

CLAVICLE

Treatment:

Usual: Collar and cuff or
Figure of eight or
Triangular brace

Routine fixation is not required

Non-union [2% shaft and 8 % lateral third clavicle]

. When symptomatic may need bone graft and plate fixation

Absolute indication for early fixation

- Open fracture
- Floating shoulder [#clavicle,scapula]



A-CL JOINT DISLOCATION

1. Weight bearing X rays. Recent: Is not useful
2. Displaced A-Cl joint
 - Operate or not to operate.
 - Meta-analysis: 88% E-G results irrespective of Rx
3. Surgery for high demand?
 - Controversial



SHOULDER DISLOCATION

Anterior : Posterior = 10:1

Associated great tub #: 25%

Axillary N 40% [clinically detectable: 10%

Assessment

Handedness

Sports and job

Direction of dislocation

Traumatic or nontraumatic

Dislocation in the opposite shoulder

Ligament laxity syndrome is common with recurrent dislocation

Incidence of recurrence: 90% in 20 yrs
less > 40 yrs

Treatment: Methods of Reduction: Kocher's

- Role of physio: Cuff tendon strengthening

PROXIMAL HUMERUS

1. Classification: Neer's classification
2. Trauma series X ray
 - True AP & Lateral
3. Non-operative [sling in 80%]
 - ORIF with a low profile plate
 - Hemiarthroplasty
4. Complication
 - Non-union 20%
 - Mal-union 30%

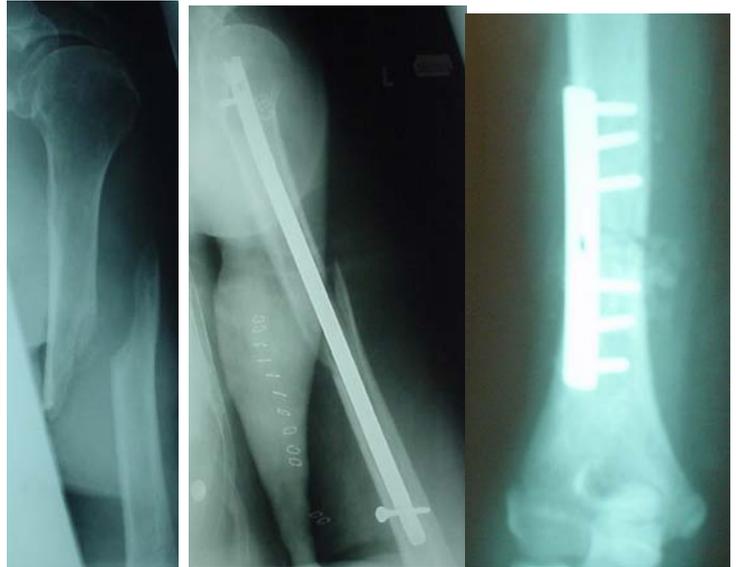


FRACTURE SHAFT OF HUMERUS

Check for radial N

Treat in a U slab initially x 2 weeks
Brace for next 4 weeks

- 98% healing
- Rarely surgery for non-union



INTERCONDYLAR FRACTURE HUMERUS

Usually occurs in adults

Classification Displaced
Undisplaced

They are intra-articular fractures

Treatment

- Displaced: always ORIF
Encourage early movement.

Complication

Joint stiffness



POSTERIOR DISLOCATION ELBOW

1. Dislocation can be associated with
 - Fracture medial epicondyle
 - Radial head
 - Coronoid
 - Capitulum
 - Radial head in 50% and ME in 10%
2. Concentric reduction [closed manipulation]
3. Slab for 7-10 days → Mobilise
4. Long term: <math><10^\circ</math> flexion deformity



RADIAL HEAD FRACTURE

Undisplaced Early mobilize in a Radial sling

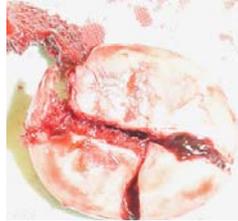
Split/displaced Fix

Comminuted Excise/replace

Always check inferior RUJ

Treatment:

