THE PATTERN OF RADIOLOGICAL FINDINGS IN UPPER LIMB INJURY AS SEEN AT KENYATTA NATIONAL HOSPITAL

This dissertation is submitted in part fulfillment of the requirements for the degree of Master of Medicine in Diagnostic Radiology, University of Nairobi

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By

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DECLARATION

This dissertation is my original work and no part of it has been presented for a degree in any other university.

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SUMMARY

Upper limb injuries are a major cause of morbidity, with consequent loss in terms of man-working hours (9,12). A large population is affected and there are broad social, economic and health implications (5,6,8,9,10,16,18). Such morbidity could be reduced through improved management of upper limb injuries (15), and this can be achieved by knowing the causes and distribution of such injuries. My desire to provide statistical data relating to the incidence and causes of upper limb injuries was the real motivation behind this study. Ultimately it is my hope that the findings of this study will go along way in guiding improved patient management strategies at Kenyatta National Hospital and the Kenyan nation at large.

Between June 2006 and December 2006 a total of 218 patients with injuries to the upper limbs were studied. Out of these, 162 were males while the remaining 56 were females.

Though there was a wide age distribution from 2yr to 73yr, the bulk of these patients were in the 0-15yr age bracket. This age group is no doubt the most versatile and physically active and therefore more likely to be involved in traumatic incidences than any other group.

In contrast to previous trends (25,26) in which road traffic accidents constituted the single most common cause of upper limb injuries, it emerged from this study that today the commonest aetiology is a fall (55.96%),followed by automobile accidents (18.35%). The other notable causes included assault, occupational and gunshot.

Fractures, dislocations/ subluxations and soft tissue injuries of the upper limbs were recorded . In a small minority of patients (3.6%) there were associated injuries in

other parts of the body such as the head and pelvis. Although plain radiography formed the basis for imaging patients with upper limb injuries, additional imaging modalities such as sonography, computed tomography and magnetic resonance imaging had a positive diagnostic value over and above plain x-rays where there were visceral/soft tissue injuries.

ABBREVIATIONS

AP..........Antero-posterior

CT........Computerised Tomography

DDR......Department Of Diagnostic Radiology

DIP.......Distal Inter-Phalangeal

f/arm......Forearm

LAT......Lateral

KNH......Kenyatta National Hospital

MCP......Metacarpo-phalangeal

MRI.......Magnetic resonance imaging

PP..........Page

PA.........Postero-Anterior

PIP.........Proximal Inter-Phalangeal

RTA.......Road Traffic Accident

SPSS.......Statistical Package for Social Sciences

UoN........University Of Nairobi

INTRODUCTION AND LITERATURE REVIEW

EMBRYOLOGY,ANATOMY AND FUNCTIONS OF THE UPPER LIMBS

Embryology of Upper Limbs

The primordia of the limbs project at right angle from the lateral surfaces of the body from the sixth intrauterine week. These outgrowths are called **limb-buds**. The buds result from condensation of mesenchymal cells covered by primitive ectoderm (2).

From the differentiation of the mesenchymal core the following structures form:

1.The appendicular skeleton (bones, periosteum, joints with cartilage and capsule).

2.The muscles, tendons and fasciae.

3.The dermis and connective tissue.

4. The blood vessels and lymphatics.

The nerves develop by invasion of the axons of the neurons situated in the ventral horn of the spinal cord and in the dorsal root ganglia. The spinal nerves are derived from the fourth cervical and second thoracic segments (2).

The dorsal portion of each limb bud flattens, giving dorsal and ventral surfaces with corresponding **cephalic/preaxial** border and **caudal/postaxial** border (2,3).With growth in length of the buds a primary constriction appears in the distal flattened portion followed by a secondary constriction in the proximal portion. The resulting divisions represent the arm, forearm and hand (2).

Ridges separated by grooves appear at the margin of the distal portion, and by the seventh week the ridges elongate into definitive fingers (2).

Differentiation within the limb rudiments lead to mesenchymal cells differentiating into chondroblasts which elaborate the cartilaginous models of the bones of the girdle and limb appendages (2).

Ossification-The upper limb bones ossify from both **primar**y and **secondary** Centres (1,2) .The primary centres are the first to appear, followed by the secondary centres. There is considerable variation in the times of appearance and fusion of these centres from one individual to the other (1,2,3,4) but there are accepted normal ranges. In general, however, the primary and secondary centres appear between a few weeks in utero to about 5years whereas fusion of these centres take place between 15years and 25 years.

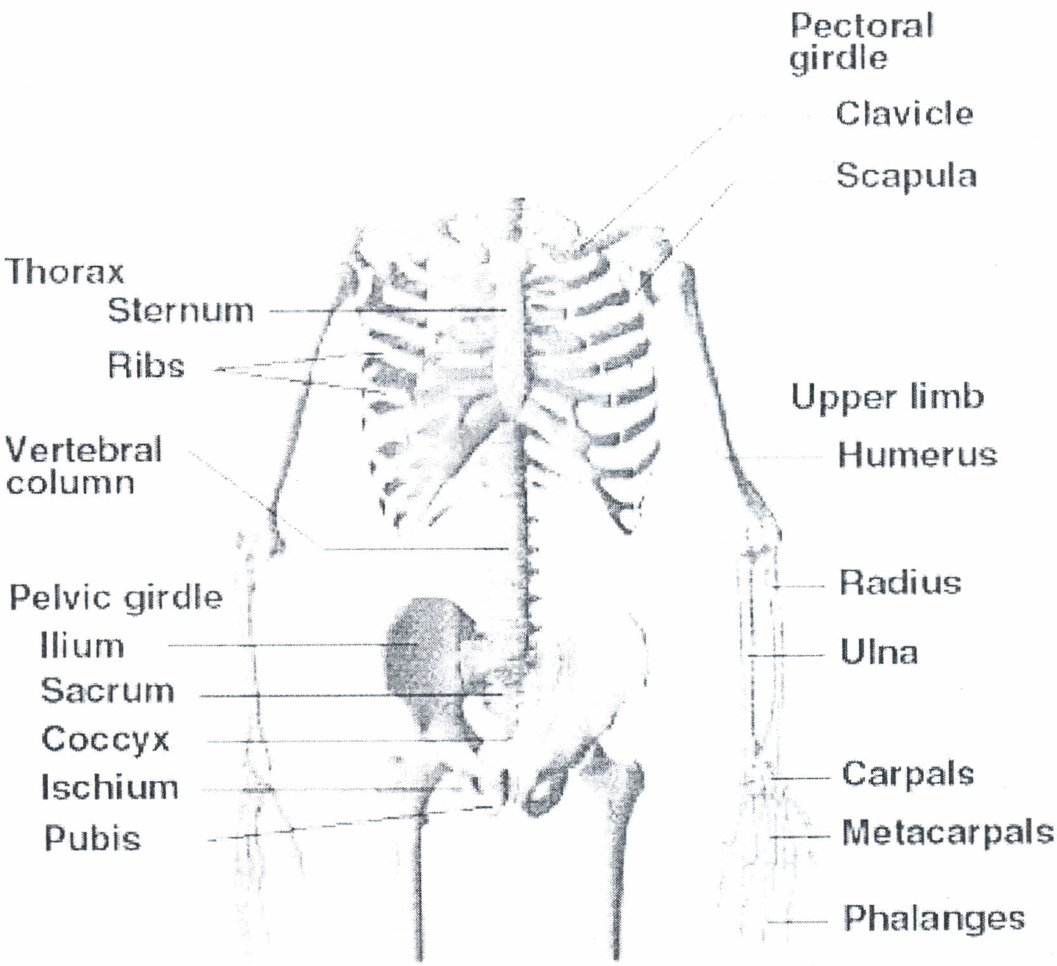
Limb rotation-The upper limbs undergo a rotation of 90 degrees laterally with the elbow at first pointing caudally and then posteriorly (2).

Postnatally-The limbs continue to grow till adolescence when there is accelerated growth culminating in attainment of adult size when the epiphysis close (2).

Anatomy of the upper limbs

The upper limb skeleton comprises the clavicle, scapula, humerus, ulna, radius, carpal bones (scaphoid, lunate, triquetrium and pisiform in the proximal raw; trapezium, trapezoid, capitate, and hamate in the distal raw), metarcarpals and phalanges (1,2,3,4).

THE UPPER LIMBS



Functions of the upper limbs

The upper limb is an essential component of the human locomotor system. It also is vital for apprehension, manipulation and execution of certain tasks. It can be used as an appendage for offence or defense. Evolutionary development over the years is undoubtedly contributory to the immense difference between human activity and ability as compared to other primates. For these reasons and probably many more a knowledge of the pattern of upper limb injuries becomes quite essential for improved early diagnosis and prompt management of these injuries (1,2).

EPIDEMIOLOGY AND THE COMMON UPPER LIMB INJURIES

Epidemiology

The incidence of upper limb injuries have been on the ascendancy over the years as shown by various studies (5,6,7,8,9,10,16,23). This is particularly so because of the increasingly mechanized enviroment in which we live. Other contributing factors include increasing alcohol and substance abuse, violent criminal activities, domestic violence and assault (12,18).

Common Upper Limb Injuries

These may be broadly classified as follows :-

1. Soft tissue injury

These are by far the most commonly encountered form of injury to the upper limbs. They may be the only clinical finding following trauma, but could also co-exist with fractures, subluxation or dislocation. Such soft tissue injuries may comprise bruises, lacerations, cut-wounds, or ecchymosis. Occasionally there may be injury to blood vessels, nerves, tendons or ligaments (5,6,21). Ligamentous and/ tendinous injuries are of special concern in sport-people (10,11).

2. Fractures

These are often a consequence of significant trauma, such as occurs in a fall from a height or road traffic accidents (21). One or more bones may be involved.

The resultant fracture may be classified as **linear**, **spiral** or **comminuted**, with / without **displacement** (4).

Simple/ Closed fractures may occur with / without breach of the overlying skin .

Compound / Open fractures on the other hand refer to fractures in direct communication with the exterior of the body (22). This distinction is crucial because compound fractures are prone to contamination by organisms introduced from without and may become septic whereas closed fractures are free from that risk (4).

Greenstick fractures are unique to children because their bones are springy and resilient. Such fractures are usually incomplete, involving only one side of the cortex while bending the opposite side (3,4).

Stress fractures tend to occur gradually as a result of repeated minor trauma to bone. The fracture may only show as a faint hairline crack (4).

Pathologic fractures occur in a bone already weakened by disease and the forces involved are typically trivial (3,4,22).

3. Dislocations5 / Subluxations

A joint is **dislocated** or **luxated** when its articular surfaces are wholly displaced one from the other, so that all apposition between them is lost (3,4).

Subluxation is said to exist when articular surfaces are partly displaced but retain some contact with the other (22).

Both should be managed by prompt reduction and immobilization of the joint for the specified period, after which joint exercise should be resumed to avoid contractures (4).

Systematic review of injuries of upper limbs

Principles of radiographic examination

The radiographic study of the bones and joints of the upper limbs invariably include antero-posterior and lateral views, and in certain anatomic areas oblique views and other special views are employed for optimum detail (3,4,14,17,19,25).

Exposure parameters and other technical factors must be meticulously adjusted to suit the patient and part being imaged.

The joint above and below the fracture should be included in the film.

However other imaging modalities such as computerized tomography and radionuclide scan among others may be indicated where plain radiography proves inconclusive (22,24,25).

<u>**Systemic review of injuries of upper limbs**</u>

1. Fractures of the clavicle (Figure 1 & 2)

Involve middle third in 80%, the outer third in 15% and the medial third in 5% of cases (3). Overriding of fragments and inferior displacement of the lateral fragment are common. Fractures of outer third are divided into : Type 1 no disruption of coracoclavicular ligament: Type 2 disrupted coracoclavicular ligament.

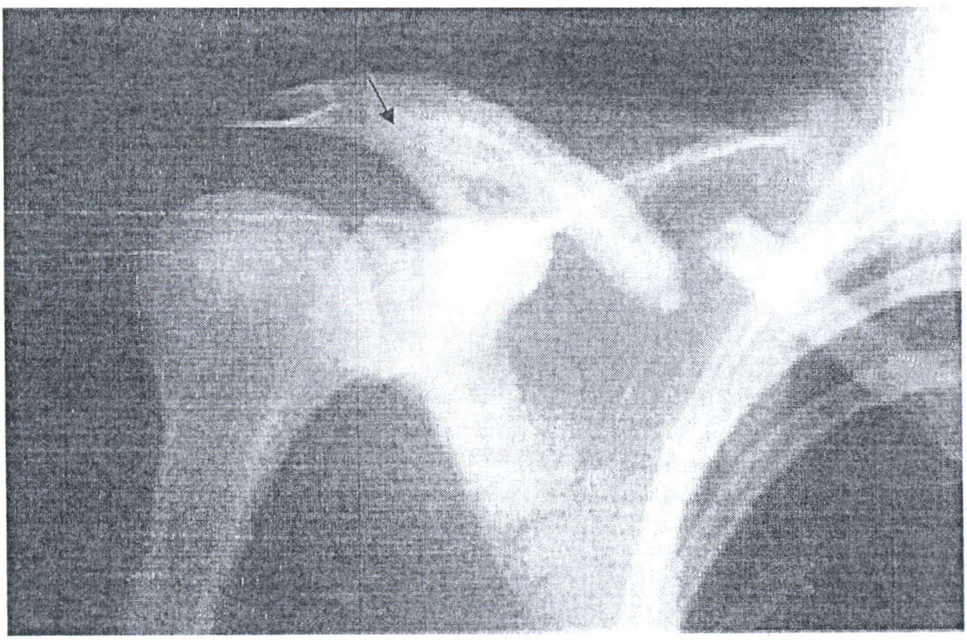


Figure 1 – AP radiograph showing midshaft fracture of clavicle.

