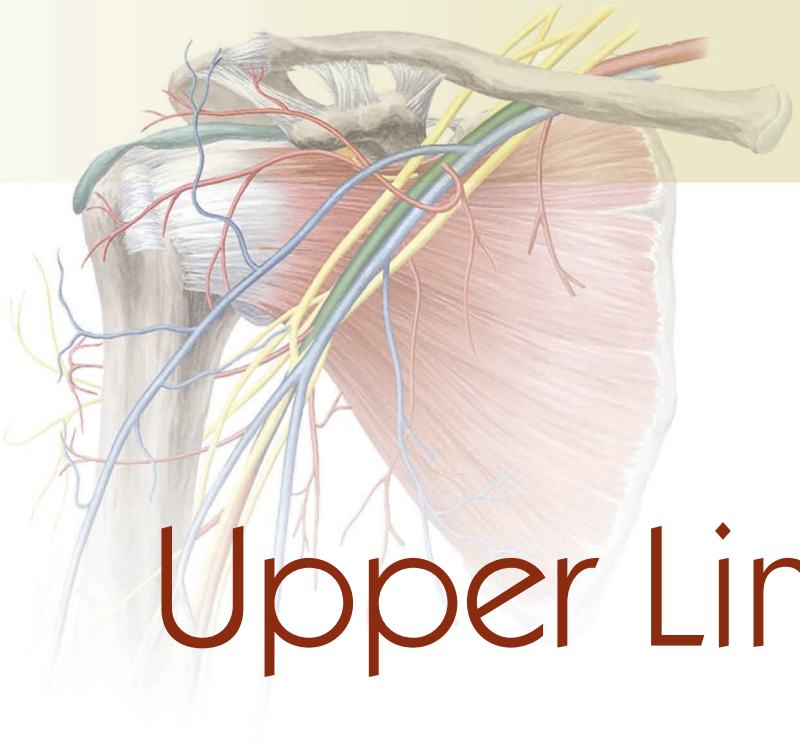

Section

1

Upper Limb

- Bones
- Pectoral Region and Axilla
- Artery
- Back and Scapular Region and Veins of Upper Limb
- Anterior Arm and Cubital Fossa
- Posterior Arm
- Forearm
- Hand
- Joints

BONES

Case

A 40 years old drunk male was admitted to the hospital after he fell from his balcony on outstretched hand. He came with left arm resting on side of thorax with elbow supported by the other hand. X-ray revealed that he has fracture of the left clavicle.

Q. Which is the most common site of fracture of clavicle?

A. Fracture of the clavicle most commonly occurs at the junction of medial 2/3 and lateral 1/3 which is the weakest point of the bone (Fig. 1.1)

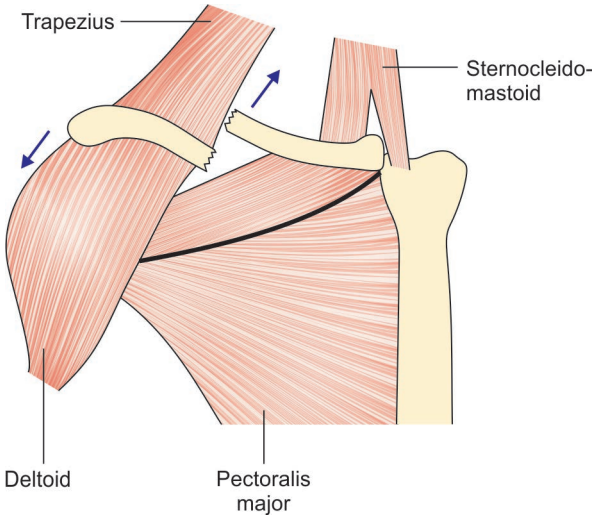

Fig. 1.1: Fracture of clavicle

Q. Why lateral segment of the fracture bone displaced downwards?

A. Due to weight of upper limb as trapezius alone is unable to support the weight of upper limb.

Q. What is greenstick fracture?

A. Here, there is fracture of the cortex of the bone but the periosteum is intact. It is treated conservatively by immobilization with application of brace in the figure of eight. This type of fracture is more common in children.

Q. Which is the most common fracture that occurs in children?

A. Fracture of clavicle is the most common fracture that occurs in children.

Q. Why clavicle is considered long bone?

A. Like a long bone clavicle has two ends and one shaft. It also takes part in transmission of weight of upper limb to axial skeleton. But clavicle is horizontally placed, is devoid of medullary cavity and is occasionally pierced by middle supraclavicular nerve. This is the reason why clavicle is called modified long bone.

Q. What is cleidocranial dysostosis?

A. Cleidocranial dysostosis (Fig. 2.5; *BD Chaurasia's Human Anatomy,* Vol 1) is the condition in which development of teeth and bones is primarily affected. The shoulders can be approximated anteriorly in front of chest due to absence of clavicle. Other symptoms include delayed maturation of skull bone, delayed or nonclosure of fontanelles, peg-like teeth, misalignment of teeth and jaws, etc.

Case

A scuffle broke out between two persons. One of them attacked the other with iron rod. The rod struck the victim on his deltoid region which caused the fracture of the surgical neck of the humerus and injury to a nerve along the surgical neck of the humerus. He has associated sensory loss over the shoulder area.

Q. Which nerve is injured in this case?

A. Axillary nerve as it winds round the surgical neck of the humerus (Fig. 1.2).

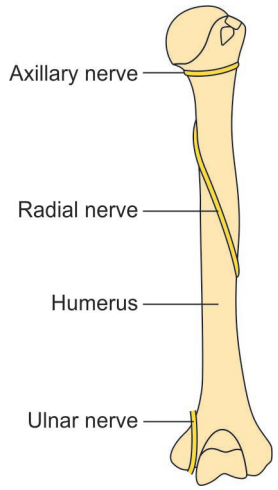

Fig. 1.2: Nerves related to humerus

Q. Which muscles are affected in this case?

A. Deltoid and teres minor

Q. Which movements are lost in such injury?

A. Abduction from 15° to 90° is lost due to paralysis of deltoid. There is weakness in lateral rotation of arm due to paralysis of deltoid and teres minor.

Q. What is regiment badge anesthesia?

A. Sensory loss on the skin over the lower half of the deltoid muscle is called regiment badge anesthesia as badge of the army regiment on the sleeve is located over this region.

Q. Why there is loss of rounded contour of the shoulder after some time in such injury?

A. Paralysis of the deltoid muscle causes disuse atrophy of the muscle resulting in flattening of the rounded contour of the shoulder. The greater tubercle of humerus becomes prominent.

Q. What are the other causes for the injury to the axillary nerve?

A. Axillary nerve may also be injured in inferior dislocation of the head of humerus or during intramuscular injection in the deltoid.