- Mobilise
- Excise
- ORIF
- Replace the head



FRACTURE RADIUS AND ULNA

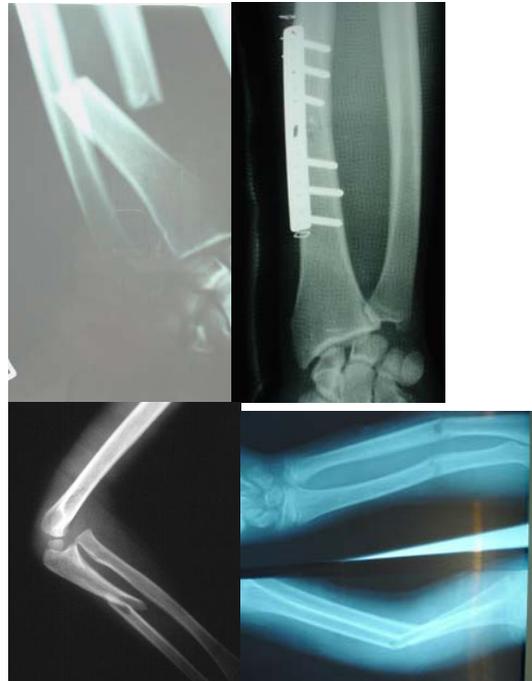
Monteggia: Fracture ulna and dislocation of SRUL

Galleazzi: Fracture Radius and dislocation of IRUJ

• Both bones fracture

Treatment: ORIF with plate

- 98% healing



FRACTURE DISTAL RADIUS

Very common fracture
Old population: suspect osteoporosis
Young population: is usually due to high velocity

Assessment

Look for median N
Look for compartment syndrome in Young patient

Radiological assessment

Normal alignment: 11° of volar angulation
23° of ulnar tilt
12 mm longer

Acceptable angulation
Within 10° of volar angulation and 5° of radial angulation; Intra-art displacement 2mm

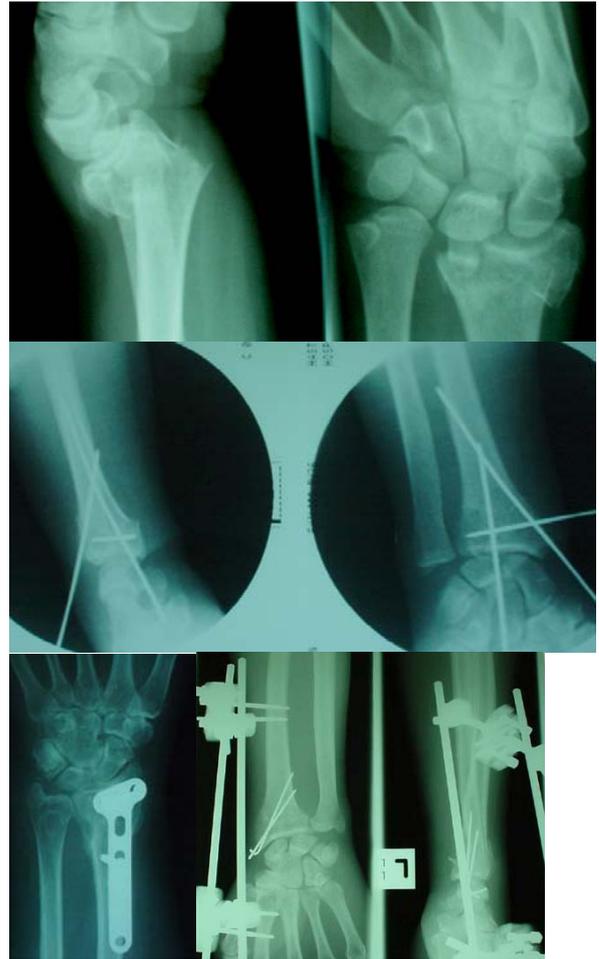
Treatment

Cast → X ray at 10 days;
And if reduction is maintained, continue the cast
If reduction is not maintained:
Remanipulate + K wire + Ext Fixator [unstable]

Educate: on Osteoporosis

Chronic pain:
Inferior radio-ulnar joint problem or
Due tear in the TFCC

Complication: Malunion
Carpal tunnel Syndrome
Extensor Pollicis Longus rupture



SCAPHOID FRACTURE

Fracture may not appear on X ray. And may
may need re-X ray at 2 weeks

All patients with tenderness over the snuff box treat
initial with scaphoid cast or early MRI

X ray: PA: UD and oblique, Lateral, PA clenched fist

Treatment

Stable 94% Needs cast treatment 6-12 wks
Unstable or displaced fracture:
Needs ORIF

