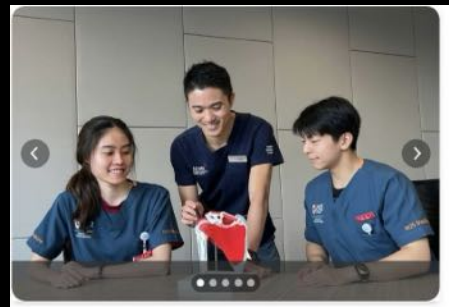


1 Stabilize | 2 History | 3 Physical Exam | 4 Initial Invx
5 Acute/ Initial Mx | 6 Advanced Imaging | 7 Definitive Mx | 8 Post Op Review

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Case Discussions

- Step by step case discussions based on the OMS Frameworks
- You will learn how to answer Viva questions in a safe and guided manner while reinforcing what you have learnt in this series!



Patient Education Portal (患者门户)

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  Reflections on life and theology
- Talks
  Recorded talks and scripts

All | Trauma | Paeds Ortho

Neck of Femur Fracture	Tibia Tuberosity Fracture	Pediatric Wrist Fracture	Tibia Shaft Fracture
Trauma	Trauma	Trauma	Trauma
Sep 15, 2025 4:57 AM	Paeds Ortho Sep 3, 2025 8:56 AM	Paeds Ortho Sep 3, 2025 8:12 AM	Sep 3, 2025 8:09 AM