Q. What is position of shoulder in fracture of anatomical neck of the humerus?

A. There is drooping of the shoulder in fracture of anatomical neck of the humerus.

Q. What are the common sites of fracture of humerus in a case of a fall in each following condition? Which important structure can be damaged depending on the site of the fracture?

a. A fall in an elderly person with osteoporosis: Surgical neck of humerus—axillary nerve.
b. A fall on the elbow with forearm flexed: Intercondylar fracture—median nerve.
c. Falling on shoulder: Avulsion fracture of greater tubercle—muscles attached to greater tubercle.
d. Falling on hand with shoulder abducted: Spiral fracture of shaft of humerus—radial nerve.

Case

A 10 years old boy was involved in a road accident. His right forearm and hand were badly crushed with uncontrolled bleeding. So, amputation of his affected arm was performed. 2 years after the surgery the boy was brought again to the doctor for painful conical stump at the site of the amputation.

Q. Why the boy came back with painful conical stump at the site of amputation?

A. Upper end of the humerus is growing end. Enough soft tissue should be left at the site of amputation for future growth of the bone, otherwise it causes formation of painful conical stump.

Q. How the growing end of the bone can be decided by examining a bone of limb?

A. The nutrient foramina is directed away from the growing end of a long bone. So, by examining the direction of nutrient foramina, growing end of the bone can be decided.

Q. How to remember the growing ends of upper and lower limbs with respect of elbow and knee?

A. The direction of nutrient foramina in bones of upper and lower limbs can be remembered as follows 'to the elbow I go, from the knee I flee'. So opposite end to the direction of the nutrient foramina is the growing end of the bone.

Case

A 22 years male was involved in an accident while riding his motor bike. On examination, pronation and supination of forearm was found deficient. X-ray examination revealed fracture of upper 1/3 of ulna with dislocation of head of radius from superior radio-ulnar joint.

Q. What is this fracture called?

A. Monteggia fracture (Fig. 1.3)

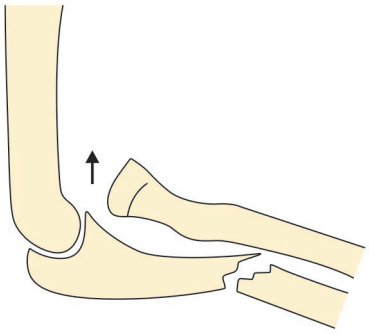

Fig. 1.3: Monteggia fracture

Q. What are the types of this condition?

A. Two types:

1. ***Extension type:*** Ulna angulates anteriorly and radius also dislocates anteriorly.
2. ***Flexion type:*** Ulna angulates posteriorly and radius also dislocates posteriorly.

Q. What is Galeazzi fracture?

A. It is fracture of distal 1/3 of radius with dislocation of head of ulna from inferior radio-ulnar joint (Fig. 1.4).

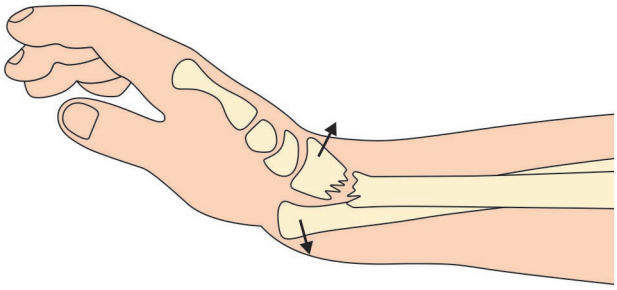

Fig. 1.4: Galeazzi fracture

Q. What is night-stick fracture?

A. It is a fracture of ulna which occurs when a night watchman reflexly raises his forearm to protect against a blow of a stick and so the stick hits the ulna.

Case

A 66 years old woman comes to the hospital after she fell on the wet bathroom floor. Examination revealed a bulging on posterior aspect of distal forearm. X-ray reveals fracture of the radius about 2 cm above its lower end. The broken distal segment is displaced backwards and upwards.

Q. What is this fracture called?

A. Colles' fracture

Q. What is the position of radial styloid process in this kind of fracture?

A. The radial styloid process comes to lie proximal to ulnar styloid process. Normally it is distal to ulnar styloid process.

Q. What is the deformity in this case?

A. Due to posterior displacement of the distal part of radius there is bulging in the lower part of posterior aspect of forearm. This kind of deformity is called dinner fork deformity (Fig. 1.5).

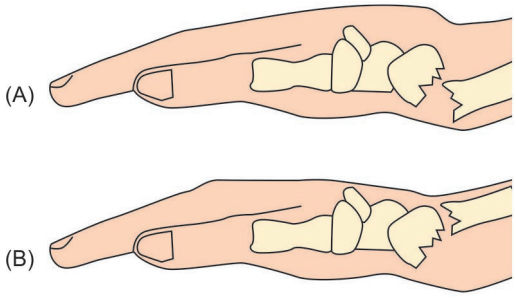

Fig. 1.5: A.Colles' fracture, B.Smith's fracture

Q. Which carpal bones are often fractured or dislocated with Colles' fracture?

A. Scaphoid and lunate as they are in direct articulation with the radius.

Q. What is Smith's fracture?

A. When the distal detached part of the radius is displaced anteriorly, it is called Smith's fracture. It is produced due to fall on the back of hand.

Case

A 25 years old athlete is brought to the emergency department after he fell while running and landed on the tips of his left-hand finger. The doctor noticed tenderness and swelling in the anatomical snuff box. X-ray of hand showed fracture of a carpal bone in the floor of the anatomical snuff box.

Q. Which bone is most likely affected in this case?

A. Scaphoid

Q. What are the boundaries of the anatomical snuff box?

A. Anatomical snuff box is bounded laterally by tendons of abductor pollicis longus and extensor pollicis brevis and medially by the tendon of extensor pollicis longus. The floor is formed scaphoid, trapezium and base of first metacarpal (Fig. 1.6).

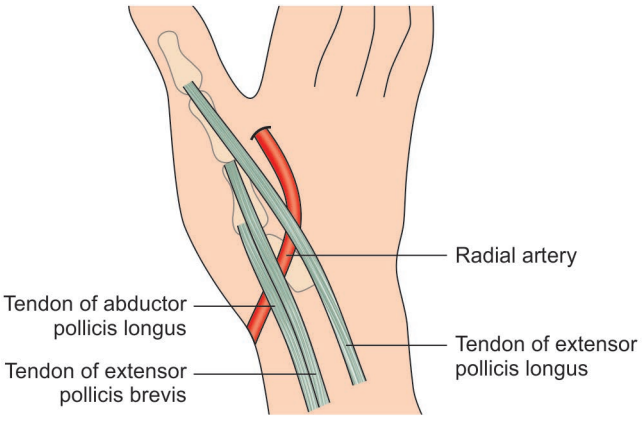

Fig. 1.6: Boundaries and content of anatomical snuff box

Q. Mention the content of the anatomical snuff box.

A. Radial artery

Q. Why avascular necrosis of the affected bone is common?

A. Normally the scaphoid is supplied by two nutrient arteries. One enters the palmar surface of the tubercle and the other the dorsal surface of the body. Occasionally, both the vessels enter through the distal half of the bone. In such cases, fracture of scaphoid will cause loss of blood supply to proximal half of the bone leading to avascular necrosis (Fig. 1.7).