Complications

Non-union
Mal-union
AVN



BENNET'S FRACTURE

Intra-articular fracture base of I metacarpal

Treatment

Stable fracture: Thumb spica cast

Unstable #, requires

- CRIF and fix with wires



BOXER'S FRACTURE

Fracture neck of V metacarpal

Leave it alone in majority [Buddy strap 3 weeks]
or if angulation more than 40* = MUA +/- K wire



Complications of Hand fracture

1. Stiffness: Excessive immobilize [>4wks]
 - Plate fix and immobilization
 -
2. Pin track infection: Reported >20% in some series.
3. Nonunion
4. Malunion
 - Rotation malunion



FRACTURE NECK OF FEMUR

Epidemiology

- More in Caucasian women
- 50% NOF and 50% Intertrochanteric fracture
- Age [doubling with each decade],
- Osteoporosis: 1S.D = 2.33

Mechanism

- : 90% fall from a standing position
- 10% Trauma [young with high velocity injury]

Types: Garden's classification

- Unstable: [III and IV]
34% AVN and 32% NU

Complication

- 1 yr mortality: 25-30%
- The overall mortality rate within thirty days 2.4%
[10 times more than elective]

Treatment

1. Optimize medical condition
2. Undisplaced fracture Fixation
[DHS or multiple cannulated screw]
3. Displaced:
Young Internal fixation
Elderly mobile THR
Elderly demented Hemiarthroplasty



INTERTROCHANTERIC FRACTURE

1. Displaced or undisplaced fracture
2. Acceptable angle: Anatomical
130-150 and 10°
3. Treatment: Dynamic Hip Screw

4. Positive Predictors for outcome[Koval]

1. Co-morbidity: ASA III is bad
2. Age: >85 is bad
3. Pre-injury mobility
 - Poor pre-op mobility do badly
4. **No relation** with fracture type



POSTERIOR DISLOCATION HIP

Posterior: Anterior = 10:1

95% have significant other injuries.

Knee: 75%; 30% Meniscal; 20% PCL and
10% ACL and 30% bone bruise

Surgical emergency; MUA. 10% OR

Post reduction CT is essential to check

Whether reduction is congruent reduction
Or any retained bone fragment in the joint



Complications

- 10% OA
- 10% AVN
- 10% Sciatic nerve [70% recover]

FRACTURE SHAFT FEMUR

High energy injuries from a MVA or following a fall
Can bleed more than litre of blood at the fracture
Pulmonary embolism is more common more so in
bilateral femoral fracture

Initial Management:

1. Blood for total count and group and hold
2. IV fluids
3. Foley's indwelling catheter
4. Continuous Pulse Ox monitoring
5. Femoral nerve block and morphine for pain
6. Traction temporarily while waiting for surgery
7. **Consent:** Closed Reduction and nailing



TIBIAL PLATEUA FRACTURE

.CT is required for assessment

.Incidence: 60= Lateral;
15= Medial;
25 = Bicondylar

Associated ligamentous:

- MCL, ACL, 50% Meniscal tear

Indication for surgery:

- a) Instability
- b) 5 mm separation
- c) 3 mm of step off



Treatment

Traction
ORIF [plate]: commonly performed

Complication
Knee arthritis
Stiffness

TIBIAL FRACTURE

Classification

- Displaced or undisplaced

Treatment

- 1. Undisplaced: Cast [AK] 12` weeks
-
- 2. Displaced
 - a. Cast brace
 - 25% Malunion
 - 5% NU
 - 20% DU union
 - 6% shortening > 1 cm
- 3. IM nail: Gold Standar
 - 50% anterior knee pain: Mild
 - Healing 18 wks Vs 25 wks
 - NU is five fold less with this Rx
- 4. AO plate: 0-15% infection
 - [nailing <1%]
 - High incidence of non-union



Complications

Hardware failure	0.5% over 10 yrs in newer nails
Anterior knee pain	50%. Commonest. Informed consent
Loss of sensation	In the distribution of infrapatellar br of saphenous N
Delayed and nonunion	Smoking and severity of injury.
Mal-union	37%.

