INTRODUCTION

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The radial nerve arises from the posterior cord of the brachial plexus; C5,6,7,8 and T1. It descends through the axilla to leave it at the lower border of teres major muscle, then it enters the spiral groove on the back of the humerus. The radial nerve emerges from the spiral groove, then it pierces the lateral inter-muscular septum, to enter the anterior compartment of the arm, then it descends in the radial tunnel between brachialis medially, and brachioradialis with extensor carpi radialis longus laterally. Anterior to the lateral epicondyle the radial nerve ends, by dividing into superficial and deep terminal branches ***(Williams et al., 1995).***

Radial nerve compression may occur at any point along its anatomical course. The most frequent site of compression lies in the proximal forearm, in the area of the supinator muscle. It is often difficult to differentiate between the tennis elbow and early stages of radial nerve compression in the elbow region especially in the radial tunnel, because both give complain of pain over the anterolateral proximal forearm ***(Mark, S. et al., 2002).***

The cases of radial nerve compression may be treated medically without proper response and the symptoms usually return and the cases may worsen, thus the surgical release of the compression is the most successful treatment ***(Crawford, 1984).***

So, the determination of the anatomical sites of radial nerve compression, especially in the elbow region is very important.

AIM OF THE WORK

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The aim of this work is to study the anatomical sites of radial nerve compression along its course.

REVIEW OF LITERTURES

ANATOMY OF THE BRACHIAL PLEXUS

Formation and roots:

The brachial plexus is a union of the lower four cervical ventral rami and the greater part of the first thoracic ventral ramus. The fourth cervical ramus usually gives a branch to the fifth cervical, and the first thoracic ramus frequently recevies a branch from the second thoracic. These ventral rami are the roots of the plexus ***(Gerard, T. 1995 and Williams et al., 1995).***

Trunks and divisions:

The fifth and sixth cervical rami unite at the lateral border of the scalenus medius, forming the upper trunk, the seventh cervical ramus becomes the middle trunk, and the eight cervical and first thoracic rami join behind the scalenus anterior forming the lower trunk. Just above or behind the clavicle each trunk bifurcates into anterior and posterior divisions ***(Williams et al., 1995).***

Cords:

The anterior divisions of the upper and middle trunks form the lateral cord, lateral to both the first and second parts of the axillary artery, the anterior division of the lower trank descends behind the first part, then medial to the second part of the axillary artery, forming the medial cord and the posterior divisions of the three trunks form the posterior cord, lateral to the first part and then behind the second part of the axillary artery ***(Henry, H. and Cornelius, R., 1985 and McMinn 1994).***

RELATIONS OF THE BRACHIAL PLEXUS :

1- Relations of the roots :

The ventral rami of the spinal nerves of C5,6,7,8 and T1 form the roots of the brachial plexus, which emerge through the intervertebral foramina between the cervical vertebrae, immediately posterior to the vertebral artery. These roots run in an inferior and anterior direction, between the anterior and posterior tubercles of the transverse processes. They are located lateral and superficial to the vertebral column, behind the scalenus anterior muscle and emerge between it and scalenus medius to form the trunks ***(Thompson and Rorie, 1983).***

2- Relations of the trunks and divisions :

The trunks lie in the posterior triangle of the neck, in the angle between the clavicle and lower part of the posterior border of the sternocleidomastoid muscle. They are related anteriorly to the skin, superficial fascia containing platysma muscle, deep fascia and the 3rd part of subclavian artery. They are crossed anteriorly by the supraclavicular nerves, the nerve to the subclavius, the inferior belly of the omohyoid muscle, the lower part of the external jugular vein, the suprascapular vessels and the transverse cervical vessels. They are related posteriorly to the scalenus medius muscle and the roots of the long thoracic nerve. Behind the clavicle each trunk bifurcates into anterior and posterior divisions, which lie in the apex of the axilla on the first digitations of the serratus anterior. They are related anteriorly to the clavicle and subclavius muscle and posteriorly to the subscapularis muscle ***(Partridge, 1987).***

3- Relations of the cords :

As they enter the axilla, the three cords pass deep to the clavipectoral fascia as well as pectoralis major and minor muscles. They

accompany the axillary artery and their relations to it are as follows; the lateral and posterior cords are lateral to the first part of the artery, the medial cord being behind it. Then they surround the second part of the artery, related according to their names. The relations of the branches of the cords to the third part of the axillary artery are as follows; **lateral** to the artery lie the branches of the lateral cord, which are the musculocutaneous nerve, lateral root of the median nerve and the lateral pectoral nerve which pierces the clavipectoral fascia to supply the pectoralis major muscle. **Medial** to the artery lie the branches of the medial cord which are the ulnar nerve, medial root of the median nerve, and medial cutaneous nerve of the forearm, the medial cutaneous nerve of the arm medial to the axillary vein and the medial pectoral nerve which pierces the pectoralis minor, where it supplies it and ends in the pectoralis major muscle. **Posterior** to the artery lie the branches of the posterior cord which are the radial nerve, axillary nerve, upper and lower subscapular nerves and thoracodorsal nerve ***(Williams et al., 1995)***.