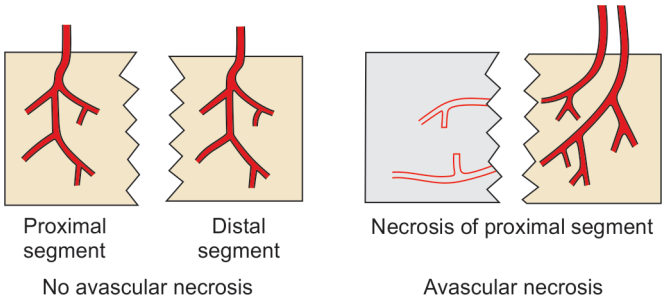

Fig. 1.7: Avascular necrosis of scaphoid

Case

A 23 years old male runner came to doctor with complaint of pain in his right wrist after he fell on the track on outstretched hand. X-ray examination reveals dislocation of a carpal bone.

Q. Which carpal bone is most likely dislocated?

A. Lunate

Q. Why lunate is most commonly dislocated?

A. The palmar surface of the lunate is broader than its dorsal surface which is opposite to other carpal bones. So, it easily slips when struck on outstretched hand (Fig. 1.8).

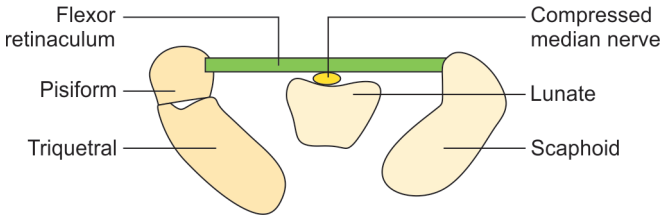

Fig. 1.8: Dislocation of lunate compressing median nerve

Q. What is the direction of dislocation of this bone?

A. Lunate usually dislocates anteriorly.

Q. Which nerve can be compressed in dislocation of this bone?

A. Median nerve in carpal tunnel can be compressed which leads to carpal tunnel syndrome like features.

Case

A 25 years old professional boxer came to the emergency department with complaint of pain in his right hand. He confessed that he had practice vigorously for getting ready for a tournament. Examination of his hand revealed that medial side of hand was quite swollen and medial knuckle was not seen when he made a fist. The doctor made diagnosis of fracture of metacarpal.

Q. What is this condition called?

A. Boxer's fracture (Fig. 1.9).

Q. Which bone is fractured in this condition?

A. Neck of fifth metacarpal.

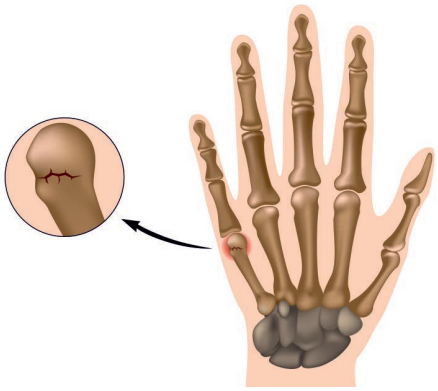

Fig. 1.9: Boxer's fracture

Q. What is Bennett's fracture?

A. It is an oblique intra-articular fracture of base of first metacarpal with subluxation of metacarpal (Fig. 1.10).

Fig. 1.10: Bennett's fracture

Q. Which muscle is called boxer's muscle?

A. Serratus anterior is called boxer's muscle as its action is required to make punches during boxing. Paralysis of serratus anterior causes loss of pushing and punching movements.

PECTORAL REGION AND AXILLA

Case

A 26 years old nursing mother who gave birth to a baby two months back visited the doctor with complaint of pain in her right breast. On examination the doctor found that the right breast was swollen and tender on palpation. USG of breast revealed collection of pus in the affected breast.

Q. What is probable diagnosis?

A. Breast abscess.

Q. What are the types of breast abscess according to its location in the breast region?

A. These are intramammary (in the breast) and retromammary (in the retromammary space).

Q. What is the probable reason of breast abscess in this case?

A. Intramammary abscess in a nursing mother usually occurs due to retrograde infection from the nipple. (Retromammary abscess usually occurs due to spread of infection from tuberculosis of ribs, empyema, etc.)

Q. How the intramammary breast abscess is drained?

A. Intramammary abscess is drained by giving a radial incision at the affected area under USG guidance. Radial incision is given in order to avoid injury to the lactiferous ducts (Fig. 1.11).

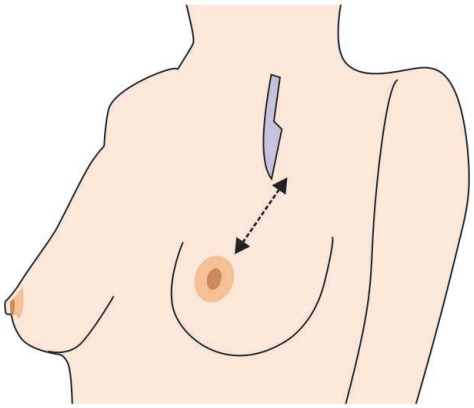

Fig. 1.11: Radial incision for drainage of breast abscess

Q. How is retrommary abscess drained?

A. Retromammary abscess is drained by submammary incision (Fig. 1.12).

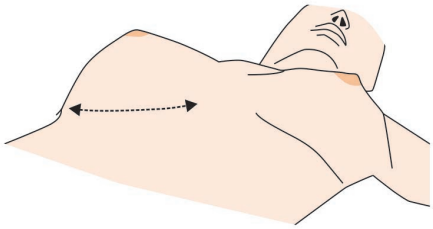

Fig. 1.12: Submammary incision for retromammary abscess

Case

A 22 years old female visited the doctor with complaint of a lump in the upper and inner quadrant of her right breast. On inspection, both the breasts were symmetrical and nipple areola complex was normal. On palpation, the doctor found that there was a solitary, smooth, well defined and mobile nodule in her right breast. The axillary lymph nodes were nonpalpable. Mammograph confirmed the same findings.

Q. What is probable diagnosis?

A. Fibroadenoma of breast.

Q. What is the cause of this condition?

A. Aberration of normal development and involution (ANDI).

Q. From which type of ducts fibroadenoma and carcinoma arise?

A. Fibroadenoma usually arises from distal smaller ducts, whereas carcinoma usually arises from larger ducts (Fig. 1.13).