ANKLE FRACTURE

Weber' Classification

Type A

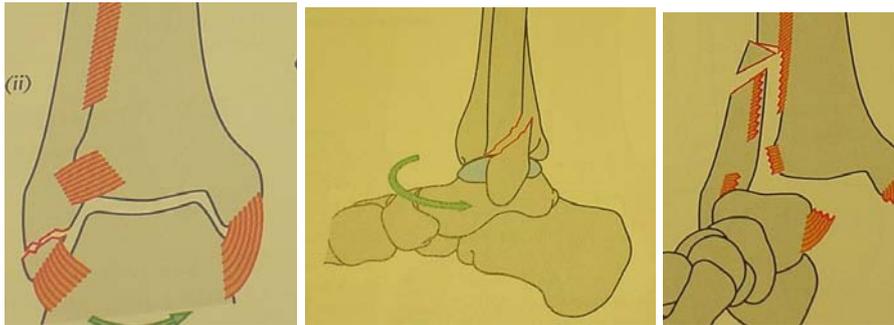
- 1. Transverse # of lat Malleolus below syndesmoses
- 2. Very stable
- 3. Rx: Walking cast for 6 wks

Type B

- 1. Fibular fracture at the syndesmosis
- 2. Are stable [look for tenderness]
- 3. Cast for stable and plate for Unstable fracture

Type C

- 1. Fibular fracture is above the syndesmosis
- 2. Diastasis of the tibio-fibular joint
- 3. ORIF



Treatment

Lateral side Plate

Medial side screw

+/- syndesmotomic screw

+ Cast for 6 weeks



LISFRANC FRACTURE

20% are undiagnosed at initial presentation

Stress views may be required

X ray: look for "Fleck sign and 2mm diastases" between I and II metatarsus

Medial border II Metatarsal is aligned with Medial border of middle cuneiform in AP

Treatment

ORIF is recommended

Screw fixation to medial metatarsal and K wires lateral metatarsus

Leave Screw for 16 wks



FRACTURE CALCANEUM

2 types of fracture

- Intra-articular fracture
- Extra-articular

Look for: spine, foot, ankle injury

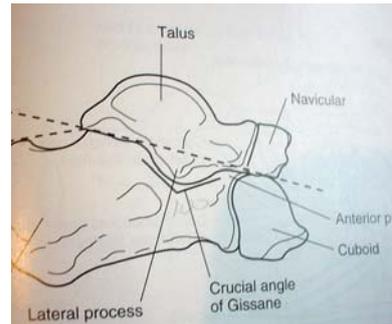
X ray

- Bohler's angle [N 20*]
- Needs CT assessment

Treatment

- RICE
- NWB for 6 weeks
- Rarely surgical fixation

- Conservatively - 14 yrs follow up –
- 20% had significant pain;
- 50% loss of subtalar movement;
- 75% could run;
- 80% have gone back to their original work.



FRACTURE SPINE

Cervical spine

- Always collar
- X ray: AP, Lateral, open mouth
- Neurological assessment for level.
Look for perianal sensation
- FHL: spinal sparing
- Catheterise
- **Incidence**
- 1. Cervical Spine 60
[10% odontoid]
- 2. Thoracolumbar 30%
- 1 month assessment is more important ie., complete lesion at 1 month there is 95% chances that quadriplegia remains complete.



PELVIC FRACTURE

H'ge is common is from # pelvis. Usually it is venous than arterial bleeding. When arterial is due to damage to superior gluteal artery [SGA: 10%]

When unstable due to bleeding: External Fixation is good. When not available use Pelvic brace or pelvic binder

Massive transfusion: Coagulopathy: Look for: prothrombin time 19 s or partial thromboplastin time 60 s;

FAST[Focused abdominal sonogram for trauma] may be required Is more accurate than DPL [Diagnostic peritoneal lavage]

What is unstable fracture pelvis

: 1 cm Posterior sacro-iliac joint opening or elevation [CT]

Long term when unstable fracture treated non-operatively

- Limb length shortening, difficulty in sitting
- 30% Altered sexual activity
- 36% Changed their jobs

Tile 1996: Unstable fracture pelvis: 30% Pain; 3% Non-union; 5% Mal-union [>2.5 cm LLD]; 3% Urethral rupture and 5% permanent nerve damage

DVT 50%: requires thromboprophylaxis.