THE BRACHIAL PLEXUS SHEATH :

The connective tissue of the prevertebral fascia and the anterior and middle scalene envelops the brachial plexus, as well as the subclavian and axillary arteries in a neurovascular sheath, which blends with the fascia of the biceps and brachialis muscles distally ***(Thompson and Rorie 1983, Partridge 1987).***

BRANCHES OF THE BRACHIAL PLEXUS :

*** Supraclavicular Branches:**

From Roots: [5,6,7 & 8]

1- Nerves to scalene and longus colli muscles [C 5,6,7 & 8].

2- Branch to phrenic nerve [C 5].

3- Dorsal scapular nerve [C 5].

4- Long thoracic nerve [C 5,6 & 7].

From Trunks [5, 6]:

1- Nerve to subclavius [C 5 & 6].

2- Suprascapular nerve [C 5 & 6].

*** Infra-clavicular Branches (From Cords only):**

Lateral Cord [C5, 6, 7]:

1- Lateral pectoral nerve [C 5,6 & 7].

2- Musculocutaneous nerve [C 5, 6 & 7].

3- Lateral root of median nerve [C 5,6 & 7].

Medial Cord:

1- Medial Pectoral nerve [C 8 & T1].

2- Medial cutaneous nerve of forearm [C 8 & T1].

3- Medial cutaneous nerve of arm [C 8 & T1].

4- Ulnar nerve [C 7, 8 & T1].

5- Medial root of median nerve [C 8 & T1].

Posterior cord :

1- Upper subscapular nerve [C 5 & 6].

2- Thoracodorsal nerve [C 6,7,8].

3- Lower subscapular nerve [C 5 & 6].

4- Axillary nerve [C 5 & 6].

5- Radial nerve [C 5, 6, 7, 8, T1]. ***(Frank, S. et al., 1994 and Williams et al., 1995).***

ANATOMY OF THE RADIAL NERVE

The radial nerve is the largest branch of the brachial plexus. It arises from the posterior cord of the brachial plexus, C5,6,7,8 and T1 *(Carlson and Logigian 1999).*

Course and relations of the radial nerve:

In the axilla and the spiral groove :

The radial nerve descends behind the thrid part of the axillary artery and the upper part of the brachial artery, anterior to the subscapularis and the tendons of the latissimus dorsi and teres major muscles. The nerve leaves the axilla at the lower border of the teres major muscle, by entering the spiral groove on the back of the humerus, with the arteria profunda brachii and later with its radial collateral branch. Then it inclines dorsally between the long and medial heads of the triceps, after which it passes obiquely across the back of the humerus between the lateral and medial heads of the triceps muscle *(Williams et al., 1995).*

On the lateral side of the arm:

On reaching the lateral side of the humerus the radial nerve pierces the lateral intermuscular septum to enter the anterior compartment, then it descends in a deep furrow between the brahialis and proximally the brachioradialis, then more distally the extensor carpi radialis longus. This furrow is called the radial tunnel *(Lotem et al., 1971 and Williams et al., 1995).*

Boundareis of the radial tunnel:

Medial side: brachialis muscle and biceps tendon.

Anterolateral wall : brachioradialis and extensor carpi radialis longus muscles.

Posterior wall: capitulum of the humerus *(Fred R and Lutz, 1991).*

Anterior to the lateral epicondyle the radial nerve divides into the superfical and deep terminal branches *(Williams et al., 1995).*

BRANCHES OF THE RADIAL NERVE :

1- Muscular branches:

Medial muscular branches which arise from radial nerve in the axilla and supply the medial and long heads of the triceps, the branch to the medial head is long, slender, lying close to the ulnar nerve and is often termed the ulnar collateral nerve. **A large posterior muscular branch** arises from the nerve as it lies in the humeral groove, it then divides to supply the meidal and lateral heads of the triceps and the anconeus by a long nerve which descends through the substance of medial head of the triceps and partially supplies it; it is accompanied by the middle collateral branch of the arteria profunda brachii and passes behind the elbow joint to end in the anconeus. **Lateral muscular branches which** arise in front of the lateral intermuscular septum and supply the lateral part of the brachialis, brachioradialis and extensor carpi radialis longus muscles *(Williams et al., 1995).*