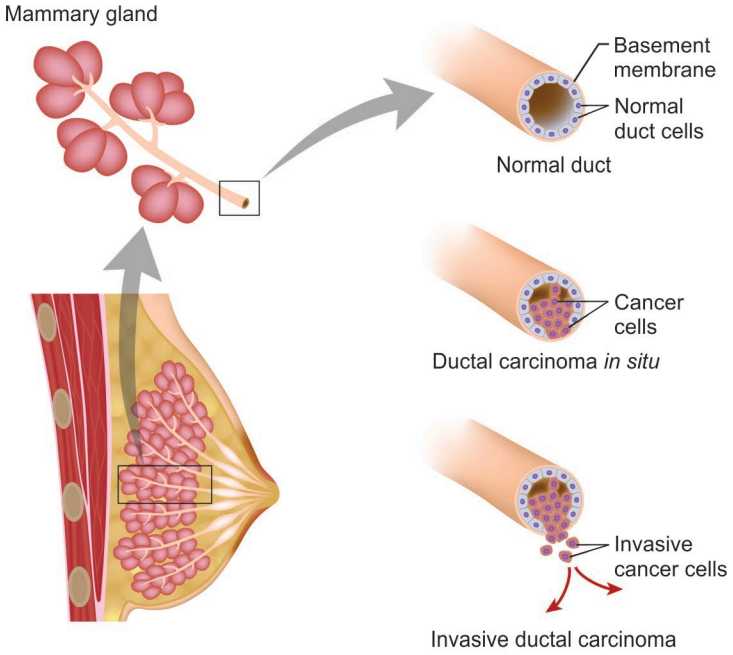

Fig. 1.13: Ductal carcinoma

Q. What are the types of this condition?
A. Intracanalicular and intercanalicular.

Q. How is this condition treated?
A. Enucleation, i.e. removal of nodule

Case

55 years old female visited the doctor with complain of a lump in upper and outer quadrant of her left breast. On examination the doctor found that skin of left breast was puckered and gave appearance of skin of an orange and the nipple was retracted. On palpation he found that the breast was fixed and axillary lymph nodes were enlarged.

Q. What is probable diagnosis?
A. Carcinoma of breast.

Q. Which quadrant of the breast is most commonly involved in carcinoma of breast?
A. Upper outer (superolateral) quadrant. Carcinoma usually arises from the larger duct system (Fig. 1.14).

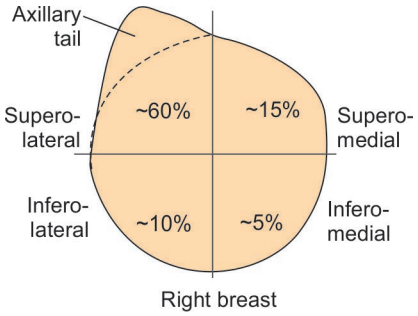

Fig. 1.14: Breast quadrants showing incidence of carcinoma

Q. Give anatomical basis for the puckering of the skin.
A. Infiltration of carcinoma into the suspensory ligament of Cooper and their subsequent contraction can cause retraction or puckering of the skin (Fig. 1.15).

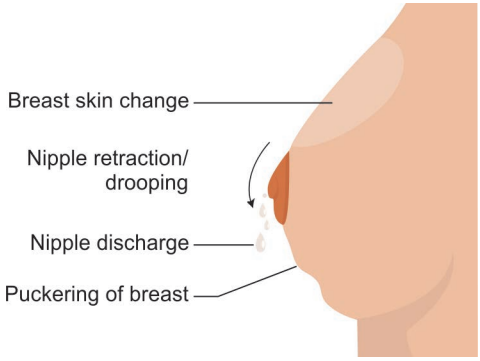

Fig. 1.15: Puckering of skin

Q. Give anatomical basis for the orange like appearance of the skin.

A. Infiltration and subsequent obstruction of the superficial lymphatics may produce oedema of the skin and fixation of hair follicle to subcutaneous tissue, thereby giving appearance like that of skin of an orange. This condition is known as Peau d'orange or oedema with pitting (Fig. 1.16).

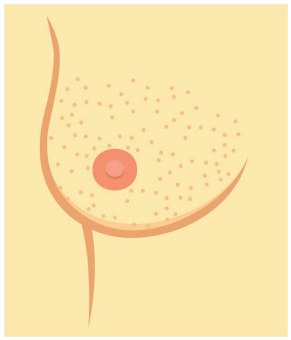

Fig. 1.16: Peau d'orange appearance

Q. Give anatomical basis for retraction of the nipple.

A. Infiltration by carcinoma into lactiferous duct and their subsequent fibrosis can cause retraction of the nipple (Fig. 1.17).

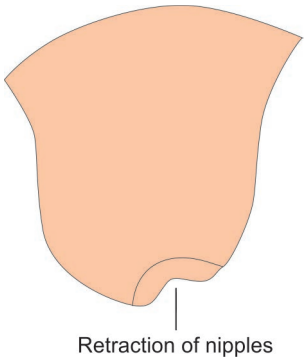

Fig. 1.17: Retraction of nipple

Q. Why was the breast fixed?

A. Due to spread of carcinoma into suspensory ligament of Cooper and underlying pectoral fascia (including retromammary space), the breast becomes fixed.

Q. How the fixity of the breast is tested?

A. It is tested by asking the patient to press her hands on her hips to make pectoralis major contract and then the doctor moves the breast on the pectoral fascia. Loss of mobility of breast indicates spread to deeper structures.

Q. How carcinoma of one breast can spread to the opposite breast?

A. Superficial lymphatics of breast communicate with opposite side across the midline. Any carcinoma infiltrating superficial lymphatics of one breast can spread to opposite side through this communication (Fig. 3.17; *BD Chaurasia's Human Anatomy,* Vol 1).

Q. Give anatomical basis for the carcinoma of breast to spread to the vertebrae and brain.

A. Carcinoma of the breast can spread through segmental veins. Veins draining the breast communicate with internal vertebral venous plexus through Batson's veins. By this route the carcinoma can spread to vertebrae and brain.

Cancer cells from breast → Posterior intercostal veins → Vertebral venous plexus of vein → Intracranial dural venous sinuses → Brain

Q. Give anatomical basis for the carcinoma to spread to abdomen.

A. Lymphatics from inferomedial quadrant of the breast may communicate with subdiaphragmatic and subperitoneal lymph plexuses. Through this route, carcinoma may spread to liver or cancer cells may undergo transcoelomic migration to form secondaries in abdomen. Such kind of secondary forming in ovary is called Krukenberg's tumour (Fig. 3.17; *BD Chaurasia's Human Anatomy,* Vol 1).