POLYTRAUMA

1. Resuscitation : ABC [EMST]
2. Chest : Chest tube; II MCL for Needle
 - IV or V anterior to AAL (Nipple line) for Hemo
3. Blood: Type specific [within 10 mnts]
 - Saline challenge: stable or unstable
4. Abdomen t: Fast scan [US]; DPG, CT scan
5. Head injury: Avoid Hypotension and hypoxia.
 - ICP → <20;
 - CCP = Mean arterial BP - ICP == 70.
6. Classify shock: 750, 1500, 2000 . 3:1 rule ie., 3ml of fluid for 1 ml of blood loss
7. Priority: Damage control : Ex fix for pelvis and long bones
8. Assessment: Scoring: Glasgow Coma Scale <13= CT and <8 = coma
9. Primary X rays [neck injury always assume] and protect the neck
10. Pain management
11. Antibiotics, Tetvac,
12. Monitor: BP< Pulse, Arterial pressure, ICP, Hb, Urine catheter and output
 - Urine output: 0.5ml/Kg in adults and 1ml/Kg in infants
13. ICU: Compartment syndrome, Joint contracture, Pressure sores
14. Hypothermia, DIC



COMPARTMENT SYNDROME

Muscles are contained within the compartment formed by the fascia and the bone. Compartments are well defined in the forearm, leg, hand, foot. Usual tissue pressure is 0-8 mm of Hg. In trauma situation, may increase more than 30 mm Hg causing a surgical emergency of compartment syndrome

Early diagnosis

- Swelling
- Stretch pain
- Severe pain
- Sensory abnormality

Pressure monitor: is used to diagnosis and is more important in diagnoses in an unconscious patient

Treatment: Urgent Fasciotomy

Delay in diagnosis causes: Volkman's Ischaemic contracture

OPEN FRACTURE

1. Initial assessment: ABC, Isolated or Multiple, Vascular or not, Compartment or not
2. Gustillo's classification
3. Wound cleaning
 - Antibiotics should be given within 3 hours of injury
 - Usually Cephazole and in case of Type II and III add Gentamycin
 - +/- Tetvac
 - Cover the wound with sterile dressing
 - Photograph of the wound
4. Pain relief: Morphine is ideal
5. Slab to immobilize
6. Debridement
7. Early stabilisation
8. Reconstruction

Gustillo's classification

Type I	Wound size	Contamination	Soft tissue injury	Bone injury
I	<1 cm	Clean	Minimal	Simple
II	>1cm	Moderate	Moderate	Moderate
IIIA	Usually 10 cm	High	Severe	Periosteum intact
IIIB	"	"	"	Periosteum separated
IIIC			Vascular	

Debridement

Remove all dead muscle

- Contractility
- Consistency
- Color
- Capillary bleed

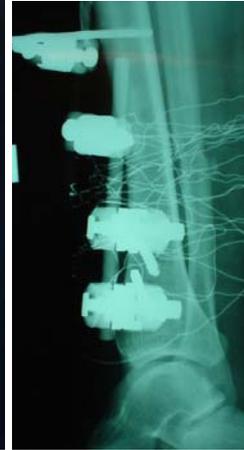
Bone: All fragments devoid of soft tissue attachment, excise

Nerve: Tag the nerve and repair later

Get early soft tissue cover [Plastic surgeon]

Vessel: Ligate or Repair as required

Pulsatile lavage: Low speed; 6 litres should be used



PATHOLOGICAL FRACTURES

Fractures which occur from low energy injuries which occur through an area of bone weakness with a pre-existing abnormality.

Differential Diagnosis

1. Tumors

Secondaries in the bone :	Breast	50%
	Prostate	20%
	Lungs	10%
	Kidney	5%
	Thyroid	5%
	Melanoma	

Multiple Myeloma

Primary Benign

Giant cell tumor
Nonossifying fibroma
Simple bone cyst

2. Metabolic

Pagets Disease

Osteomalacia

Osteoporosis

Hyperparathyroidism

3. Developmental

Osteogenesis Imperfecta

Osteopetrosis

4. Infection

- Osteomyelitis:



SECTION II PAEDIATRIC TRAUMA

1. Polytrauma
2. Abuse or not
3. Age and # Rx
4. Acceptable alignment
5. Remodeling
6. Classification
7. Indication
8. Growth potential; deformity and shortening