2. Dislocations of the shoulder joint

Dislocation of the shoulder may be grouped into two main types- anterior and posterior.

Anterior dislocation is the more common. The cause is nearly always a fall on the outstretched hand or direct trauma to the shoulder itself. In most cases the humeral head is displaced through a rent in the capsule and comes to lie in the infraclavicular fossa just below the coracoid process (fig.2).

Posterior dislocation may be due to direct blow to the front of the shoulder, an electric shock or an epileptiform convulsion. The humeral head is driven backwards and medially rotated.

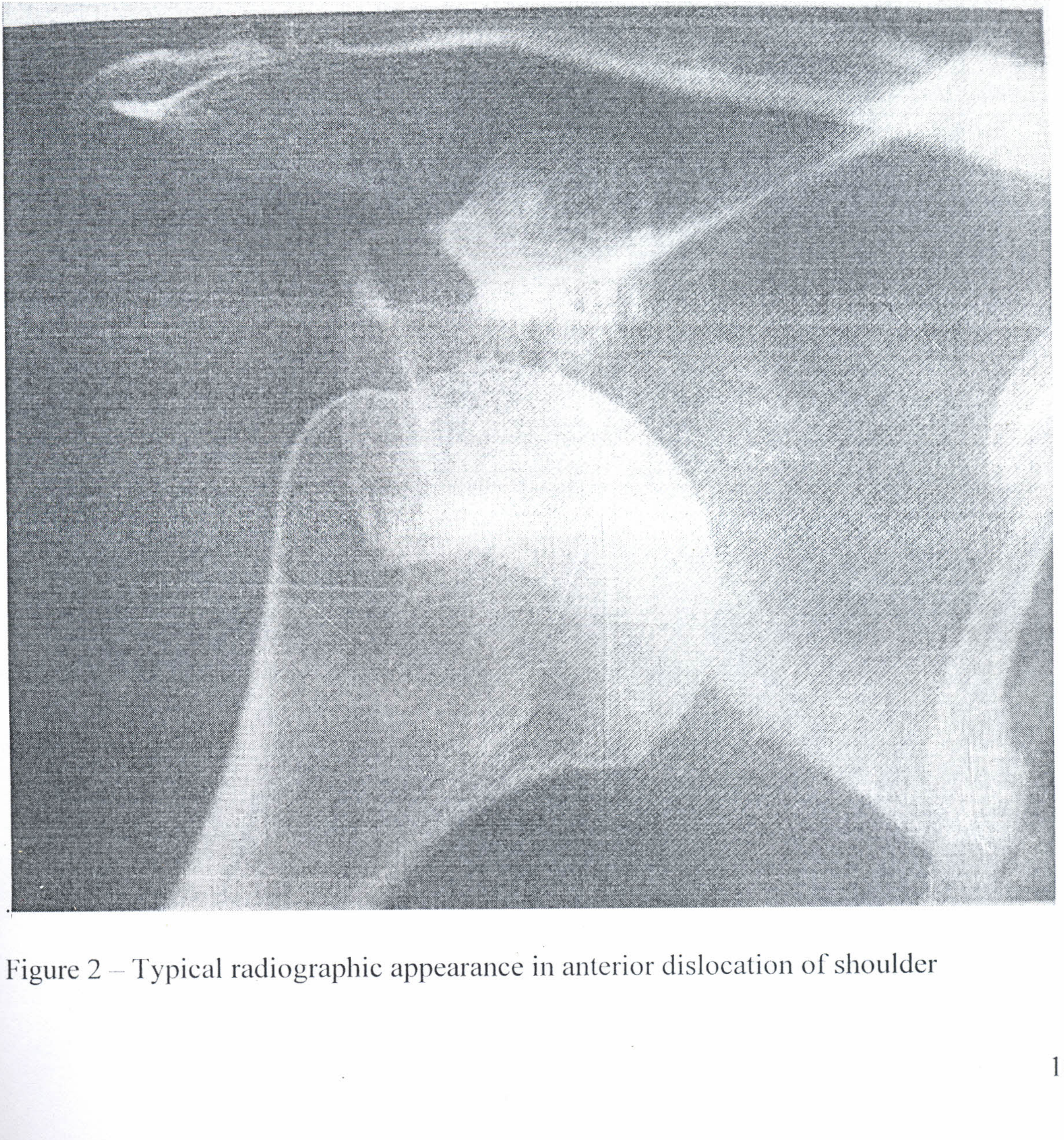


Figure 2 – Typical radiographic appearance in anterior dislocation of shoulder

3. Acromioclavicular separation (fig.3)

This usually result from a fall on the outstretched arm or point of shoulder. It is classified as

- Sprain(Grade 1)
- Subluxation(Grade 2)
- Dislocation(Grade 3)

Examination of this is done in the erect position with weights being carried in both hands to accentuate the deformity.Both sides are included in the film.

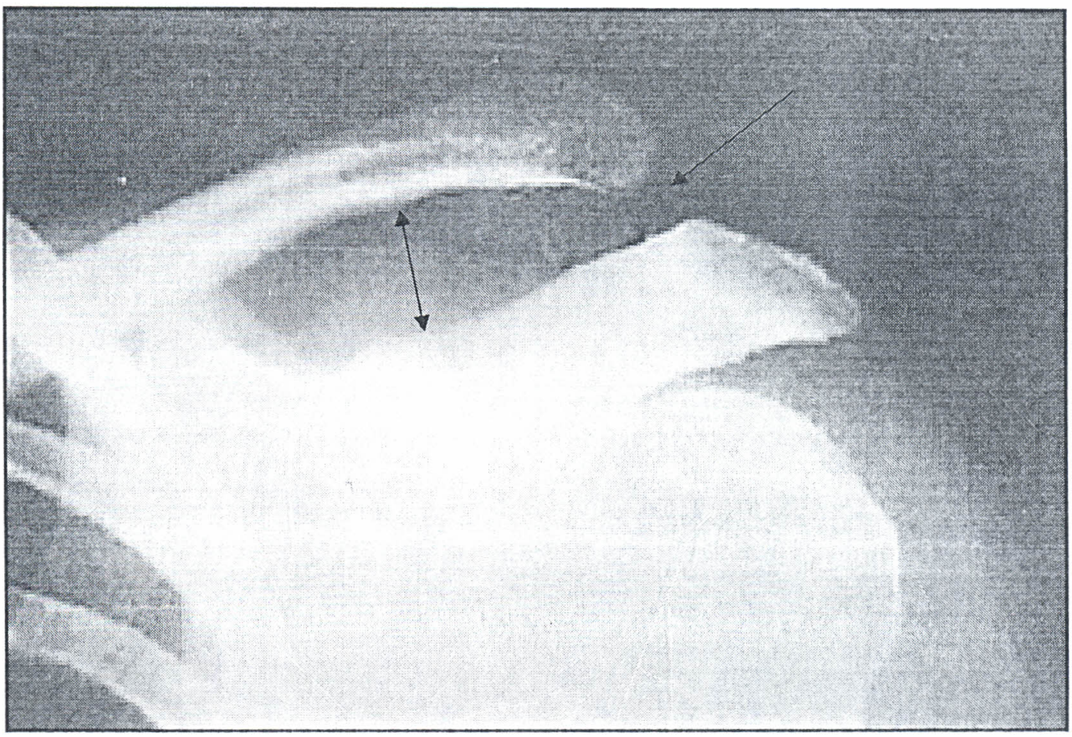
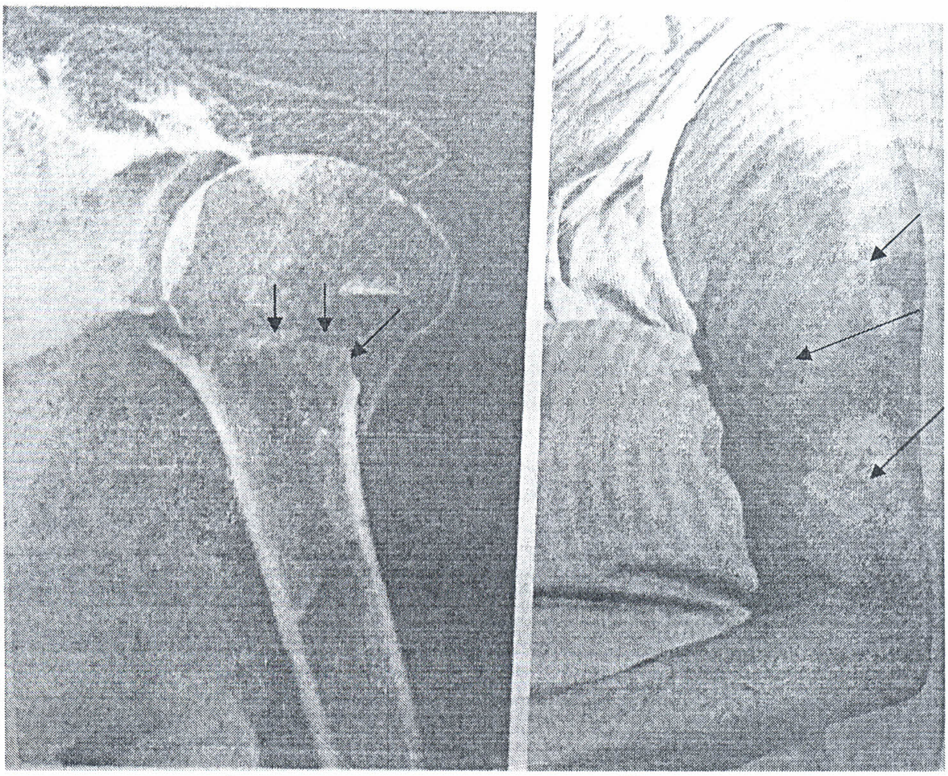


Figure 3 – Dislocation of acromioclavicular joint: widened acromioclavicular joint (arrow) &normal acromioclavicular distance (double-headed arrow).

4.Fractures of proximal humerus (fig. 4-7)

Most of these result from falls on the outstretched arm, particularly in elderly women secondary to osteopenia. Fractures of the surgical neck or greater tuberosity are the common injuries (13,14). Spiral and oblique fractures are common, usually with angulation or displacement of the distal fragment (3,4). Radial nerve injury is an important accompaniment of this type of injury.



A B

Figure 4 – (A) fracture neck of humerus with moderate displacement.

- (B) photograph shows extensive bruising that is typical of these fractures.

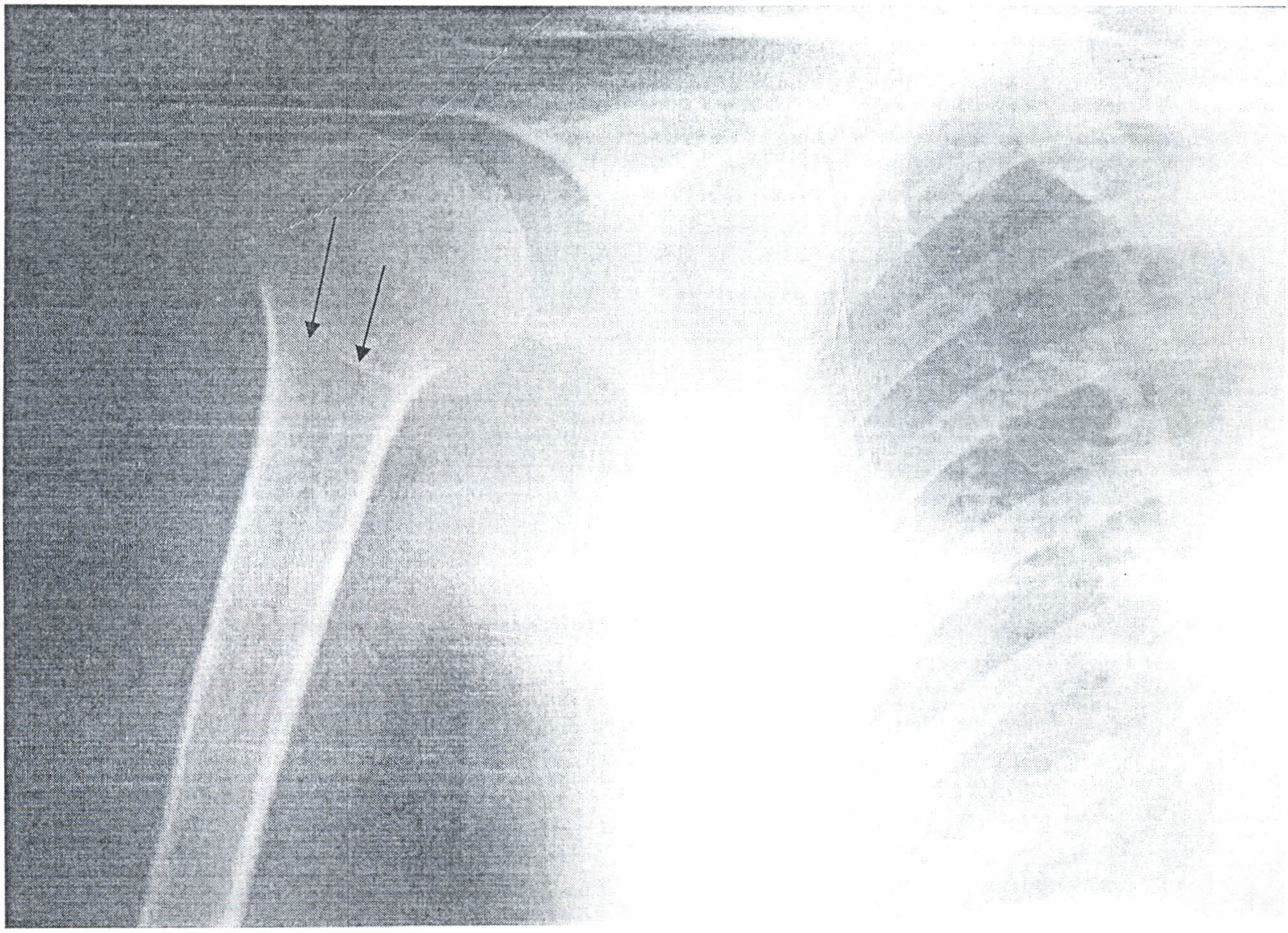


Figure 5 – fracture neck of humerus.