Q. Which radiological procedure is recommended for early detection of breast carcinoma?

A. Mammography (Fig. 1.18)

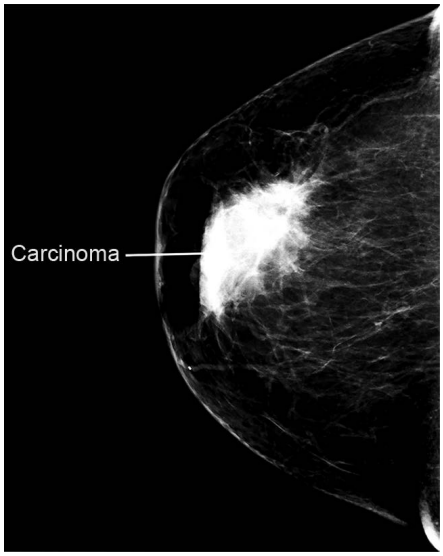

Fig. 1.18: Mammogram

Q. Which test is employed for confirmation of diagnosis of breast carcinoma?

A. Fine needle aspiration cytology (FNAC) is the most accurate and rapid method for diagnosis of carcinoma of breast.

Q. What is the surgical treatment of breast carcinoma?

A. Lump up to 4 cm in diameter is treated by removal of lump (by radial incision) and axillary lymph nodes followed by radiotherapy. Lump larger than 4 cm in diameter is treated by radical mastectomy (removal of breast, axillary lymph nodes and pectoralis minor) or modified radical mastectomy (removal of breast and axillary lymph nodes in a facial tent).

Q. What are the signs that can indicate presence of carcinoma of breast?

A. Lump, puckering of skin, change in colour or texture of skin, retraction of nipple, discharge from nipple and asymmetry of breast are a few signs which can indicate probable carcinoma of breast.

Q. What are the other causes of lump in breast?

A. Breast cyst, fibroadenoma, fibroadenosis, papilloma, etc. are other causes of lump in breast.

Case

A patient of breast carcinoma underwent radical mastectomy where the affected breast along with axillary lymph nodes were removed. On follow-up visit patient complained of difficulty in overhead abduction along with excessive prominence of the medial border of the scapula. Or

A 44 years old male firefighter is admitted to the hospital after blunt trauma to his left axilla. Physical examination reveals undue prominence of medial border of the scapula with difficulty in overhead abduction on ipsilateral side.

Q. Which nerve is affected in this case?

A. Long thoracic nerve or nerve of Bell (C 5, 6, 7). As the nerve passes through the axilla, it may be accidentally cut during removal of axillary lymph nodes in radical mastectomy or may be injured by a blunt trauma in axilla as seen in second case scenario.

Q. What are the other causes for injury to the long thoracic nerve?

A. Carrying heavy loads on shoulder, sudden pressure on the shoulder from above or stab injury can cause injury to the long thoracic nerve.

Q. Which muscle is paralysed in this case?

A. Serratus anterior (boxer's muscle or swimmer's muscle)

Q. What is the deformity in this case?

A. Winging of scapula—excessive prominence of medial border of the scapula particularly while pushing and punching (Fig. 1.19).

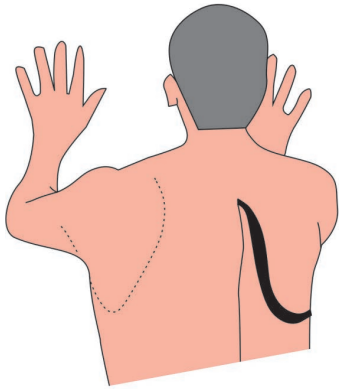

Fig. 1.19: Winging of scapula

Q. Give anatomical basis of winging of scapula.

A. During pushing and punching movements, pull of the normal serratus anterior keeps the medial border of scapula firmly applied to the thoracic wall. In paralysis of serratus anterior, there loss of such action of serratus anterior along with unopposed action of retractors of the scapula (rhomboids and middle fibres of trapezius) causing retraction of the medial border of the scapula and thereby producing winging of scapula.

Q. What is disability in this case?

A. Loss of pushing and punching movements. During attempts at doing these movements, there occurs winging of scapula. Overhead abduction of shoulder is also affected.

Q. How serratus anterior muscle is tested?

A. Forward pressure with the hands against a wall makes the medial border and inferior angle of scapula prominent if the muscle is paralysed.

Case

30 years old male visited the doctor with complain of loss of abduction of arm and flexion of forearm. On examination the doctor noticed following: Patient's right arm was adducted and medially rotated, whereas his right forearm was extended and pronated. There was also sensory loss on lateral aspect of the right upper limb. When asked further, the patient told the doctor that he had an accident about a week ago when he fell from the scooter on his shoulder with jerky lateral flexion of his head to the left side and so stretching his right side of neck. Or

During a difficult child birth a baby's head was delivered but his rest of the body was stuck in the birth canal. The baby had to be pulled by his head which was done with great difficulty. Next day the doctor noticed that the infant's right arm was adducted and internally rotated, whereas his right forearm was extended and pronated. On further examination it was found that there was sensory loss on the lateral aspect of the right upper limb. Or

A male patient undergoing the surgery of the right hand was given interscalene brachial plexus block. The next day the doctor noticed that his right arm was adducted and internally rotated, whereas his right forearm was extended and pronated. On further examination it was found that there was sensory loss on the lateral aspect of the right upper limb.

Q. What is the name of the deformity?

A. The deformity is called Policeman's tip hand or Porter's tip hand or Waiter's tip hand deformity (Fig. 4.16; *BD Chaurasia's Human Anatomy,* Vol 1).

Q. Which is the probable site of the injury?

A. This kind of deformity is produced by injury to the upper trunk of the brachial plexus. The site of injury is called Erb's point where six nerves meet. These six nerves are C5 and amp; C6 roots, suprascapular nerve, nerve to subclavius, ventral and dorsal divisions of upper trunk (Fig. 4.15; *BD Chaurasia's Human Anatomy,* Vol 1).

Q. Which fibers of brachial plexus are affected?

A. Fibers of C5 and C6 roots are affected—mainly C5 and partly C6.

Q. What are the causes of injury to the upper trunk of the brachial plexus?

A. These are as follows:

1. Fall on shoulder.
2. Difficult child birth where baby is pulled by the head and neck.
3. Injury by needle while administering anaesthetic solution by interscalanae approach for surgery of upper limb.

Q. Which dermatomes are involved in this case?

A. Area of skin along the lateral border of arm and forearm supplied by C5 and C6 dermatomes are involved in this case (Fig. 7.6; *BD Chaurasia's Human Anatomy,* Vol 1).

Q. Which muscles are affected in this condition?

A. Mainly biceps, deltoid, brachialis and brachioradialis and partly supinator, supraspinatus, infraspinatus and teres minor. Broadly these muscles are abductors and lateral rotators of arm and flexors and supinators of forearm.