POLY TRAUMA IN CHILDREN

1. Systolic B.P: 80 + twice the age
Diastolic Pressure is 2/3 of systolic
2. Hypotension in children is a serious hypovolemia
It indicates 45% of blood loss
3. Child's blood volume: 80/kg.
Resuscitation: 20 ml/kg warmed crystalloid is the initial bolus.
3 bolus should be given. 1:3 fluid rule applies to children as well

Vital functions

Age	weight	Heart Rate	BP	R.R.	U.O.P
Infant	12 kg	160	80	40	1.5ml/Kg/hr
Preschool	16 Kg	120	90	30	1 ml/kg
Adolescent	35	100	100	20	0.5

Resuscitation

1. IV access can be difficult; may need cut down.
2. Intraosseous infusion: Proximal tibia is safe [<8 years]
3. Beware: Hypothermia and Hypoglycemia in children
4. Suspected Spleen injury: CT
5. Head injury common.

Paediatric Spine Injury

1. Large head. Board to prevent flexion of the head.
2. SCIWORA [Spinal cord injury without radiologic anomaly] 10-15%
3. Pseudosubluxation of C2-3: 40%
<3mm translation
No soft tissue swelling
The posterior alignment is good.
When in doubt: CT
4. Odontoid: apophysis 5-10 yrs

How Polytrauma in children is different from adults?

1. Small body volume: High velocity injury
2. Large body surface : Hypothermia
3. Growth plate: Take this fact into consideration
4. Compliance
5. Anesthesia
Intubation is difficult: Anterior placement of trachea
Large tonsil and tongue
Short trachea and intubation into R bronchus
Uncuffed tubes: cricoid ring acts as a natural cuff [<12 yrs]

Most fractures in Children

Suitable for Non-operative treatment because:

- Have active periosteum
- Fractures in children heal rapidly
- Remodelling

PERKIN'S RULE OF FRACTURE HEALING

	Healing	Consolidation
Spiral fracture upper limb	3 weeks	6 weeks
Spiral fracture lower limb	6 weeks	12 weeks
For transverse fracture	Multiply by 2	

ROLE OF INTERNAL FIXATION

1. Type III and IV Salter's
2. Displaced supracondylar fracture
3. Displaced lateral condyle
Medial epi with fragment in the joint
4. Displaced radial neck [$>50^\circ$] angulation
5. Forearm fracture : Plate or Nail < 8 yrs: $> 20^\circ$ is unacceptable
> 10 yrs do not accept more than 10°
6. Fracture shaft femur:
 - > 6 yrs: flexible intramedullary nail
 - Plate fixation
 - External fixation
 - Traction and hip spika
 - >13 years: Intramedullary rod [Trochanteric entry]

FRACTURES AROUND THE ELBOW

Ossification centers around "CRITOE"

- Capitulum 2
- Radial head 4
- Internal [medial epicondyle] 6
- Trochlea 8
- Olecranon 10
- External epicondyle 12

Fat pad sign

- Anterior pad may be visible normal.
- Posterior fat pad sign [Skegg]
 - 75% a posterior fat pad sign ultimately had a fracture.
 - 55% are supracondylar fracture of the humerus;
 - 26% had a fracture of the proximal part of the ulna;
 - 12% had a fracture of the lateral condyle
 - 10% had a fracture of the radial neck.

SUPRACONDYLAR FRACTURE HUMERUS

Commonest fracture around the elbow

Neurovascular deficit was seen in 12 (4%)