2- Cutaneous branches:

The posterior cutaneous nerve of the arm which arises in the axilla and supplies the skin on the dorsal surface of the arm as far as the olecranon. **The lower lateral cutaneous nerve of the arm which** arises in the spiral groove, then perforates the lateral head of the triceps distal to the deltoid tuberosity, and descends to the front of the elbow close to the cephalic vein. It supplies the skin of the lateral part of the lower half of the arm. **The posterior cutaneous nerve of the forearm which** arises in the spiral groove, then perforates the lateral head of the triceps and

descends first lateral in the arm, then along the dorsum of the forearm as far as the wrist. It supplies the skin in its course and joining, near its end, with dorsal branches of the lateral cutaneous nerve of the forearm *(Williams et al., 1995)*.

3- Articular branches which are distributed to the elbow joint *(Williams et al., 1995)*.

4- Superficial terminal branch:

It descends from the lateral epicondyle anterolaterally in the proximal two-thirds of the forearm, it descends lateral to the radial artery, successively anterior to the supinator, pronator teres, radial head of the flexor digitorum superficialis and flexor pollicis longus. It leaves the artery about 7 cm proximal to the wrist, passing deep to the tendon of the brachioradialis, and curves medially round the lateral side of the radius to reach the dorsum of the hand. Then it pierces the deep fascia and divides into five and sometimes four dorsal digital nerves. On the dorsum of the hand it usually communicates with the posterior and lateral cutaneous nerves of the forearm. The pollicial digital nerves reach to the root of the nail, those in the index midway along the middle phalanx, those to the medius and the lateral part of the annularis not farther than the proximal inter-pahlangeal joints. These dorsal digital nerves of the radial nerve may be distributed to the radial two-thirds of the dorsum of the hand. *(McMinn, 1994 and Williams et al., 1995).*

The superficial terminal branch of the radial nerve may supply the whole dorsum of the hand *(Sayfi, 1967).* It may supply only the radial 2 ½ digits *(Auerbach et al., 1994 and Ndiaye et al., 1996).*

5- Deep terminal branch (posterior interosseous nerve):

It reaches the back of the forearm round the lateral aspect of the radius and between the two planes of the supinator muscle fibres. In the average, the posterior interosseous nerve enters the supinator muscle, 5 cm distal to the tip of the lateral epicondyle of the humerus through the fibrous arch known as the arcade of Frohse (in 30% of adults) which is formed by the tendinous thickened edge of the proximal border of the superficial head of the supinator ***(Spinner, 1968; Lister et al., 1979 and Williams et al., 1995).***

The posterior interosseous nerve enters the supinator 3 cm distal to the radiohumeral joint, and gets out from the muscle either under the distal edge of the supinator muscle in 50% or passes through the supinator muscle 4.2 cm distal to the articular surface of the radial head in the other 50% ***(Seradge et al., 2000).***

The posterior interosseous nerve supplies the extensor carpi radials brevis and the supinator before entering it, and as it traverses the supinator it supplies it again with additional branches. The branch to the extensor carpi radialis brevis may arise from the beginning of the superficial branch of the radial nerve. As the posterior interosseous nerve emerges from the supinator posteriorly it gives off : **a) Three short branches to supply** the extensor digitorum, extensor digiti minimi, extensor carpi ulnaris. **b) Two long branches,** a ***medial*** to the extensor pollicis longus and extensor indicis, and a ***lateral***, supplying the abductor pollicis longus and ending in the extensor pollicis brevis. The nerve is at first between the superficial and deep extensor muscles, but at the distal border of the extensor pollicis brevis it passes deep to the extonsor pollicis longus and, diminished to a fine thread. In then descends on the interosseous membrane to the dorsum of the carpus, where it presents a flattened and

somewhat expanded termination or "pseudoganglion", from which filaments supply the carpal ligaments and articulations. **Articular branches from the deep branch of the radial nerve supply** the distal radio-ulnar, some intercarpal and intermetacarpal joints and digital branches supply the metacarpophalangeal & proximal interphalangeal joints (***Williams et al., 1995).***

RADIAL NERVE COMPRESSION

Radial nerve compression may occur at any point along its anatomical course. The most frequent site of compression lies in the proximal part of the forearm *(Mark, S. et al., 2002).*

* RADIAL TUNNEL SYNDROME :

Radial tunnel is a deep furrow between brachialis medially and brachioradialis and extensor carpi radialis longus laterally *(Lotem et al., 1971).*

Radial tunnel syndrome is the most common compression neuropathy of the radial nerve *(Eversmann, 1983).* It is also, one of the most common compressions in the upper limb *(Arle and Zager, 2000).*