Q. Describe the deformities in this condition.

A. Arm is adducted and medially rotated. Forearm is extended and pronated.

Q. Describe the disabilities in this condition.

A. There is loss of abduction and lateral rotation of arm and flexion and supination of forearm.

Q. Give anatomical basis for arm to be adducted and medially rotated.

A. Due to paralysis of supraspinatus and deltoid, there is loss of abduction of arm at shoulder joint. This leads to unopposed action of adductors of arm causing arm to remain adducted. Further, due to paralysis of infraspinatus and teres minor there is loss of lateral rotation of arm. Consequently, this leads to unopposed action of the medial rotators causing arm to remain medially rotated.

Q. Give anatomical basis for forearm to be extended and pronated.

A. Due to paralysis of biceps, brachialis and brachioradialis there is loss of flexion of the forearm at elbow joint. This leads to unopposed action of extensors of forearm causing forearm to remain in extended position. Further, due to paralysis of biceps and supinator there is loss of supination of forearm. Consequently, this leads to unopposed action of pronators of forearm causing the forearm to remain pronated.

Q. Which reflexes are lost in this condition?

A. Biceps and supinator jerks are lost as these reflexes are governed by C5 and C6 spinal roots.

Case

During a difficult child birth a baby's right hand was delivered first and the baby was then pulled by the hand. After a month, the baby was brought to the doctor by his parents with complaint of deformity of right hand and inability to straighten the fingers. They also

complained of baby was not opening the right eye properly. On examination the doctor noticed hyperextension of metacarpophalangeal joint and flexion of interphalangeal joints of right hand and loss of sensation on medial border of forearm and hand. The skin was warm and dry over the area of cutaneous loss. There was drooping of right upper eyelid and the right eye pupil was constricted.Or

A 23-year-old male climbed the mango tree and while he was picking the mangoes, he lost balance and fell. As he was falling, he reached out and grabbed a branch of tree by his right hand. A few days later, he reported to a doctor with complaint of deformity of right hand. On examination the doctor noticed hyperextension of metacarpophalangeal joint and flexion of interphalangeal joints of right hand and loss of sensation on medial border of forearm and amp; hand. The skin was warm and dry over the area of cutaneous loss. There was drooping of right upper eyelid and the right eye pupil was constricted.

Q. Which deformity of the hand is observed by doctor on examination?

A. The deformity of the hand observed in this case is claw hand (Fig. 1.20).

Fig. 1.20: Claw hand

Q. What is the position of joints in this deformity?

A. There is hyperextension of metacarpophalangeal joints and flexion of interphalangeal joints of affected hand.

Q. Which are the disabilities found in this condition?

A. Disabilities—there is loss of flexion of metacarpophalangeal joints and extension of interphalangeal joints of medial four digits.

Q. What is the anatomical basis for this deformity?

A. Due to paralysis of lumbricals and interossei of hand there is loss of flexion at metacarpophalangeal joints and extension at interphalangeal joints. This leads to unopposed action of long flexors and extensors of hand producing claw hand deformity.

Q. Which other movements of the fingers are affected? Mention the clinical tests for the muscles involved.

A. There is loss of adduction and abduction of fingers due to paralysis of palmar and dorsal interossei respectively.

Clinical test for palmar interossei: The patient is asked to hold a piece of paper tightly between two fingers while the doctor tries to pull it. If the paper is held firmly between the fingers, it means that palmar interossei are normal (Fig. 9.29; *BD Chaurasia's Human Anatomy,* Vol 1).

Clinical test for dorsal interossei: The patient is asked to abduct the fingers against resistance given by the doctor. If the patient is able to abduct the fingers, it means that dorsal interossei are normal (Fig. 9.28; *BD Chaurasia's Human Anatomy,* Vol 1).

Q. Which is the probable site of the injury?

A. The probable site of the injury is lower trunk of the brachial plexus.

Q. What is the name of the clinical condition?

A. Klumpke's palsy

Q. Which fibers of brachial plexus are involved?

A. Mainly T1 and partly C8

Q. What are the other causes of such deformity?

A. These are as follows:

1. Pancoast tumour of lung (tumour of apical part of the lung)
2. Cervical rib.

Q. Which dermatomes are involved in sensory loss?

A. Area of skin along the forearm and hand supplied by C8 and T1 dermatomes are involved in this case (Fig. 7.6; *BD Chaurasia's Human Anatomy,* Vol 1).

Q. Why was the skin warmer and dry over the area of cutaneous loss?

A. There is loss of sympathetic supply in the area of cutaneous loss, thereby the skin feels warmer due to arteriolar dilatation and is dry due to loss of sweating.

Q. What are the other changes seen in the skin of the affected area?

A. Trophic changes are seen in the skin of affected area in long standing cases. The skin becomes dry and scaly, nails become brittle and there is atrophy of pulp of fingers.

Q. Why the baby is not able to open the right eye properly?

A. Due to paralysis of involuntary part of levator palpabrae superioris, there is partial drooping of the upper eyelid of right eye. This condition is known as ptosis.

Q. Why the right eye pupil is constricted?

A. Due to paralysis of the dilator pupillae muscle, constrictor component becomes dominant which is responsible for constriction of the pupil on the affected side. This condition is known as miosis.

Q. Ptosis and miosis is part of which syndrome?

A. Horner's syndrome. When the injury to lower trunk of brachial plexus also involves thoracic sympathetic chain at the level of T1 ganglion, it will cut the sympathetic supply to the head and neck of the same side. This will produce variety of symptoms collectively known as Horner's syndrome.

Q. Which are the other symptoms of Horner's syndrome?

A. Anhydrosis (loss of sweating), enophthalmos (sunken eyeball), loss of ciliospinal reflex and heterochromia iridis (lighter coloured iris in congenital Horner's syndrome) (Fig. 4.18; *BD Chaurasia's Human Anatomy,* Vol 1).

Q. Give anatomical basis for the symptoms of Horner's syndrome.

A. It is due to interruption of sympathetic fibres to head and neck region producing various conditions as shown in Table 1.1.

Table 1.1: Anatomical basis of different conditions found in Horner's syndrome

Condition	*Anatomical basis*
Ptosis	Due to paralysis of involuntary part of levator palpabrae superioris muscle
Miosis	Due to paralysis of dilator pupillae muscle
Anhydrosis	Due to loss of sweating
Enophthalmos	Due to loss of orbital fat cushion of the eyeball
Loss of cilio-spinal reflex	Due to disfunction of sympathetic pathway and paralysis of dilator pupillae muscle
Heterochromia iridis (congenital Horner's syndrome)	Due to interference in melanin production

Q. Mention cilio-spinal reflex.

A. Pinching the nap of the neck reflexly produces the dilatation of pupil of the same side. This is called the cilio-spinal reflex.