Commonest is Anterior interosseous nerve

Treatment: Surgical emergency

Closed reduction and fixation was by crossed Kirschner wires

Open reduction may be necessary in 15%

Complications

Mal-union Cubitus Varus deformity in 4%

Vascular Compartment syndrome; Volkman's ischaemic contracture

Nerve Median, Radial and Ulnar

Stiffness

Myositis Ossificans



LATERAL CONDYLAR FRACTURE

Displaced or undisplaced

Cast or ORIF with wire

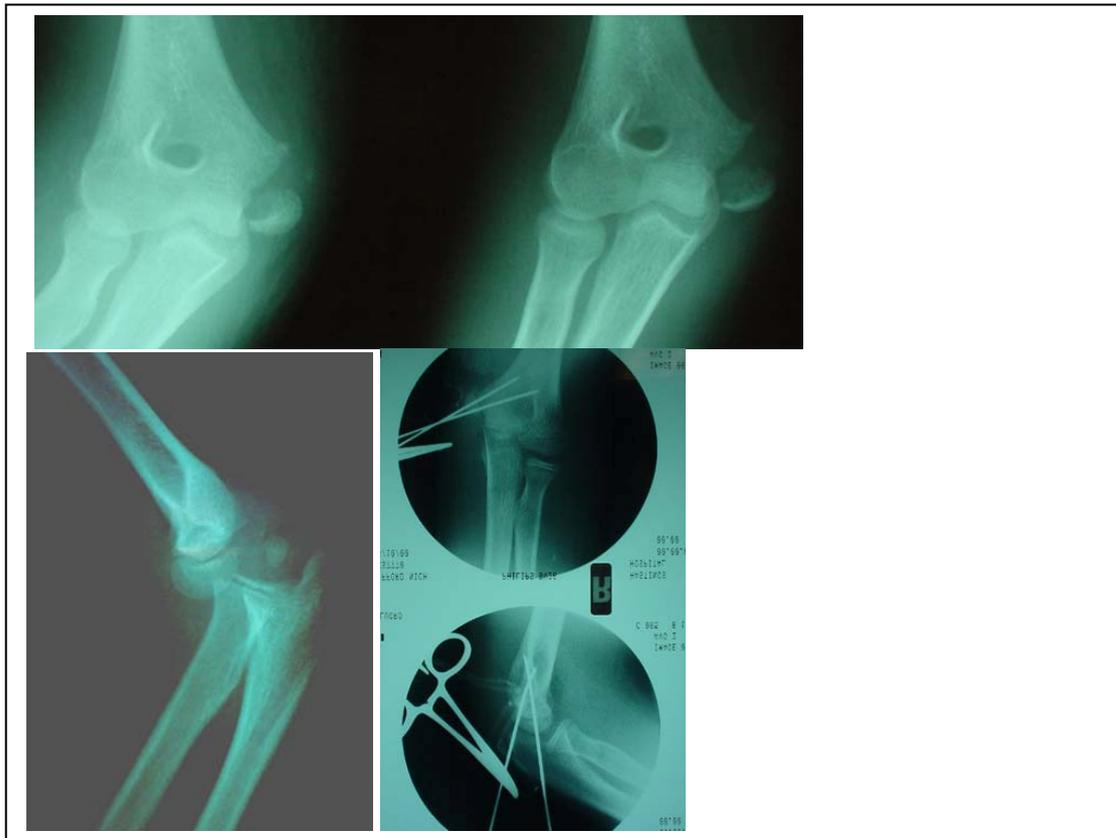


Complications:

- Nonunion,
- Malunion, lateral growth arrest, and cubitus valgus.
- Tardy ulnar nerve palsy.
- Stiffness

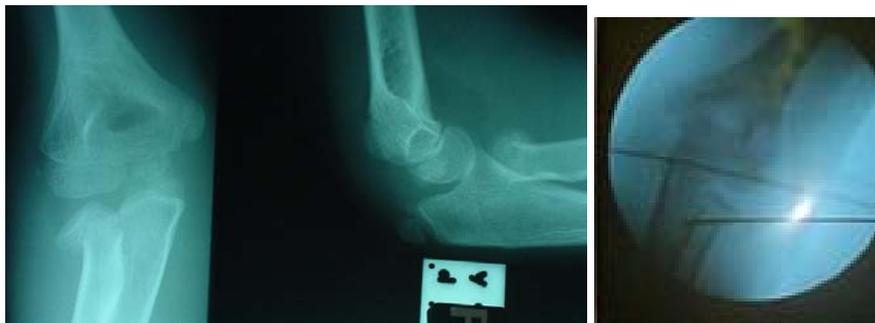
MEDIAL EPICONDYLAR FRACTURE

Majority needs slab treatment for two weeks and then mobilization.
Surgical treatment when medial epicondyle is displaced in the joint



RADIAL NECK FRACTURE

1. X ray -ve: does not rule out fracture head of radius
 - 2 Assess ROM: record rotation
 4. Any tenderness over IRUJ
- Radial neck: 20% of elbow injury
Angulation $<30^\circ$ immobilise
 $>30^\circ$ CR or ORIF