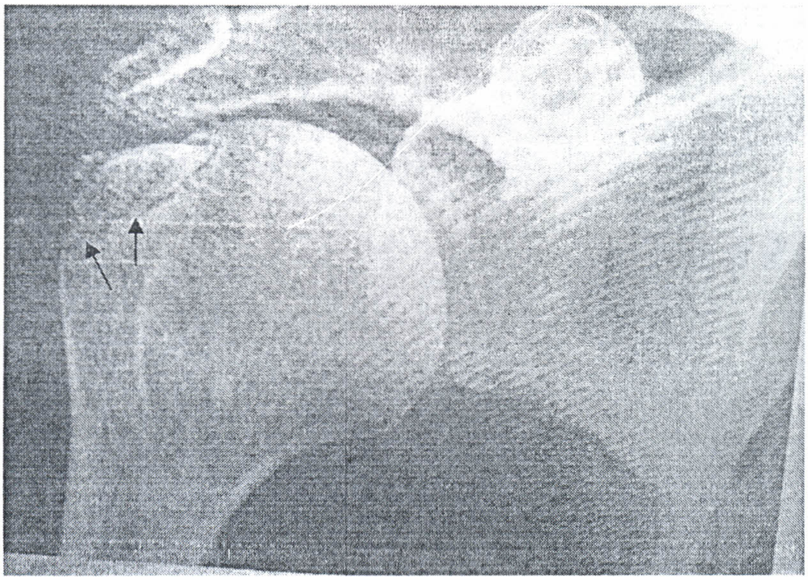


Figure 6 – fracture of greater tubercle.

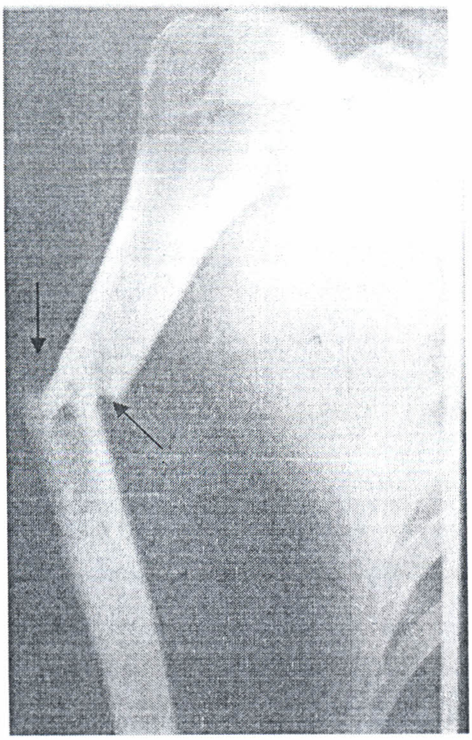


Figure 7 – transverse fracture shaft of humerus.

5.Fractures of the distal end of humerus

These often involve the epiphysis, with avulsed fragment displaced into the fossa between the coronoid process and the trochlear (19). Open reduction is usually required (4).

Supracondylar fractures of the humerus usually result from a fall on the outstretched hand and are the commonest elbow injuries in children (3,5). Haemarthrosis with elevation of the anterior and / posterior fat pads as well as volar displacement of the capitellum are helpful signs (figure 8,&9). Volkmann's ischaemic contracture is a common complication of these injuries because of vasospasm of brachial artery (3,4).

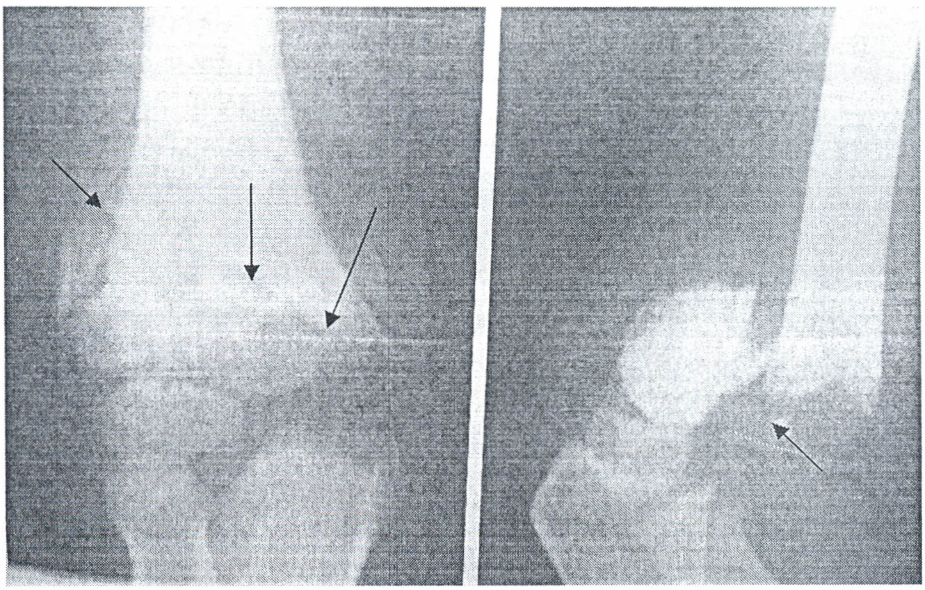


Figure 8 – supracondylar fracture of humerus.

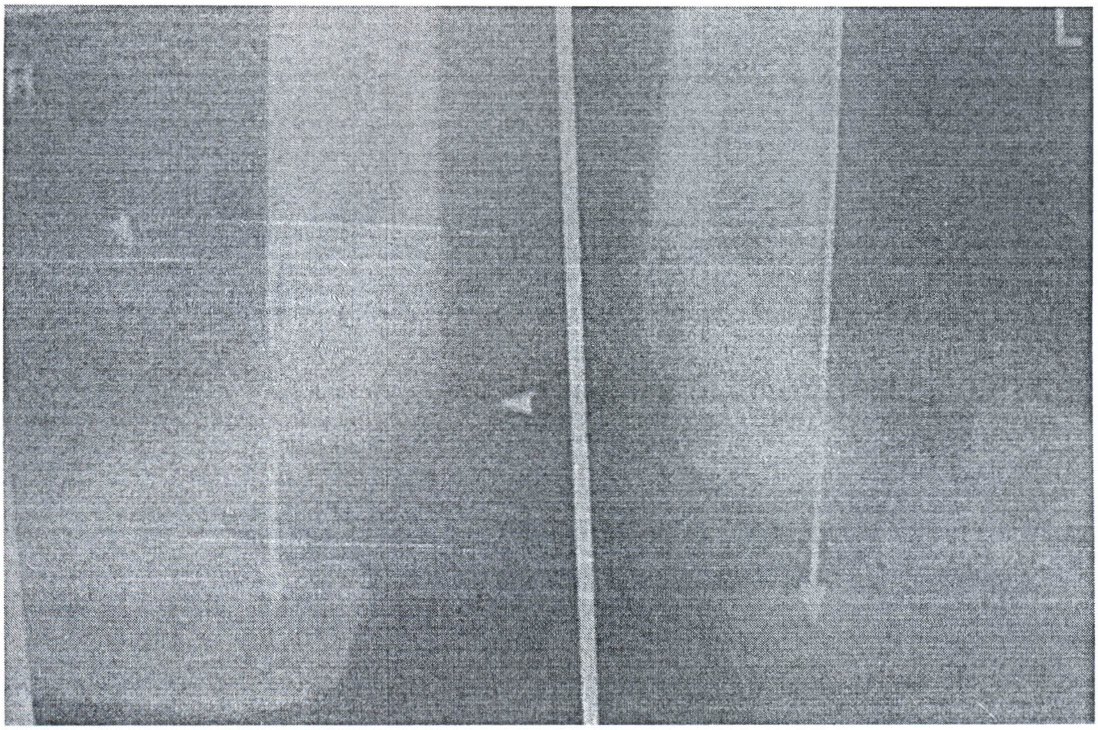


Figure 9 – Supracondylar fracture of humerus: left humerus is normal, the line extending from anterior cortex of the shaft passes through the middle third of capitellum. On the right, the line cuts the posterior third of capitellum indicating anterior displacement of the fragment. A haemarthrosis displaces both fat pads (arrowheads) on the right.

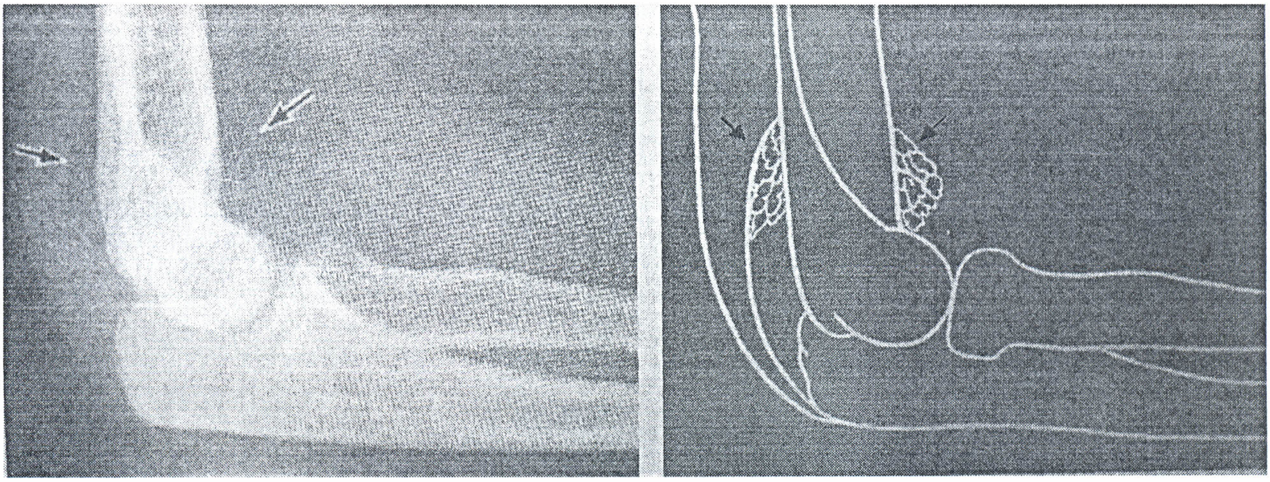


Figure 10 Traumatic bursitis: arrows indicate anterior and posterior radioluscencies representing anterior and posterior fat pads. The concavity inferiorly in the posterior fat pad is due to impression of the distended synovial sac.

Dislocation of elbow joint

The posterior dislocation is the most frequent(figure 11). This may be accompanied by a tear of brachialis muscle, muscles of flexion, injury of brachial vessels and radial, ulna and median nerves.

Associated fractures include :

i) the coronoid process of ulna

ii) the radius

iii) the condyles of the humerus

iv) the epicondyles of the humerus

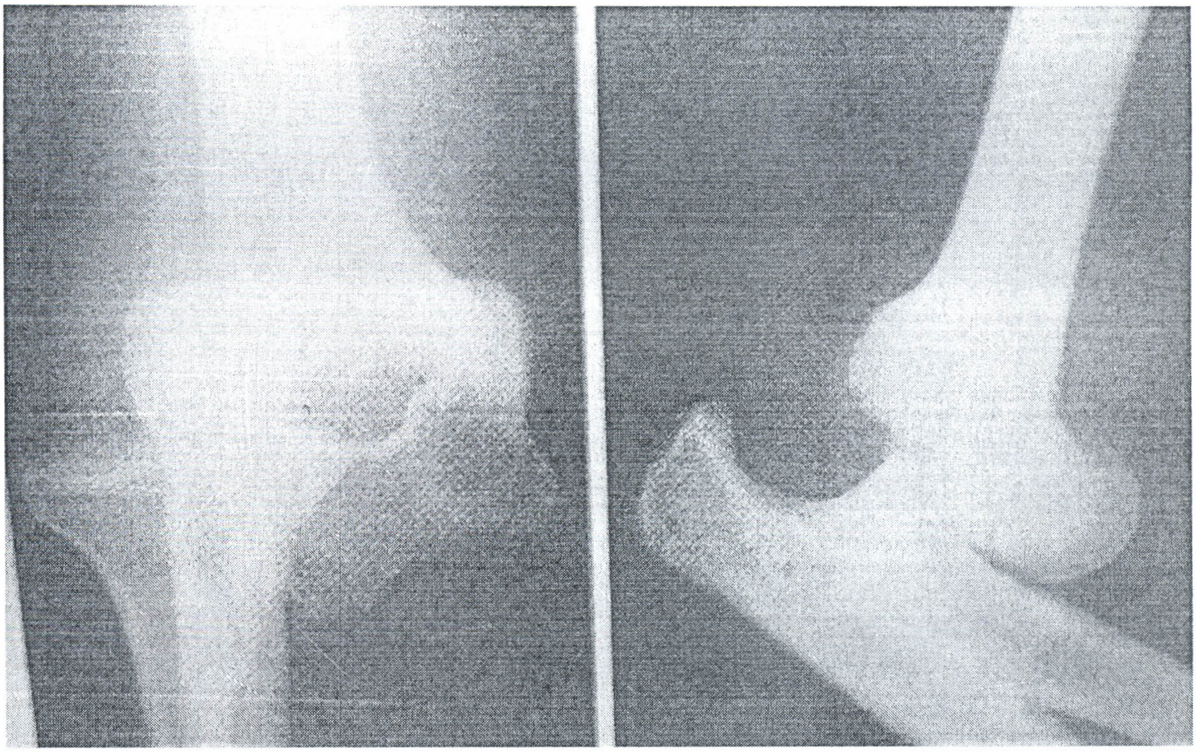


Figure 11 – posterolateral dislocation of the elbow.