Case

A professional body builder came to the doctor with complain of pain and tingling and numbness in right upper limb. He told the doctor that he had visited a construction side to see progress of work of his flat where a solid concrete block from 2nd floor had fallen over lower part of side of right neck. On examination, the doctor found feeble radial pulse and rhythmic movement of scapula. Doppler study showed formation of thrombus in 1st part of axillary artery.

Q. Why the patient complained of pain and paresthesia?

A. Decrease in blood supply to the upper limb causes ischemia of muscles and nerves of upper limb causing pain and paresthesia.

Q. What is the reason for feeble pulse?

A. Feeble pulsation of radial artery occurs due to low pressure in radial artery because of obstruction of axillary artery by the thrombus.

Q. What is pulsatile scapula?

A. Due to opening of collateral circulation between first part of subclavian artery and third part of axillary artery through anastomosis around scapula, increased amount of blood now passes through it. This causes scapula to move rhythmically with each pulse. This is called pulsatile scapula.

Q. Where does the anastomosis between subclavian artery and axillary artery take place?

A. Anastomosis between subclavian artery and axillary artery takes place in two places: (Fig. 6.12; *BD Chaurasia's Human Anatomy,* Vol 1)

1. Around the body of scapula in subscapular, supraspinous and infraspinous fossae.
2. Around the acromion process of scapula

Q. Name the arteries that take part in anastomosis around body of scapula.

A. This is the anastomosis between 1st part of subclavian artery and 3rd part of axillary artery.

It is formed by following arteries: (Fig. 6.12; *BD Chaurasia's Human Anatomy,* Vol 1)

1. Suprascapular artery—branch of thyrocervical trunk of first part of subclavian artery
2. Deep branch of transverse cervical artery—branch of thyrocervical trunk
3. Circumflex scapular artery—branch of subscapular artery of third part of axillary artery.

Q. Name the arteries that take part in anastomosis around acromion process of scapula.

A. This is the anastomosis between 1st part of subclavian artery and 2nd and 3rd parts of axillary artery. It is formed by following arteries: (Fig. 6.12; *BD Chaurasia's Human Anatomy,* Vol 1)

1. Acromial branch of thoracoacromial artery—branch of 2nd part of axillary artery
2. Acromial branch of suprascapular artery—branch of 1st part of subclavian artery
3. Acromial branch of posterior circumflex humeral artery—branch of 3rd part of axillary.

ARTERY

Case

A 35 years old male went to the doctor with complaints of painless swelling in right axilla, loss of appetite and weight loss. On examination the doctor found that there was bulging in the right axilla which was soft and non-tender. USG of axilla showed collection of pus in axilla and then aspiration of pus was done. Microbiological study of the pus showed presence of the tuberculous bacilli. MRI of cervical spine showed wedging of C5, C6 and C7 vertebrae, reduction of intervertebral disc space and presence of paraspinal abscess.

Q. What is probable diagnosis?

A. Tuberculosis of cervical vertebrae

Q. What are the other causes for swelling in axilla?

A. Lipoma, enlargement of axillary tail of Spence, enlargement of axillary lymph nodes, aneurysm of axillary artery, etc.

Q. What is the reason for collection of pus in axilla in this case?

A. The axillary sheath is the prolongation of the prevertebral fascia that covers the trunks and cords of brachial plexus and axillary artery up to axilla. Pus from cervical vertebrae behind the prevertebral fascia can track along the axillary sheath and collect in the axilla.

Q. How the abscess in axilla is drained?

A. Axillary abscess is incised through the floor of the axilla, midway between the anterior and posterior axillary folds and nearer to the medial wall in order to avoid injury to the main vessels running along anterior, posterior and lateral walls of the axilla.

Q. How the swelling in this case can be differentiated from enlarged axillary lymph nodes?

A. In this case, the pus arises in the cervical region tracking down to the axilla. So, the swelling is soft and painless. Enlargement of axillary lymph nodes may occur due to infection or carcinoma in the territory of their drainage. In case of bacterial infection, the lymph nodes are soft, tender and mobile, whereas in carcinoma they are fixed and stony hard.

Q. How the axillary lymph nodes are palpated?

A. Axillary lymph nodes are palpated using both the hands. Left axillary lymph nodes should be palpated by right hand and right axillary lymph nodes should be palpated by left hand.

Case

A 24 years old male is diagnosed with metastatic squamous cell carcinoma of the skin over the lower part of the sternum. On examination, the doctor found a few enlarged lymph nodes over the pectoral region.

Q. Which lymph nodes receive most lymph from the affected area?

A. Anterior axillary lymph nodes (Fig. 4.11; *BD Chaurasia's Human Anatomy,* Vol 1).

Q. Mention the areas from which lymph is drained by the affected lymph nodes.

A. Anterior axillary lymph nodes drain lymph from the anterior and lateral thoracic walls up to umbilicus and also the skin and parenchyma of the mammary gland.

Q. Where do efferents from affected lymph nodes drain?

A. Efferent from anterior axillary lymph nodes drains into central and apical groups of axillary lymph nodes.

Q. Pain along the medial side of upper part of the arm occurs due to compression of which nerve?

A. Intercostobrachial nerve passes through the central part of the axilla and supplies the skin of the medial side of upper part of the arm. Compression of this nerve due to enlargement of central group of axillary lymph nodes can cause pain along the area supplied by it.

Q. What are Rotter's nodes?

A. These are a few nodes intervening between pectoralis major and minor muscles. They form alternate channel of lymph drainage from deep surface of mammary gland when normal channels are obstructed by spread of cancer cells.

Q. Which lymph nodes drain the upper limb?

A. Lymphatics from entire upper limb except those accompanying cephalic vein drain into lateral axillary lymph nodes. Lymphatics accompanying cephalic vein drain into deltopectoral (cephalic) lymph nodes.

Case

A 25 years old male lost his right leg in traumatic car accident. He was discharged from the hospital and was given an axillary crutch to walk. Six months after the incident he came to doctor with complaint of deformity of right hand. On examination, the doctor noticed thumb drop, finger drop, wrist drop and loss of extension at elbow. There is also sensory loss along the posterior aspect of arm, forearm and lateral side of dorsum of hand.

Q. Which structure is involved in this case?

A. Trunk of radial nerve in axilla is compressed by the crutch in right axilla.

Q. Give anatomical basis for thumb drop, finger drop and wrist drop.

A. Due to paralysis of extensor pollicis longus and brevis, there is loss of extension of thumb causing thumb drop. Due to paralysis of extensor indices, extensor digitorum and extensor digiti minimi there is loss of extension at metacarpophalangeal joints of all fingers causing finger drop. Due to paralysis of extensor carpi radialis longus and brevis, there is wrist drop.

Q. Give anatomical basis of wrist drop in this case.

A. Due to paralysis of extensor carpi radialis longus, extensor carpi radialis brevis and extensor carpi ulnaris along with unopposed action of wrist flexors, there occurs wrist drop.