FRACTURES RADIUS AND ULNA

Common fracture in children

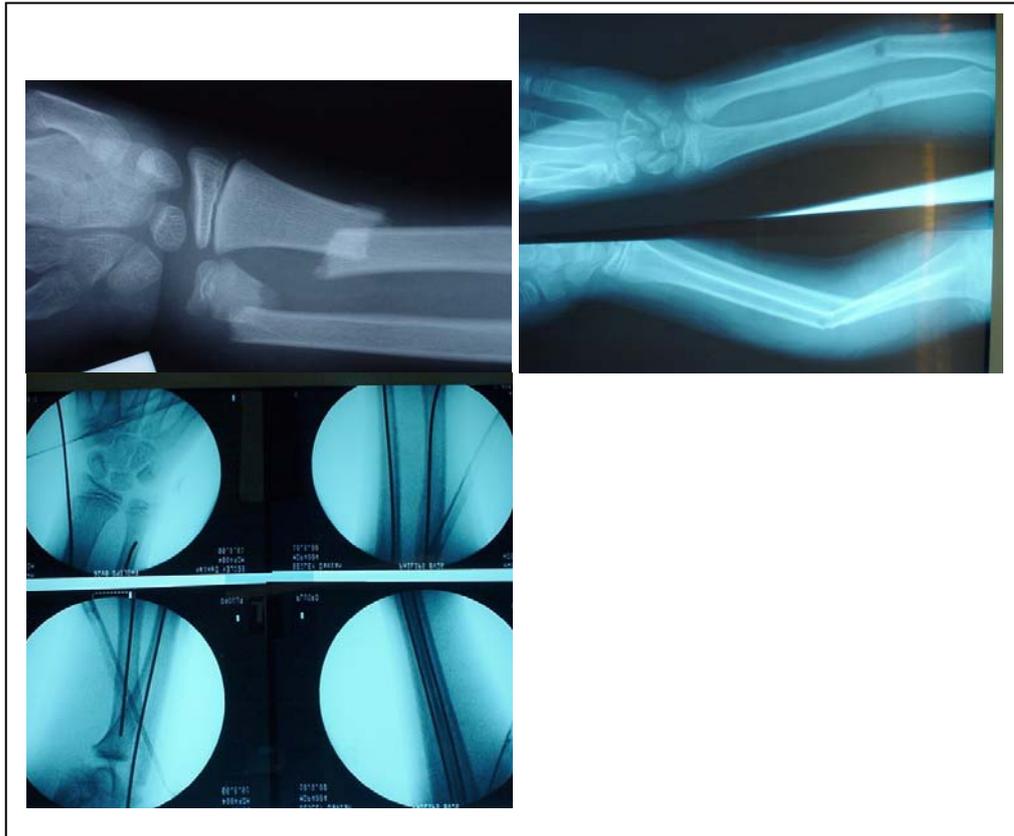
X ray: Joint above and below;

10° loss of 15° can cause and limit rotational movement

20° deformity, the loss of 50°

Treatment

1. Cast fixation
2. ORIF: Displaced
 - Monteggia and Galeazzi
 - Open fracture
 - Floating elbow
3. Intramedullary nailing



Fixation of bones: Plating Vs nailing

- Plating:** Large exposure
Ugly scar
Risk of cross union, need for plate removal,
Risk of nerve injury and re-fracture with removal.
- K wire:** Limited skin incision and better scar
Flexible rod system avoid problem of stress raiser.
3 point fixation (start proximal to growth plate.)

Monteggia and Galeazzi

Monteggia: # ulna and dislocation of radial head

Galeazzi: # Radius and dislocation of inferior radio-ulnar joint

Both these fractures are unstable but can be treated in cast in children needs closed observation for redisplacement. In adults always need ORIF.



FRACTURE SHAFT FEMUR IN CHILDREN

1. Traction or Hip spica

Traction: Traditionally it is a gold standard.

Problem: Prolonged hospitalization

2. Immediate spica: < 6 yrs,

Minimize hospitalization

Loss of reduction in 20%. Need weekly X ray and if required reapplication

Acceptable reduction

>11 yrs Varus or valgus <5* and AP >10* short: 10 mm

- 5-10 yrs Varus or valgus <10 and AP 15* and short 15

- <5 : “ <15; AP 20 and short 20

Remodeling is rapid : first two years of fracture

3. Intra-medullary nail:

In children over 6 years

Is gold standard

4. External Fixation

5. ORIF plate

6. In >13 years: Nailing can be used