6.Fracture of the olecranon process of ulna (fig.12)

The olecranon is fractured by a fall on the point of the elbow. The fracture may take three forms :

i) a crack without displacement

ii) a clean break with separation of the fragments

iii) a comminuted fracture

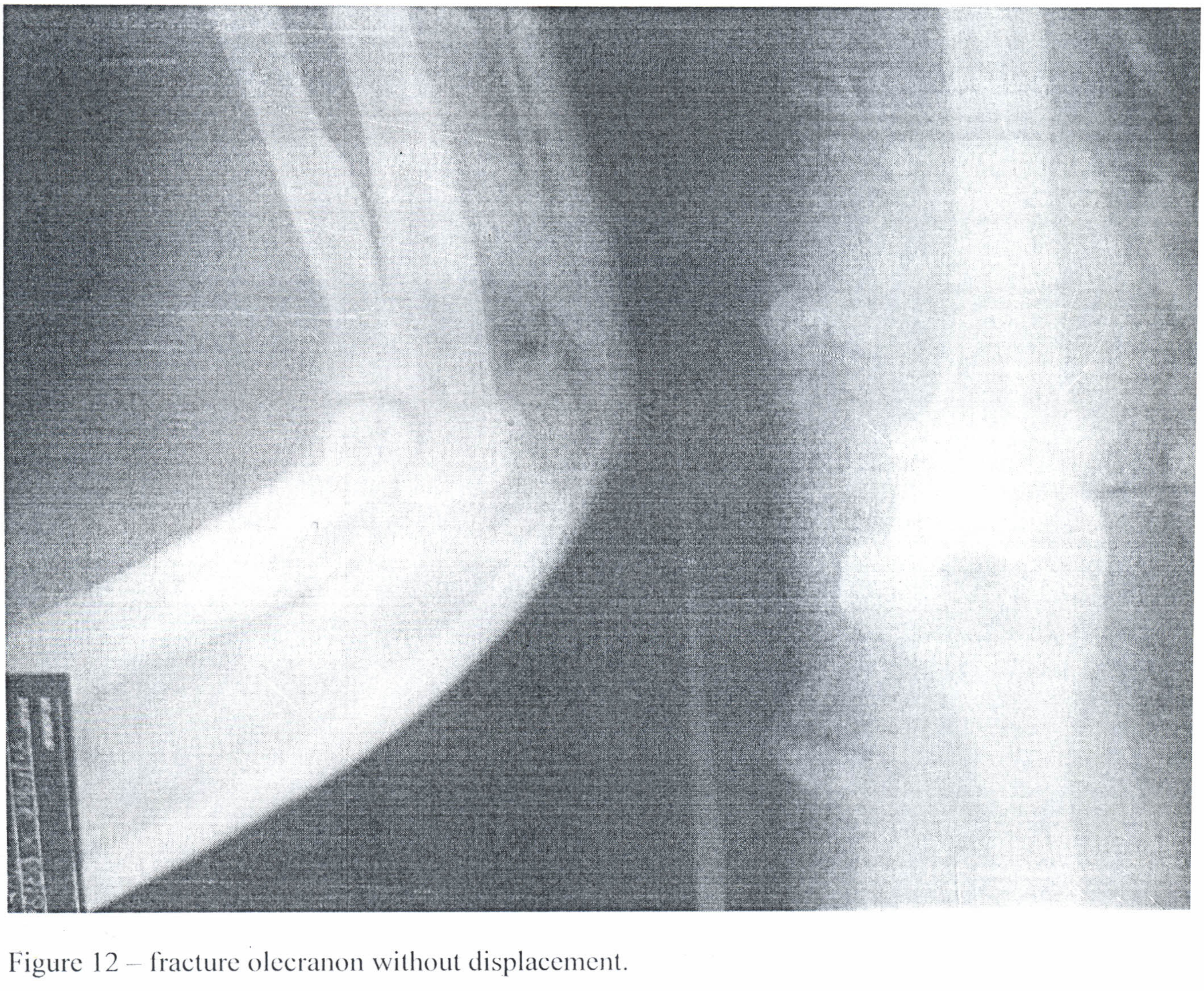


Figure 12 – fracture olecranon without displacement.

Galeazzi fracture

This results from a fall on the outstretched hand with the forearm in pronation, or a direct blow to the dorsolateral aspect of the wrist, it consist of a fracture of the distal third of the radius with associated dislocation of the distal radioulnar joint. The distal fragment is dorsally displaced and angulated, the ulna is both dorsally and medially dislocated (figure 13).

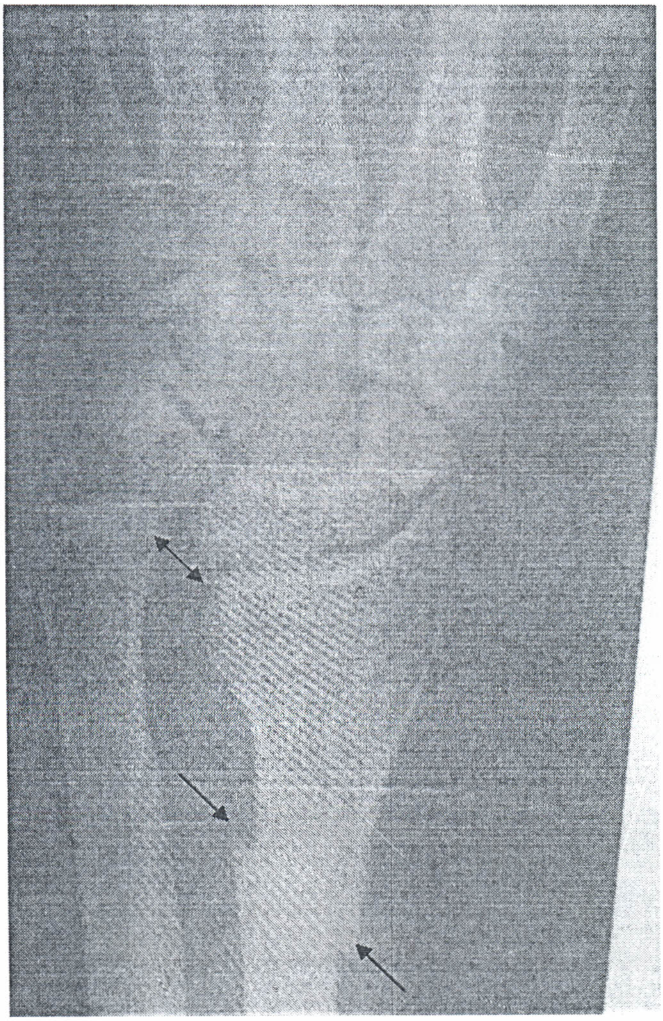


Figure 13 Galeazzi fracture: dislocation of the distal ulna (double-headed arrow) accompanies the radial fracture (arrows).

7. **Monteggia fracture**

This is due a forced pronation of the forearm during a fall or direct blow to the dorsal aspect of the proximal third of the forearm. It consists of an anteriorly angulated proximal ulnar fracture associated with anterior dislocation of the radial head (fig14).

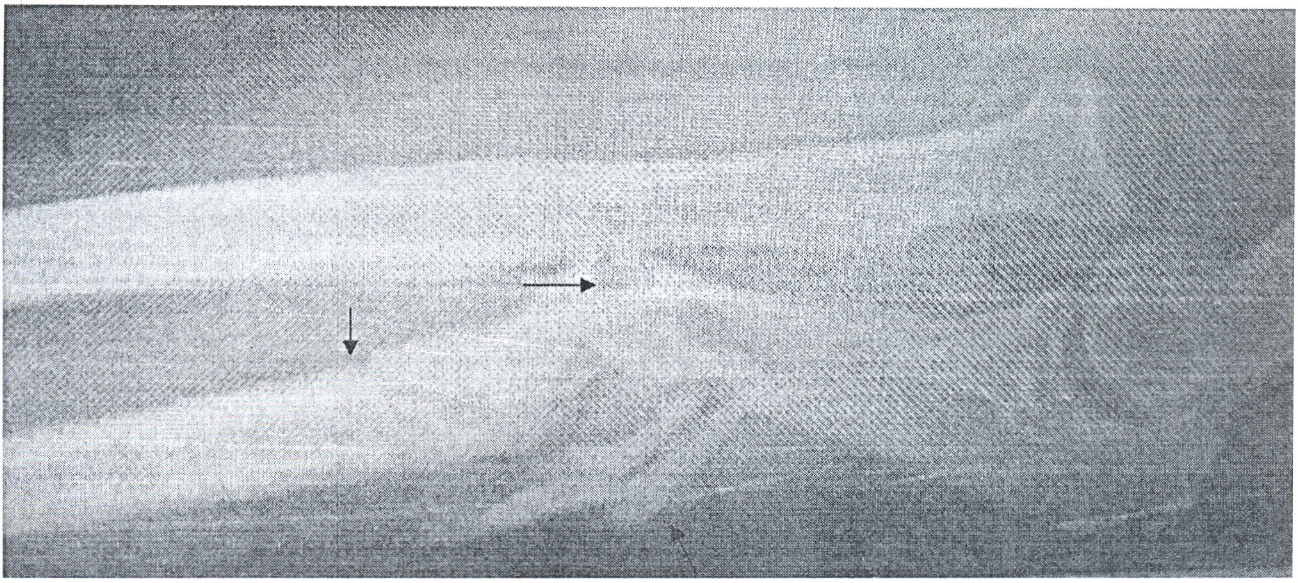
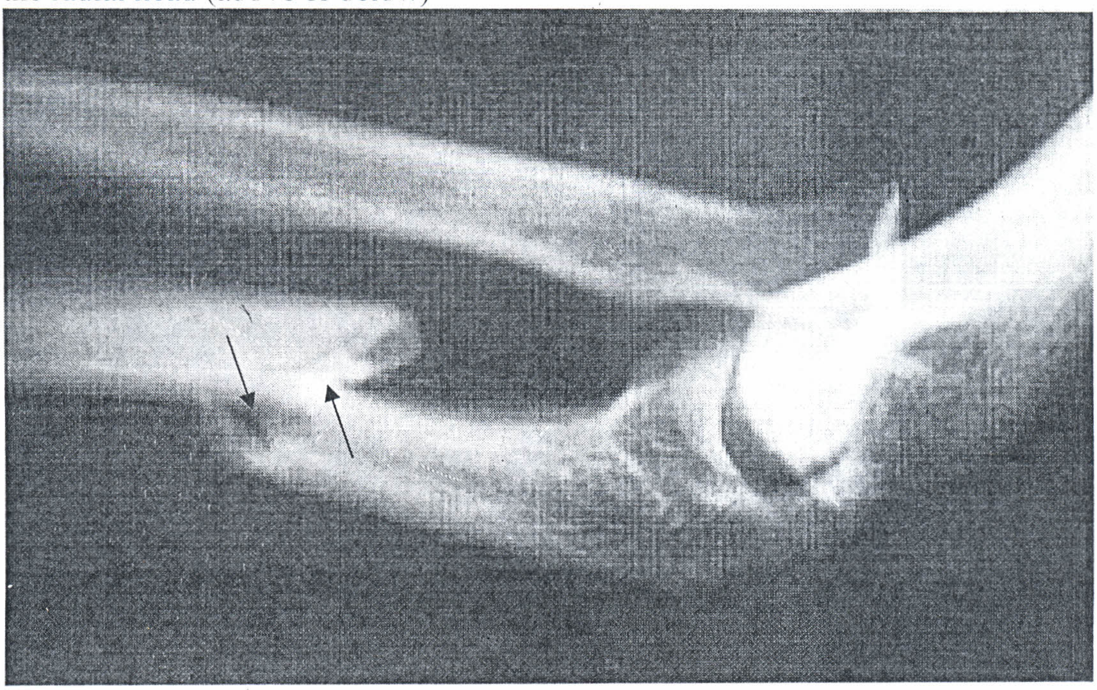


Figure 15 – Monteggia fracture: comminuted fracture of the ulna with dislocation of the radial head (above & below)



7.Fractures of distal radius

These are extremely common and have been catalogued by eponyms as follows :

i) Colles' fracture (fig. 16) – is due to a fall on the outstretched hand. The radial fracture occurs in the distal shaft, usually about 2cm from the articular surface. The distal fragment displaces dorsally and proximally, giving a 'dinner-fork' deformity.

ii) Reversed Colles' fracture / Smith fracture (fig.17) – is usually due to a fall on the back of the hand or a direct blow to the dorsum of the hand. The distal fragment is displaced ventrally with radial deviation of the hand giving a 'garden-spade' deformity.

iii) Galeazzi fracture (fig.13).

iv) Barton's fracture- is an oblique fracture of the posterior lip of the distal end of the radius , which is usually directed upward and backward (fig. 18).

v) Chaffeur's fracture- is a fracture of radial styloid process involving the distal articular surface. The fragment is usually directed upward and outward, and the carpus is generally shifted to the radial side along with the radial fragment (fig.19).