Q. Why there is loss of elbow extension in this case?

A. Due to paralysis of triceps brachii and to lesser extent anconeus, there is loss of extension at elbow.

Q. Enumerate the sensory branches of the radial nerve.

A. In axilla—posterior cutaneous nerve of arm.

In spiral groove—lower lateral cutaneous nerve of arm and posterior cutaneous nerve of forearm.

In cubital fossa—superficial terminal branch.

BACK AND SCAPULAR REGION AND VEINS OF UPPER LIMB

Case

The right shoulder abduction of a 58 years old woman had become increasingly painful over the past year. Examination by an orthopaedic doctor revealed following: There is no pain during abduction up to initial 60°. The pain starts on further abduction and lasts during abduction up to 120° and then the pain disappears during abduction from 120° to 180°.

Q. What is probable diagnosis?

A. Supraspinatus tendinitis

Q. What is the name of syndrome with respect to pain occurring in the arc of 60° to 120° abduction?

A. Painful arc syndrome or rotator cuff syndrome (Fig. 1.21).

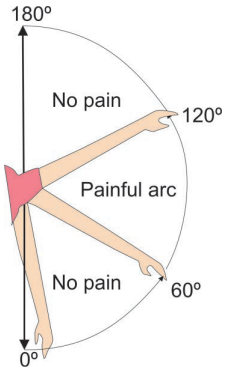

Fig. 1.21: Painful arc syndrome

Q. Give anatomical basis for the pain to occur during abduction from 60 to 120 degree.

A. Pain starts at about 60 degree and lasts till 120 degree of abduction as inflamed supraspinatus muscle starts getting impinged between great tubercle of humerus and coracoacromial arch in that range. Further abduction of shoulder can take place only after lateral rotation of humerus. This rotation takes the greater tubercle of humerus away from the coracoacromial arch and thus releasing the pressure on the supraspinatus tendon causing disappearance of pain too.

Q. How the pain of subacromial bursitis differs from that of supraspinatus tendinitis?

A. In subacromial bursitis, pressure over the deltoid below the acromion with arm by the side causes pain. However, pressure over the same point with arm abducted to right angle causes no pain (Dawbarn's sign). This is due to the fact that during abduction to right angle, the subacromial bursa passes beneath the coracoacromial arch causing disappearance of pain too.

Q. What is suprascapular nerve entrapment?

A. The suprascapular nerve is occasionally compressed in suprascapular notch usually in schoolchildren by bag strap. This causes paralysis of supraspinatus and infraspinatus leading to disuse atrophy of affected muscles and difficulty in initiation of the shoulder abduction.

Case

During a road accident, a person fell from the scooter on the right shoulder. This resulted in inferior dislocation of the right humerus causing injury to a nerve along the surgical neck of the humerus. He has associated sensory loss over the shoulder area. Or

A 25 years old male patient came with loss of abduction of shoulder more than 15°. When asked, he told that he had taken a folic acid injection on the right shoulder 2 days back. He has associated sensory loss over the shoulder area.

Q. Why the head of humerus is most commonly displaced inferiorly?

A. The head of humerus is most commonly displaced inferiorly because it is not supported inferiorly by musculotendinous cuff (rotator cuff) or coracoacromial arch. The shoulder joint is more prone to dislocation than any other joint in body (Fig. 1.22).

Fig. 1.22: Dislocation of head of humerus

Q. Which nerve is injured in this case?
A. Axillary nerve

Q. Which muscles are paralysed in such nerve injury?
A. Deltoid and teres minor

Q. Which movements are lost in such injury?
A. Abduction from 15° to 90° is lost due to paralysis of deltoid. There is weakness in lateral rotation of arm due to paralysis of deltoid and teres minor.

Q. What is regiment badge anaesthesia?
A. Sensory loss along the lower half of the deltoid muscle is called regiment badge anaesthesia as badge of the army regiment on the sleeve is located over this region (Fig. 6.10b; *BD Chaurasia's Human Anatomy,* Vol 1).

Q. Why there is loss of rounded contour of the shoulder after some time in such injury?
A. Paralysis of the deltoid muscle causes disuse atrophy of the muscle resulting in flattening of the rounded contour of the shoulder. The greater tubercle of humerus becomes prominent.

Q. What are the other causes for the injury to the axillary nerve?
A. Axillary nerve may also be injured in fracture of surgical neck of the humerus or during intramuscular injection in the deltoid.

Q. How the function of axillary nerve is tested?
A. Axillary nerve is tested by testing the action of deltoid. A person is laid down in supine position and he is asked to do abduction starting from 15° against resistance. Supine position is given to nullify the effect of gravity.

Q. What is the peculiarity of nerve to teres minor?
A. Nerve to teres minor bears a pseudoganglion (pseudoganglion gives appearance of a ganglion but is made of connective tissue. Pseudoganglion is also found in the terminal part of posterior interosseous nerve and deep peroneal nerve) (Fig. 6.6; *BD Chaurasia's Human Anatomy,* Vol 1).

Case

A 25 years old male professional body builder worked hard on his shoulder muscles. His shoulder muscles were enlarged to such an extent that the size of quadrangular space was greatly reduced.

Q. Which nerve is likely to be compressed in this case?

A. Axillary nerve as it passes through the quadrangular space.

Q. Which muscles are likely to be paralysed in this case?

A. Deltoid and teres minor

Q. Which vessels are likely to be compressed in this case?

A. Posterior circumflex humeral vessels as they along with axillary nerve pass through the quadrangular space.

Q. What are the boundaries of quadrangular space?

A. These are as follows: (Fig. 6.11; *BD Chaurasia's Human Anatomy,* Vol 1).

1. Above by subscapularis, capsule of shoulder joint and teres minor
2. Below by teres major
3. Medially by triceps brachii
4. Laterally by surgical neck of humerus

Q. What are the contents of upper triangular space?

A. Circumflex scapular artery.

Q. What are the contents of lower triangular space?

A. Radial nerve and profunda brachii vessels.

Case

A 53 years old female visited the doctor with complaint of neck pain with tingling and numbness in right upper limb. MRI examination revealed herniation of an intervertebral disc in the cervical region. Physical examination revealed weakness in wrist extension and paresthesia on dorsum of hand in the region adjoining middle three digits.

Q. Which intervertebral disc is herniated in this case?

A. Disc between 7th and 8th cervical vertebrae (Fig. 1.23).

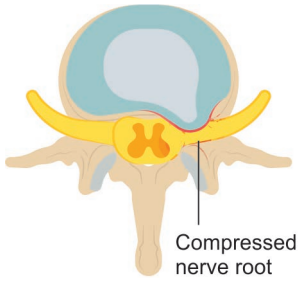

Fig. 1.23: Herniation of disc