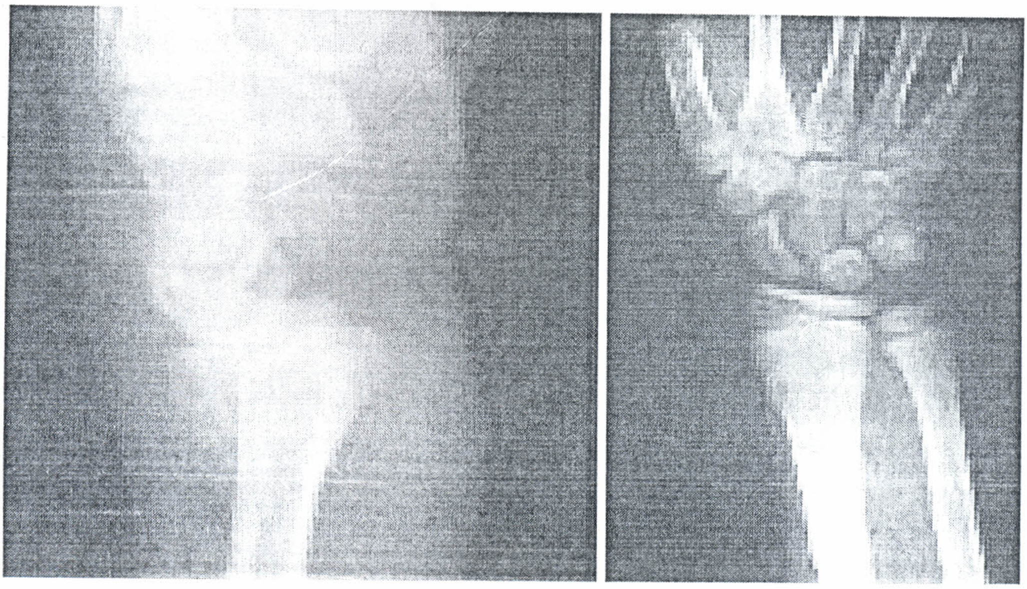
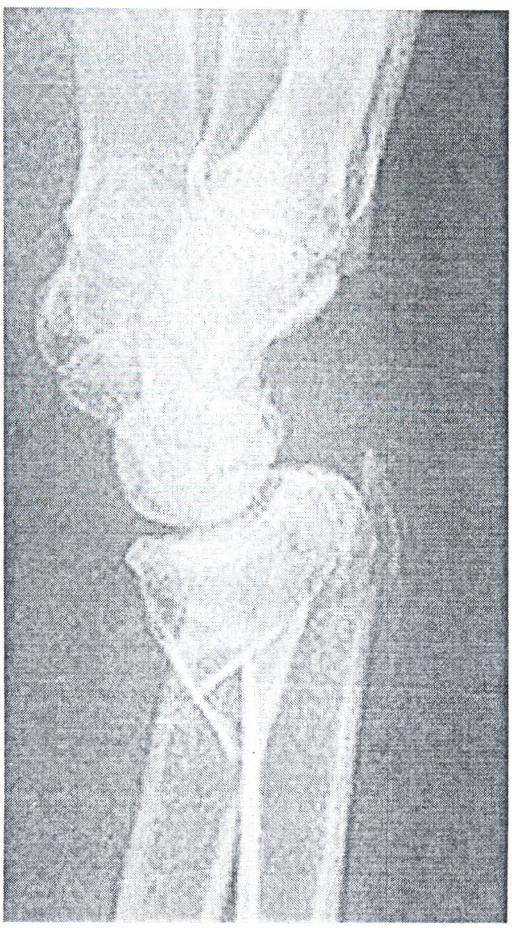


Figure 16- Colles' fracture, lateral (left) & AP (right) views

Figure 17 (below) Smith's fracture, lateral view



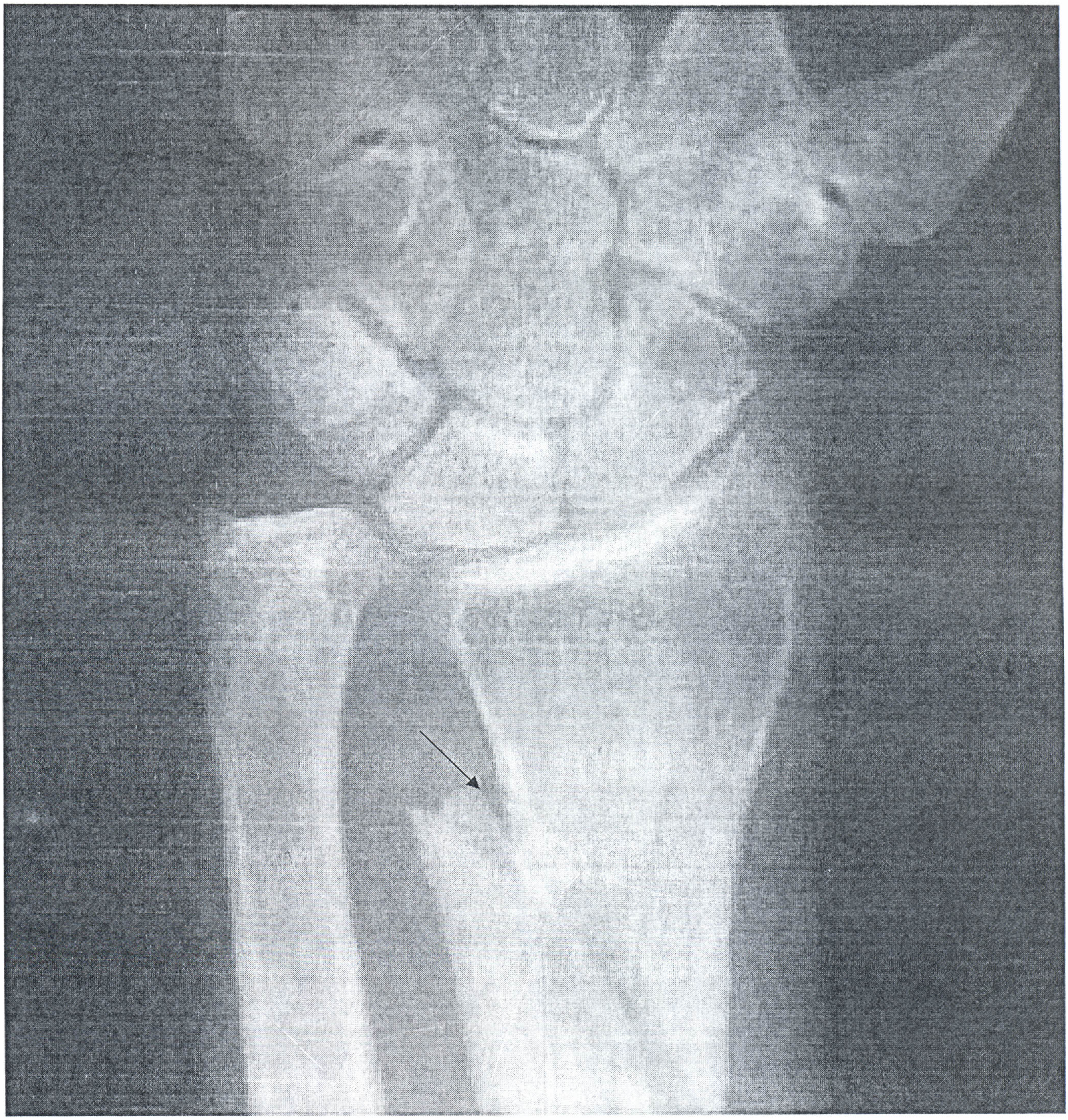


Figure 18 – Barton's fracture

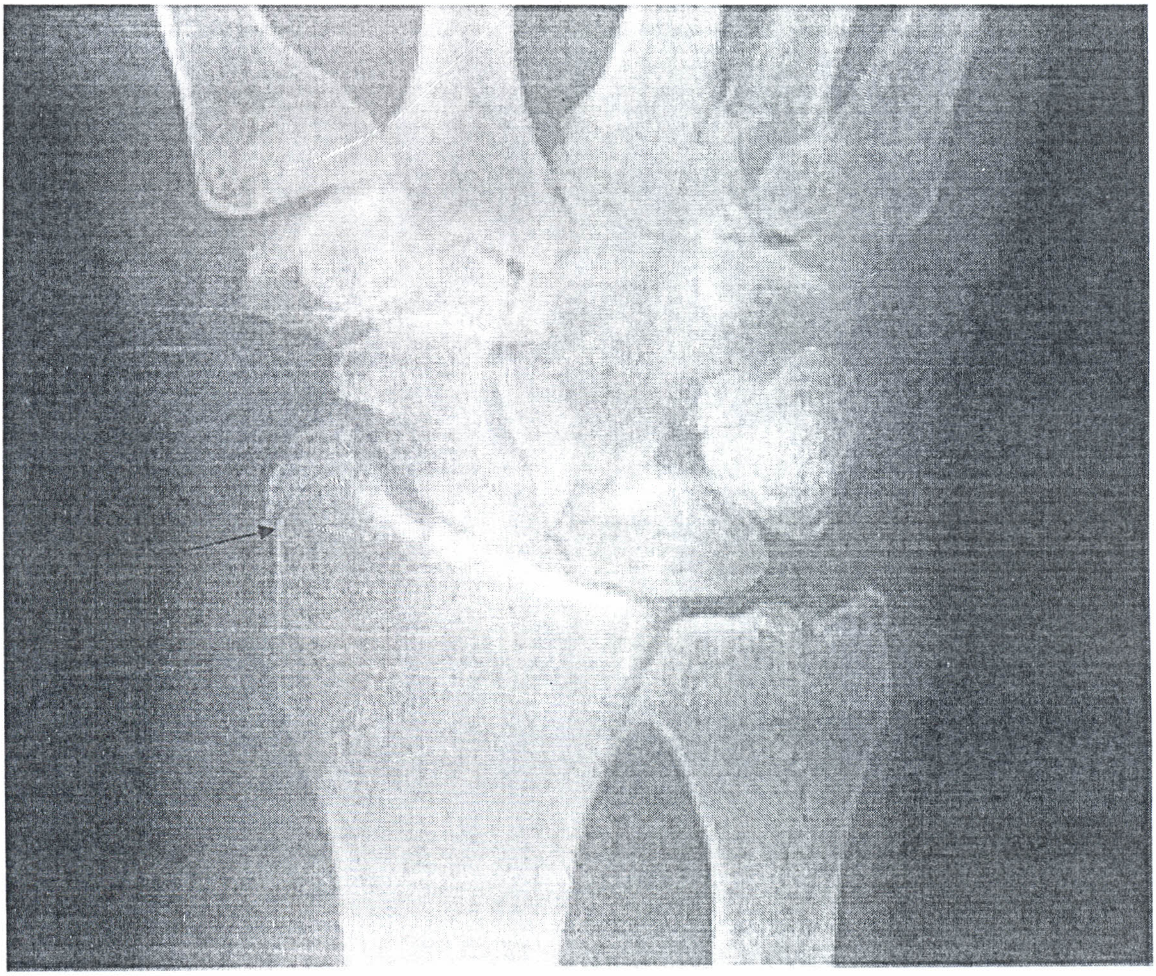


Figure 19 Chauffer's fracture.

8. Fractures and dislocations of the Carpal Bones

The scaphoid bone is the most common carpal bone to be fractured (3,20). Non-union and osteonecrosis of the proximal fragment are important complications (3,4,20) as the vascular supply enters in the middle of the bone (fig. 20).

Dorsal avulsion fractures of the triquetrium are the second most common (3,20).

Fractures of the other carpal bones are rare except for the hamate, the hook of which may be detached acutely by blows on the proximal palm of the hand or by chronic trauma such as from holding a tennis racquet or golf club (3,10,11).

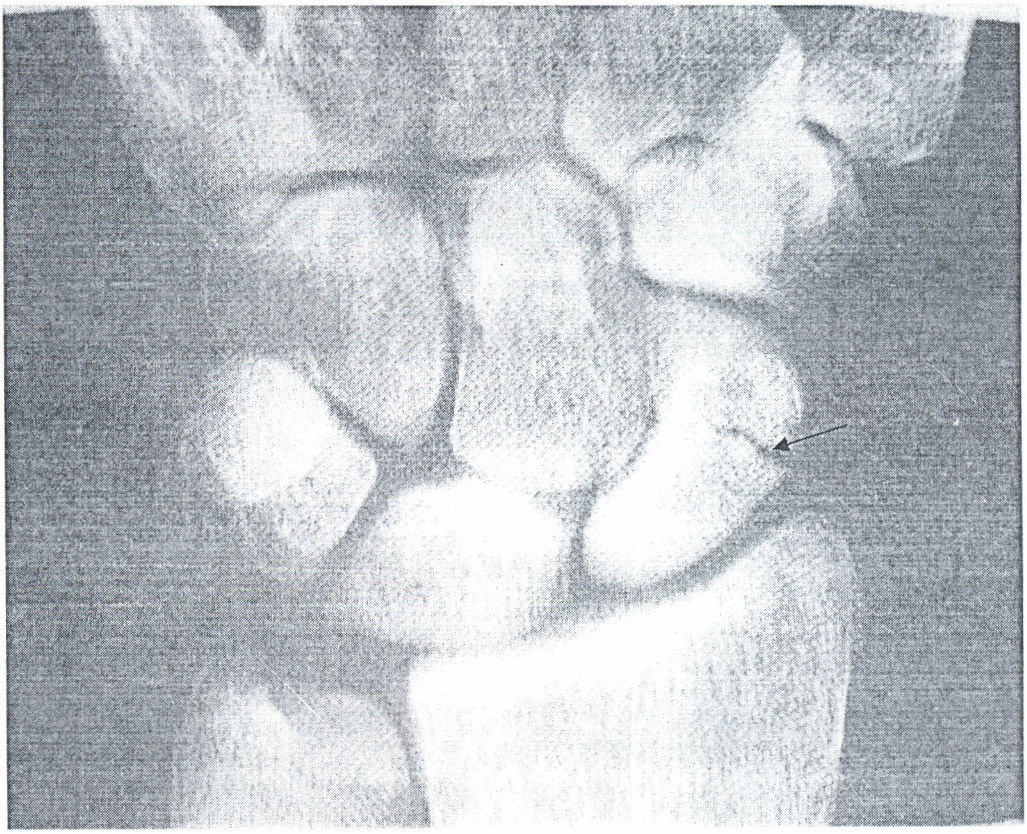


Figure 20 fracture through waist of scaphoid.

Dislocations of the carpus are best appreciated by understanding two important concepts (3,4,20):

a)On the PA view, the proximal and distal carpal lines define the carpal relationship. These lines should be roughly parallel, and the intercarpal joint spaces should be approximately equal (fig.21).

b)On the lateral view of the normal wrist in its neutral position, a straight line can be drawn through the long axis of the radius, lunate and capitate (fig.22).

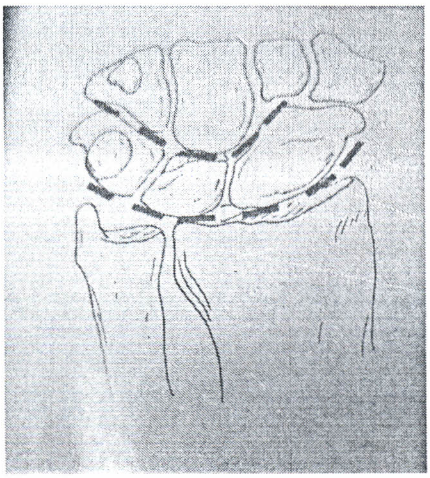


Figure 21 The normal carpal bone alignment.

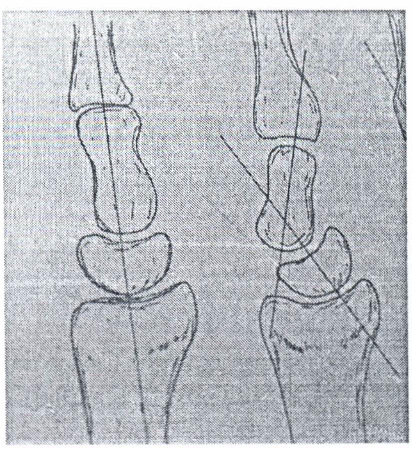


Figure 22 left shows normal wrist,

Right shows palmar flexion instability. The lunate is rotated towards the palmar surface of the wrist, with the capitate rotated towards the dorsal surface.

In **lunate dislocation** , the normal anatomy of the proximal carpal raw is lost, and the lunate overlaps the capitate, hamate and triquetrium on the PA view, and assumes a triangular shape (fig.23). On the lateral view, the lunate is seen overlying the volar aspect of the wrist (fig.24).

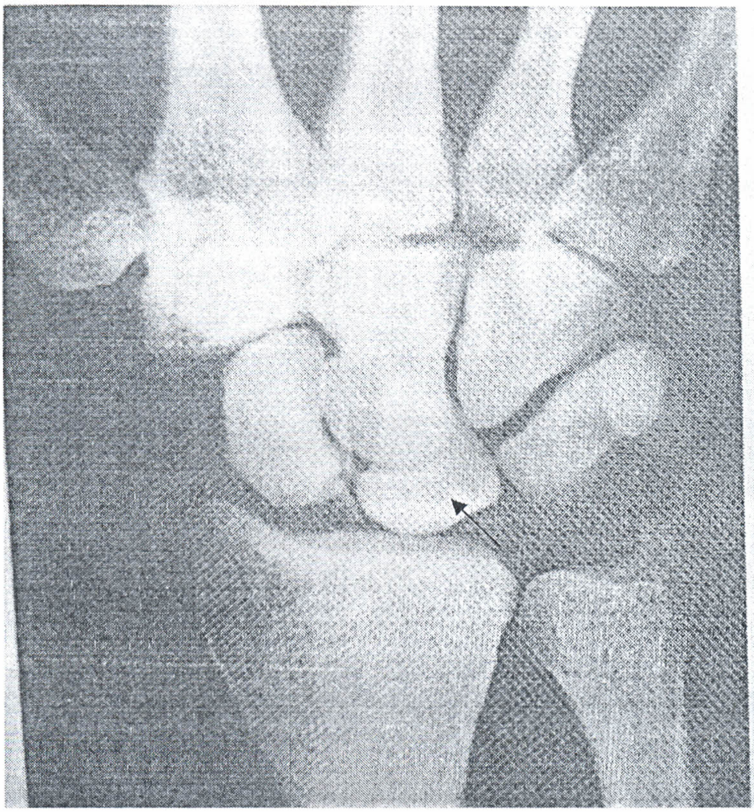


Figure 23 – Lunate dislocation.

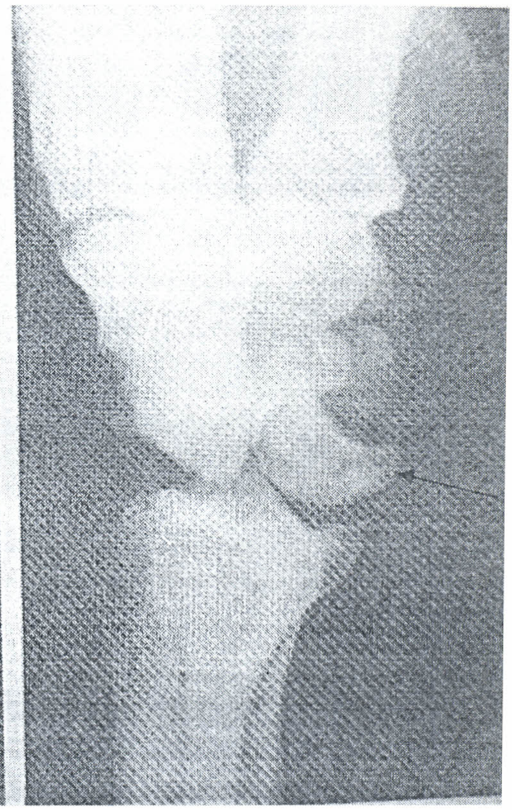


Figure 24- Lunate dislocation

Scapholunate dissociation is identified by widening of the scapholunate joint space. (**Terry-Thomas sign**) (fig25.).This may be seen in rotational dislocation of the scaphoid (3,4).

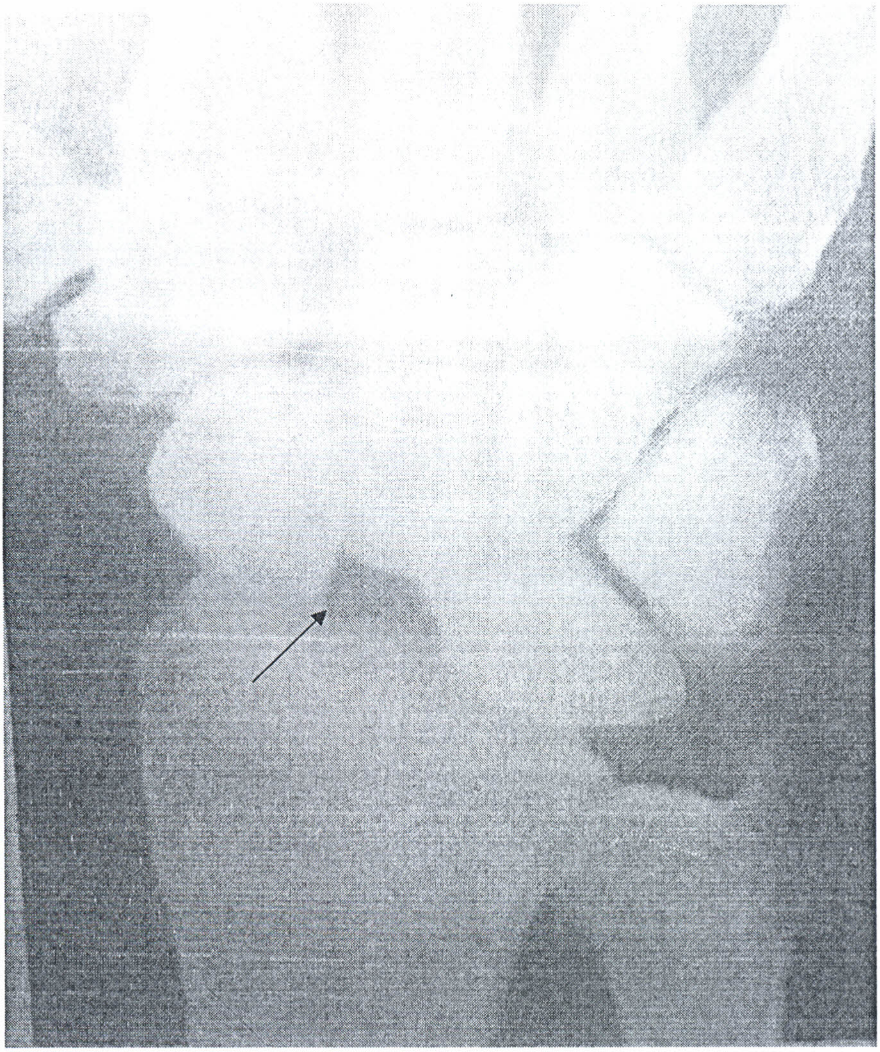


Figure 25 – Scapholunate dislocation.

9. Fractures and Dislocations of the Hand

Fracture- dislocation of carpometacarpal joint of the thumb (**Bennett's Fracture**) is characterized by fracture through the base of the first metacarpal and dislocation of the radial portion of its articular surface (4) (fig 26). The **boxer's fracture** of the fifth metacarpal is a common injury involving the distal aspect of the metacarpal, with volar angulation of the distal fragment (4) (fig. 27).

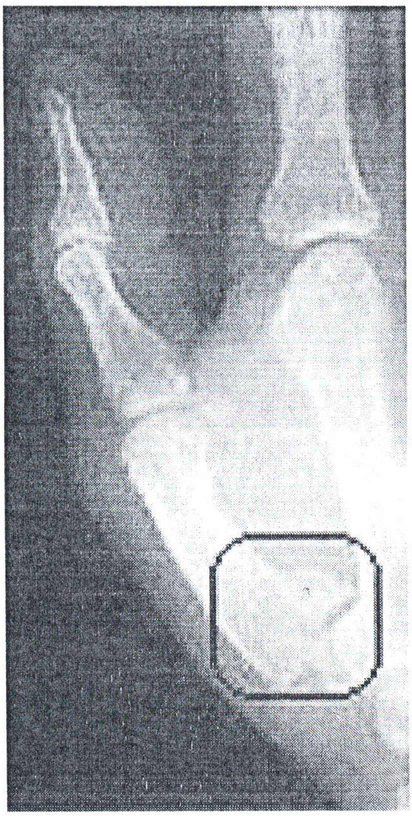


Figure 26 – Bennet's fracture

Figure 27 – Boxer's fracture

10. Fractures of Metacarpals (fig. 28)

These are common lesions of the hand and are second in frequency only to fractures of the phalanges (4). If not adequately corrected, severe deformities and disability of the hand may result.

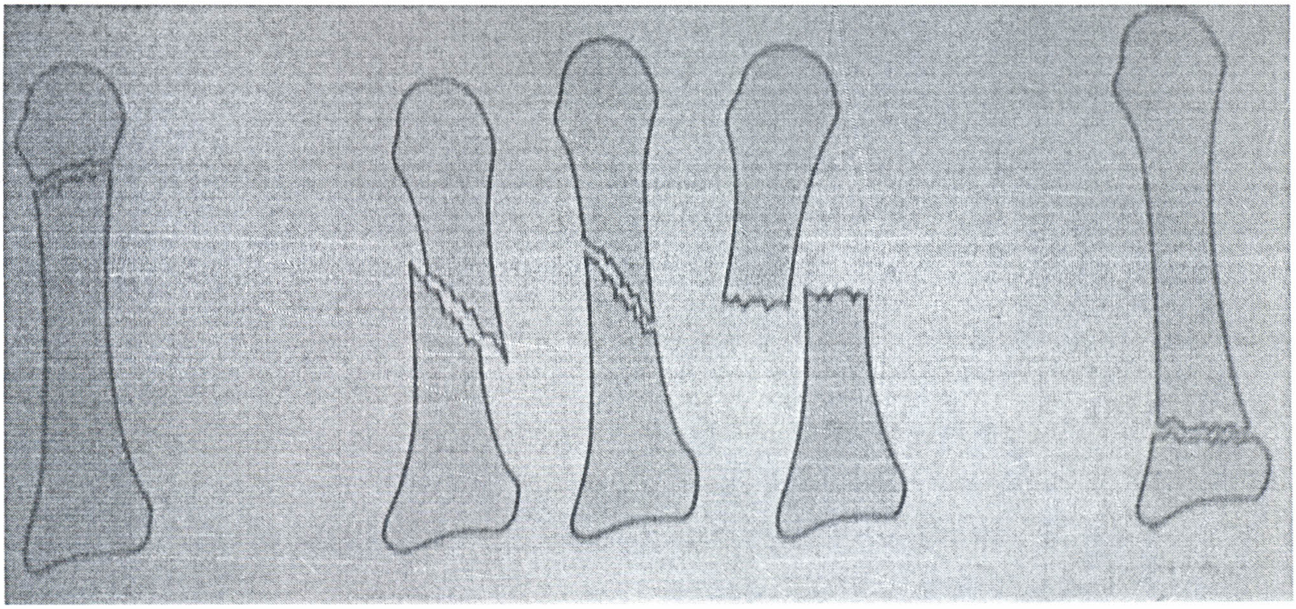


Figure 28 – fractures of metacarpals at neck, shaft and base.

11. Fractures of Phalanges (fig. 29)

Usually fractures of the proximal phalanx are associated with a volar angulation of fragments (3,4).

In the case of the middle phalanx, if the fracture site is proximal to the insertion of the tendon, a dorsal angulation of fragments results (3,4). If fracture site is distal to the insertion of the flexor sublimes tendon, a volar angulation of fragments results (3,4).

In the case of the distal phalanx, a comminuted fracture is the usual occurrence and very little displacement of fragments occurs (4).

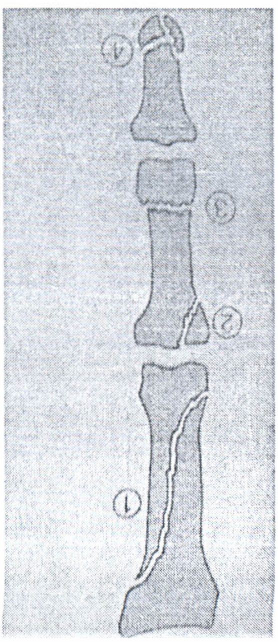


Figure 29 – 1,2,3 & 4 are fractures of phalanges namely : long spiral, shaft oblique, base transverse & comminuted distal phalanx respectively.

12. Dislocation of the metacarpo-phalangeal and interphalangeal joints

Most are caused by forced hyperextension. The distal segment is usually displaced backwards from the proximal (4) (fig.30).

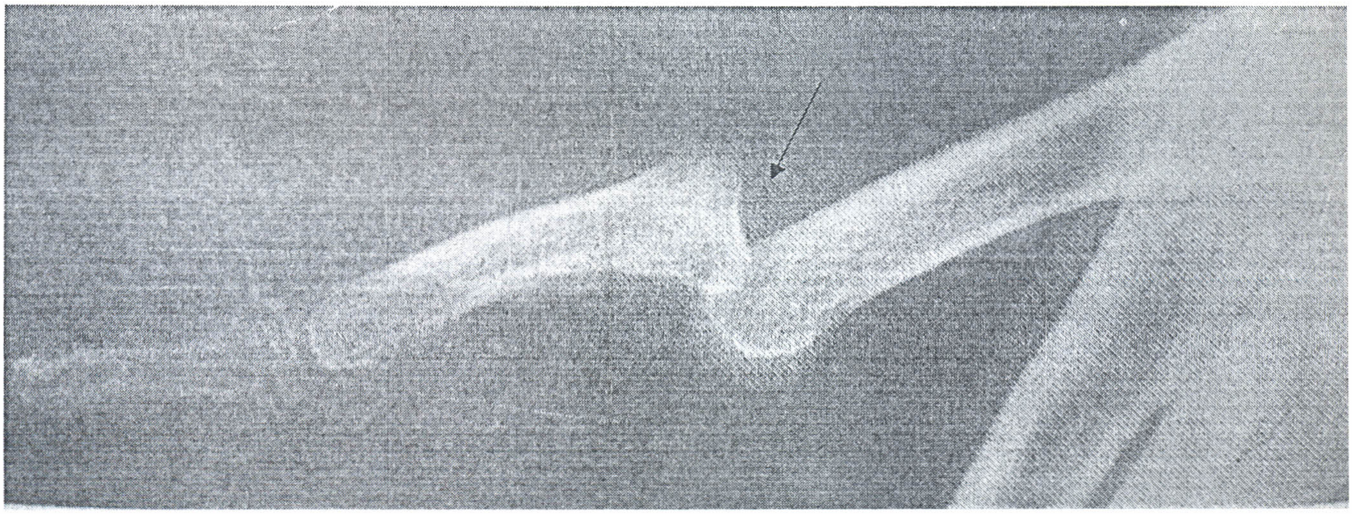


Figure 30 - Dislocation of the metacarpophalangeal and interphalangeal joints.

HEALING AND COMPLICATIONS OF FRACTURES

Healing Of Fractures

This begins immediately provided the prevailing conditions are favourable e.g following right clinical management such as reduction / mobilization.

This proceeds through five stages:

i) **Haematoma formation**

This is occasioned by seepage of blood from torn blood vessels and takes place within hours after injury. Over several days this is resorbed and leaves no sequelae.

ii) **Cellular proliferation**

This occurs both in the endosteal and periosteal surfaces. Such cells are the precursors of osteoblasts which later lay down the intercellular substance.

iii) **Callous formation**

The cellular proliferation gives rise to osteoblasts and chondroblasts which lay down intercellular matrix and cartilage which is later impregnated with calcium salts to form the immature bone of fracture callous. Macroscopic evidence of bone healing (i.e. callous formation) is seen on average 13 days post injury.

iv) **Consolidation**

Here woven bone (callous) is transformed into lamellar bone and this occurs 1-2 months after injury.

v) **Remodelling**

Bone is strengthened along lines of stress and removed at points of less stress (months- years). Cancellous bone fractures, however, heal without necessarily forming callous.

Complications Of Fractures

Injuries of upper limbs may be followed by varying degrees of morbidity and functional loss.

In the period just after injury there may be sepsis of bruised or lacerated surfaces. This may in time evolve into chronic soft tissue wound or spread deep to involve bone with subsequent osteomyelitis.

Improper or inadequate fracture reduction may result in limb angulation or limb-shortening. The latter may well be the recipe for premature degenerative joint disease.

Occassionally fractures may fail to unite in good time or there may be complete nonunion secondary to interposition of soft tissues or wide separation of fracture fragments.

Dislocation/ subluxation if not sufficiently reduced may result in limitation of joint movement.

Soft tissue injuries often have better prognosis except where nerves are involved. These may be the cause of longstanding post-traumatic pain, paraesthesias, weakness or even paralysis.

Aim

The aim of this study is to identify the various causes of upper limb injuries and the incidences of the different types of injuries as seen at the Casualty Department of Kenyatta National Hospital over a period of six months between June 2006 and December 2006.

This research was conducted based on plain x-ray findings.

Despite recent advances in imaging modalities especially with the advent of Computerised Tomography and Magnetic Resonance imaging, Plain Radiography still remains the most commonly used and most readily available choice for imaging upper limb trauma. It is comparatively cheaper, and interpretation may not always require a qualified radiologist. Thus diagnosis and management of upper limb injuries may be expedited faster with this imaging modality.

Objectives

i) BROAD OBJECTIVES : - To describe the pattern of upper limb injuries as seen at Kenyatta National Hospital.

ii) SPECIFIC OBJECTIVES:- To determine the causes and distribution of upper limb injuries.

- To identify possible remedial measures to counter the ever rising incidence of upper limb injuries.

Justification

Upper limb injuries are a major cause of morbidity, with consequent loss in terms of man-working hours (9,12). A large population is affected and there are broad social, economic and health implications (5,6,8,9,10,16,18). Such morbidity could be reduced through improved management of upper limb injuries (15), and this can be achieved by knowing the causes and distribution of such injuries. By providing statistical data relating to the incidence and causes of upper limb injuries, this study aims to identify the various ways by which patient management at Kenyatta National Hospital could be improved.

Research Questions

1. What is the radiological pattern of upper limb injuries at Kenyatta National Hospital?
2. What are the more common causes and risk factors in upper limb injuries?
3. What is the age distribution of upper limb injuries?

STUDY DESIGN AND METHODOLOGY

STUDY DESIGN
This was a prospective study.

STUDY AREA
The study was carried out at Kenyatta National Hospital.

STUDY POPULATION
The study included every fifth patient presenting at Kenyatta National Hospital Casualty Department with upper limb injury and on whom plain x-ray examination had been done.

Patient's details were entered into a data collection form by the researcher. Later the details were entered into computer software for analysis.

SAMPLE SIZE DETERMINATION
The study took six months and the sample size was determined by the formula below and included every fifth patient presenting with upper limb injury and meeting the inclusion criteria.

At 95% confidence interval and relative precision of 5% the sample size was derived from the formula

$$n = \frac{z^2 (1 - p)}{d^2}$$

where n = sample size
z = standard normal deviate (1.96)
p = estimate prevalence of condition under study
d = level of accuracy

Using the above formula and with estimate prevalence of 29% and sampling every fifth patient the calculated sample size was 218.

SAMPLING METHOD

All patients presenting with upper limb injury within the specified period of time and meeting the inclusion criteria (purposeful sampling) were identified. Study sample population was selected out of this number by picking every fifth patient.

INCLUSION CRITERIA

Only patients with upper limb injury and had plain x-ray diagnosis were included in the study.

EXCLUSION CRITERIA

Patients with clinical diagnosis of upper limb injury but no plain x-ray imaging for whatever reason.

STUDY LIMITATIONS

1.Not all patients with upper limb injuries seen were able to afford x-ray imaging.

2.Some patients opted for imaging and further management elsewhere after being seen at KNH casualty.

3.Some patient who would otherwise have been eligible for inclusion were left out because of missing details in their x-ray request forms.

DATA MANAGEMENT

Data collection - this was done by the researcher with assistance from radiographers on duty, the relevant patient data being entered into the data collection sheets and later into computer software ready for analysis.

Only the researcher filled in the data collection forms and transferred the data into the computer.

Data analysis - the data obtained will be presented in form of tables and supported by a literal discussion. Statistical package for social scientists(SPSS) was applied in data analysis with the assistance of a statistician.

ETHICAL CONSIDERATION

This study has been conducted with due regard for patient's rights and confidentiality.

The right to voluntary participation, and the liberty to withdraw at any time if a patient so wished were upheld. At no time was any patient persuaded against their wish to participate. No inducements or incentives were given in return for participation. Patients participated purely on the understanding that they and the general public at large stood to gain from positive findings of this study.

The study proceeded only after seeking and receiving the necessary approval of the Kenyatta National Hospital Research and Ethics Committee.

RESULTS

Table 1 -AGE DISTRIBUTION OF INJURIES

AGE (YR)	NUMBER OF PATIENTS	FREQUENCY
0-5	30	13.8%
6-10	55	25.2%
11-15	33	15.1%
16-20	19	8.7%
21-25	16	7.3%
26-30	19	8.7%
31-40	20	9.2%
41-50	18	8.3%
> 50	8	3.7%
TOTAL	218	100.0%

Table 2 –TYPES OF INJURIES

AGE (YR)	NUMBER & FREQUENCY					
	#: f/arm	humerus	hand	clavicle	scapula.	dislocations
0-5	16 6.5%	13 5.3%	0 0%	0 0%	0 0%	1 0.4%
6-10	40 16.3%	11 4.5%	1 0.4%	0 0%	0 0%	4 1.6%
11-15	21 8.6%	10 4.1%	1 0.4%	0 0%	0 0%	4 1.6%
16-20	12 4.9%	2 0.8%	2 0.8%	2 0.8%	1 0.4%	1 0.8%
21-25	5 2.0%	7 2.9%	3 1.2%	0 0%	1 0.4%	1 0.4%
26-30	10 4.1%	5 2.0%	4 1.6%	0 0%	0 0%	7 2.9%
31-40	12 4.9%	3 1.2%	3 1.2%	2 0.8%	0 0%	9 3.7%
41-50	8 3.3%	6 2.4%	3 1.2%	1 0.4%	0 0%	4 1.6%
>50	6 2.4%	2 0.8%	0 0%	0 0%	0 0%	1 0.4%
TOTAL	130 53.1%	59 24.1%	17 6.9%	5 2.0%	2 0.8%	32 13.1%

II- DISTRIBUTION OF VARIOUS UPPER LIMB INJURIES

Table 3- General Distribution

INJURY	NUMBER	FREQUENCY
Fractures (alone)	186	85.3%
Dislocations (alone)	18	8.3%
Fracture + Dislocation	14	6.4%
TOTAL	218	100.0%

Table 4- Specific Distribution

INJURY	NUMBER	FREQUENCY
Fracture Forearm	130	53.1%
Fracture Humerus	59	24.1%
Fracture Hand	17	6.9%
Fracture Clavicle	5	2.0%
Fracture Scapula	2	0.8%
Dislocations	32	13.1%
TOTAL	245	100.0%

Table 5- DISTRIBUTION OF DISLOCATIONS

SITE (JOINT)	NUMBER	FREQUENCY
SHOULDER	7	21.9%
ELBOW	8	25.0%
WRIST	13	40.6%
MCP	2	6.3%
PIP	1	3.1%
EPIPHYSEAL	1	3.1%
TOTAL	32	100%

III- AETIOLOGY OF UPPER LIMB INJURIES

Table 6 – General

AETIOLOGY	NUMBER	FREQUENCY
Fall	132	60.5%
RTA	47	21.6%
Assault	24	11.0%
Occupation	9	4.1%
Gunshot	6	2.8%
TOTAL	218	100.0%

Tables 7-12 Site Specific Aetiology

Table 7-AETIOLOGY OF FOREARM FRACTURES

AGE	FALL	RTA	ASSAULT	OCCCUPATION	GUNSHOT
0-5	12.3%	0.0%	0.0%	0.0%	0.0%
6-10	28.5%	0.0%	0.8%	0.0%	0.0%
11-15	15.4%	0.8%	0.0%	0.0%	0.0%
16-20	6.2%	5.4%	0.8%	0.0%	0.0%
21-25	0.8%	2.3%	0.0%	2.3%	0.0%
26-30	0.8%	0.0%	0.8%	0.0%	2.3%
31-40	3.8%	5.4%	3.0%	0.0%	0.0%
41-50	0.8%	0.8%	3.0%	0.8%	0.8%
>50	1.4%	0.0%	0.8%	0.0%	0.0%
TOTAL	70.1%	14.7%	9.2%	3.1%	3.1%

Table 8 -AETIOLOGY OF HUMERAL FRACTURES

AGE	FALL	RTA	ASSAULT	OCCUPATION	GUNSHOT
0-5	13.7%	0.0%	0.0%	0.0%	0.0%
6-10	18.6%	0.0%	0.0%	0.0%	0.0%
11-15	13.7%	1.6%	0.0%	0.0%	0.0%
16-20	0.0%	1.6%	0.0%	0.0%	0.0%
21-25	3.5%	1.6%	0.0%	1.7%	0.0%
26-30	1.6%	8.5%	3.4%	1.7%	0.0%
31-40	0.0%	8.5%	0.0%	0.0%	1.7%
41-50	0.0%	8.5%	8.5%	0.0%	0.0%
>50	0.0%	1.6%	0.0%	0.0%	0.0%
TOTAL	51.1%	31.9%	11.9%	3.4%	1.7%

Table 9-AETIOLOGY OF HAND FRACTURES

AGE	FALL	RTA	ASSAULT	OCCUPATION	GUNSHOT
0-5	0.0%	0.0%	0.0%	0.0%	0.0%
6-10	5.9%	0.0%	0.0%	0.0%	0.0%
11-15	5.9%	0.0%	0.0%	0.0%	0.0%
16-20	0.0%	0.0%	11.8%	0.0%	0.0%
21-25	0.0%	5.9%	5.9%	0.0%	0.0%
26-30	0.0%	5.9%	23.5%	5.9%	0.0%
31-40	0.0%	5.9%	5.9%	5.9%	0.0%
41-50	0.0%	0.0%	0.0%	5.9%	0.0%
>50	5.9%	0.0%	0.0%	0.0%	0.0%
TOTAL	17.7%	17.7%	47.1%	17.7%	0.0%

Table 10 -AETIOLOGY OF CLAVICLE FRACTURES

AETIOLOGY	NUMBER	FREQUENCY
FALL	1	20%
RTA	3	60%
GUNSHOT	1	20%
TOTAL	5	100%

Table 11- AETIOLOGY OF SCAPULA FRACTURES

AETIOLOGY	NUMBER	FREQUENCY
FALL	1	50%
RTA	1	50%
TOTAL	2	100%

Table 12- AETIOLOGY OF DISLOCATIONS

AETIOLOGY	NUMBER	FREQUENCY
FALL	17	53.1%
RTA	4	12.5%
ASSAULT	8	25.0%
OCCUPATION	3	9.4%
GUNSHOT	0	0.0%
TOTAL	32	100%

Table 13 Associated Injuries

AGE-(YR)	NUMBER	FREQUENCY
0-5	0	0.0%
6-10	0	0.0%
11-15	0	0.0%
16-20	0	0.0%
21-25	1 PELVIS	12.5%
26-30	2 CHEST&LOWER LIMBS	25.0%
31-40	4 LOWER LIMBS	50.0%
41-50	1 SKULL	12.5%
>50	0	0.0%
TOTAL	8	100%

Table 14 GENDER DISTRIBUTION

SEX	NUMBER	FREQUENCY
MALES	162	74.3%
FEMALES	56	25.7%
TOTAL	218	100%

DISCUSSION

Upper extremity injuries are a major problem in modern society (15).Besides the impact on patients themselves,the disorders also form a huge economic burden due to costs for sick leave and health care(15).Upper extremity injuries affect people all over the world.

The upper limb is a supportive , protective and freely mobile organ, hence it is frequently involved in trauma. Most upper limb injuries are manifested by pain, discomfort, or limited mobility and function in the upper extremity.

In medical literature authors repeatedly suggested that during the last decade's there has been an increase in upper limb injuries over time worldwide (5, 6, 9, 15).

Over a period of six months between June 2006 and December 2006 a total of 218 patients with upper limb injuries were studied in a prospective study at the Casualty department of Kenyatta National Hospital and the findings are presented here.

Whereas a majority of patients had injury confined to upper limbs , a small minority (3.2%) had concurrent injuries of other parts of the body. RTA(75%) and assault(25%) were the only causes identified in this study contributing to such concurrent injuries.

An overwhelming 186 patients (85.3%) had fractures , 18 patients (8.3%) had dislocations and the remaining 14 patients had both fracture and dislocation.

Fractures of the upper limbs

Fractures of the upper limbs are relatively common among trauma patients. Most of these involve the forearm (53.1%), the leading cause being a fall (70.1%). Upto 59.3% of forearm fractures are seen between the 0 – 15yr age bracket, though the peak incidence is seen between 6- 10 yr which account for 16.3%. This age group (0-15yr) tend to be prone to forearm fractures because of falls while playing or undertaking sporting activities.

Only 12.1% of upper limb fractures were noted above 40yr, and these were largely due to occupational or accidental injuries. The contribution of other factors such as alcohol, industrialization and low socio-economic status have been documented in scientific literature (11,13,17).

The forearm is the most commonly involved site (53.1%) followed by the humerus (24.1%). Forearm fractures tend to be associated with dislocation at the wrist and or elbow joints, while fractures of the humerus carry a significant risk of neurovascular bundle involvement. It is therefore necessary to include both the wrist and elbow joints when surveying a patient for fractures of the forearm. Those patients found to have humeral fractures with accompanying neurological deficit should certainly be sent for further clinical and neurovascular evaluation and imaging preferably using MRI.

Forearm fractures

These accounted for 53.1% of all cases of upper limb fractures. The peak age involved was 6 10yr, with a male: female ratio of 2.3 : 1. The leading cause was a fall (70.1%), usually on the outstretched hand and the overral trend showed a steady decline in frequency with age . This was in keeping with the fact that children compared to adults play more and suffer more falls.Some of the well recognized fractures of the forearm include Colles',Reversed Colles',Galeazzi, Barton's and Chauffer's fractures, all of which are well described in the literature review.The multiplicity and complexity of forearm injuries necessitates thorough clinicoradiological workup in order to minimize morbidity.

Fractures of the humerus

These contributed 24.1% of upper limb fractures, the commonest cause being a fall (51.1%) and the peak age incidence being 6 – 10yr. The male:female ratio was 1.75:1. Supracondylar fractures were the commonest, accounting for over half the cases. This injury is of particular significance because it is commonly associated with vasospasm of brachial artery which can result in Volkmann's ischaemic contracture (12,14). Mulimba in his study on these fractures (12) concurred with the above findings on the incidence and aetiology. Atinga (14) undertook a survey of supracondylar fractures in Machakos,Kenya with similar findings regarding peak age and the leading aetiology were similar.

Fractures of the hand

6.9% of all fractures of the upper limbs were found to involve the hand. A majority of these involved the metacarpals and phalanges and only rarely were the carpal bones fractured. The major aetiological factors were road traffic accidents (17.7%) and assault (47.1%) . Male preponderance and a peak age of 26 30yr was noted.Similar statistics have been recorded by Hicks (11) in his study on workers of a bus company in Nairobi, Kenya.

Fractures of the clavicle

Though rare, there were 5 cases identified during the study making up 2% of all cases. 80% of these were caused by road traffic accidents, implying considerably large forces were invoved. There were two peaks, namely 16 – 20yr and 31-40 yr. All were males, underlining the inherently higher involvement of men in high impact injuries compared to women.

Fractures of the scapula

2 cases of fractures of the scapula due to road traffic accident and a fall were identified. Both were males in the 16 – 20yr and 21-25yr age bracket.

Dislocations of the upper limbs

These were confirmed to constitute 13.1% of the study population with a large proportion (43.8%) occurring concurrently with fracture of the upper limb.

The elbow joint (25%), shoulder joint (21.9%) and wrist joint (40.6%) formed the bulk of upper limb dislocations.Epiphyseal dislocations (3.1%) were the least common.

Overral the most common cause of dislocations was a fall (43.8%), the 6 – 10yr age group being the peak. Males were more affected than females (M:F=2:1).

Elbow dislocations (25%)

In my study these are the 2nd commonest (28.1%) dislocations involving the upper limbs, the leading cause of which is a fall (66.7%). The 31 – 40yr age group is the peak, and males are more affected. Elbow dislocations commonly occur concurrently with supracondylar fractures.

Shoulder dislocations

Roger (13) in his study showed that anterior shoulder dislocation is more common than posterior dislocation, a finding that was confirmed in this study.Anterior dislocation accounted for (75%) of all shoulder dislocations in this study. Assault (37.5%) was found to be the single most common cause of anterior shoulder dislocations, the peak age being 31 – 40yr. Posterior dislocations are rare and only one case was noted in this study.

Out of all upper limb dislocations, shoulder dislocation constituted 21.9%.

Wrist dislocations

Included here were dislocations at distal radioulnar joint, radiocarpal joints, intercarpal joints and carpometacarpal joints. 40.6% of all dislocations occurred at the wrist, the peak age being 31 – 40yr. Most were secondary to a fall (41.7%) and were frequently associated with forearm fractures such as Colles' and Smith's fractures. Wrist injuries are a common occurrence the world-over as confirmed by Rogers (13) and Sutton (3).

Dislocations of MCP ,PIP and DIP joints

Only 3 cases were seen, making 9.4% of all dislocations. Peak age distribution of 31-40yr and male sex preponderance were replicated. Assault and injury secondary to a fall were the leading causes each contributing 33.3%.

Other associated injuries

There were 8 cases of other associated injuries occurring with upper limb injuries. This amounted to 3.6% of the study population. 2.25% involved the lower limbs, while the chest, pelvis and skull contributed 0.45% each. The finding of associated injuries in other parts of the body almost always indicated large force involvement: in this study road traffic accidents contributed to 75% of such injuries! Most of these patient needed other forms of imaging in addition to plain radiography, underscoring the limitations of plain radiography in evaluating soft tissue injuries.

Conclusions and Recommendations

Conclusions

1. There is an apparent change in the aetiological patterns of upper limb injuries within Nairobi and most probably in the entire Kenyan Nation at large. Whereas previous studies pointed out that road traffic accidents were the leading cause of such injuries (15,17), it now emerges from this study that the number of cases due to automobile accidents come second to injuries occasioned by falling. This could probably be due to improved road safety, a quite likely scenario given the recent introduction and enforcement of certain aspects of traffic rules e.g introduction of speed governors, use of safety belts, and enforcement of speed limits within certain zones.

2. Plain radiography remains the basis for imaging patients with suspected upper limb injury. Based on the findings of this study which relied 100% on plain x-ray examination:

   a) the commonest injury to the upper limbs is a fracture and the forearm is more likely to be involved than any other part.

   b) the leading cause of upper limb injury in Nairobi City is a fall in the younger age group (0-15yr). This was followed by road traffic accidents, assault and accidental/ occupational injuries in that order, the latter group being commoner in the young adults and the middle aged.

   c) the peak age incidence for upper limb injuries is 6 – 10yr, followed by 11 – 15yr, 0 – 5yr, 31-40yr, 21-25yr, 26-30yr, 41-50yr and >50 yr age groups in that order. The 6-10yr age group are most vulnerable because they play more and are more frequently involved in falls.

The role of consultant radiologists here cannot be overemphasized, but even more crucial is the need to allocate more learning opportunities to all doctors in the field of imaging. This should be done not only for those in medical schools but as part of an ongoing continuous medical education and capacity building for those doctors already working.

3. Some of the factors directly/indirectly contributing to upper limb injuries may not have been explicity uncovered in this study due to certain shortcomings namely:-

- there were cases where there was inadequate documentation of the clinical history by the attending clinician.
- incorrect details/ history given by patients due to the legal/social sensitivities of certain cases especially those relating to assault.
- the study population size limitation by scarcity of resources and time factor meant that some aspects pertaining to the trend of upper limb injury could not be captured.

Recommendations

1. The role of a fall in the young contributing to the highest cause of upper limb injury should be further explored, and advise given to parents and schools.

2. Any child with upper limb injury following a fall should be well examined and imaging done to exclude fracture.

3. Children form the majority of those affected by upper limb injuries. Given the growing skeleton in children, fracture management in children is crucial in order to prevent long term sequelae.

4. Docementation of all upper limb injuries should be in full, and actual age given to the radiologist when reporting films to avoid misdiagnosis of unfused epiphseal plate as fractures.

5. The study should be extended to cover all the provinces in Kenya, in order to come up with a National Policy on injury and management of upper limb injuries.

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APPENDIX 1

GENERAL PATIENT INFORMATION

PATIENT'S STUDY NUMBER:

PATIENT'S CASUALTY NUMBER:

PATIENT'S X-RAY NUMBER :

AGE :

SEX : 01-MALE 02-FEMALE

TELEPHONE CONTACT :

AETIOLOGY OF INJURY

1--- FALL

2---ROAD TRAFFIC ACCIDENT

3---OCCUPATION RELATED

4---ASSAULT

5---SPORTS RELATED

6----MISCELLANEOUS

APPENDIX 2

RADIOLOGIC FINDINGS

i)VIEWS TAKEN: AP LATERAL OTHERS(SPECIFY)

ii)SITES: RIGHT-

LEFT -

iii)INJURY --FRACTURE

--DISLOCATION

--SOFT TISSUE

iv)OTHER OCCURING INJURIES

--HEAD & NECK

--CHEST

--ABDOMEN

--PELVIS

--LOWER LIMBS > RIGHT

> LEFT

APPENDIX 3

BUDGET

NO	REQUIREMENT	COST (KSHS)
1	Stationery, photocopy , typing	15,000
2	Secretarial Services	5,000
3	Data Analysis	20,000
4	Computer printing	10,000
5	Imaging , scanning (using digital camera)	20,000
6	Binding	5,000
7	Data collection	10,000
8	Transport	10,000
9	Contingency	10,000
	TOTAL	**105,000**

The researcher met the cost of the above expenses .

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