Fred and Lutz (1991), mentioned that, the radial tunnel syndrome was first described in 1883 and more recently by *Roles and Maudsley (1972).*

Causes of the radial tunnel syndrome:

Radial tunnel syndrome is due to a series of fibrous bands that lie anterior to the head of radius *(Roles and Maudsley, 1972).* Also, it results from the development of a radial fan of vessels that cross the radial nerve. It has been theorized that these vessels expand with exercise, causing compression of the posterior interosseous nerve *(Eversmann, 1983).*

The tendinous arcade of Frohse is an important factor in the development of the radial tunnel syndrome. This arcade is probably formed by repeated pronation and supination of the forearm throughout a

patient's lifetime, which may happen due to exercise or occupational demands *(Spinner, 1968; Lister et al., 1979 and Hong et al., 1989).*

Radial tunnel syndrome results from compression of the radial nerve by the free edge of the supinator muscle, or closely related structures in the vicinity of the elbow joint. Patients with occupations requiring repetitive manual tasks involving rotation of the forearm seem to be particularly at risk of developing radial tunnel syndrome such as athlets of racket sports *(Lawrence et al., 1995 and Dickerman et al., 2002)).*

If the tunnel is too small for any reason, the nerve can be squeezed and begin to cause pain. Repetitive forceful pushing and pulling, bending of the wirst or elbow, gripping and pinching further stretch, this irritate the nerve. Sometimes a direct blow to the lateral side of the elbow may injure or damage the radial nerve. Constant use of the arm for twisting activties can cause irritation on the radial nerve and lead to radial tunnel syndrome (*Randale, S. 1996).*

Radial tunnel syndrome is thought to result from intermittent and dynamic compression of the posterior interosseous nerve in the proximal part of the forearm associated with repeated supination and pronation. Recent studies have suggested that the posterior interosseous nerve is fixed in the supinator muscle and that the wirst pronation is the actual movement that places the most stress on the posterior interosseous nerve. There are three occupational risk factors for radial tunnel syndrome which are: The first one is the exertion of force of 1kg more than 10 times per hour, this is the main biomechanical risk factor. The second one is prolonged static load applied to the hand during work. The third one is work posture with the elbow fully extended *(Roquelaure et al.,2000).*

Physical stress by type of job was the factor most strongly correlated with ongoing cervicobrachial symptoms. Symptoms from neck and upper extremities were twice as common in workers who used vibrating hand tools. Those workers showes increased prevalence of radial tunnel syndrome in the dominant arm ***(Dimberg et al., 1989).***

Radial tunnel syndrome was found in 70% of cases of upper extremity disorders. Most of these cases were computer users. As it is thought to result from extensive keyboard work on computer ***(Pascarelli and HSU, 2000 and Ekstrom and Holden, 2002).***

Two unique anomalies were contributing factors in the radial nerve entrapment, which are the completely tendinous proximal border of extensor carpi radialis brevis and bifid origin of the same muscle ***(Moss and Switzer, 1983).***

There are five different elements that could affect the deep branch of the radial nerve in the radial tunnel and cause an entrapment syndrome which are a capsule – tendon – aponeurotic complex on the anterior aspect of both the humeroradial joint and head of radius, the vascular arcade formed by the radial recurrent artery and its branches, the arcade formed by the medial edge of extensor carpi radialis brevis muscle and the superior and inferior arcades of the superficial layer of the supinator muscle ***(Rifaud et al., 1999).***

Other less common causes of radial nerve compression are :

1) Hyperextension of the elbow, which tends to stretch the nerve anatomically, predisposing it to a narrow arcade ***(Spinner, 1968).***
2) Edema of adjacent structures, where neoplasm or inflammatory swelling may compress the nerve ***(Spinner, 1968).***

3) Another entrapment site occurs when firmly adhesions develop from surgical dissections anterior to the radial head ***(Roles and Maudsley, 1972).***
4) A tendinous arcade at the distal edge of the supinator muscle ***(Sponseller and Engber, 1983).***
5) Thickened tissue about the nerve proximal and distal to its bifurcation, particularly in patients with history of parathesias ***(Crawford, 1984).***
6) In the forearm, the radial nerve can be involved in fractures of the radial head and fractures of the radius and ulna ***(George Tindall et al., 1995).***

Radial tunnel syndrome is characterized by pain over the anterolateral proximal forearm in the region of the radial neck. The maximum tenderness is located four fingerbreadths distal to the lateral epicondyle in the region of the supinator muscle, as compared with lateral epicondylitis in which maximum tenderness is usually directly over the epicondyle. Symptoms are intensified by extending the elbow and pronating the forearm. In addition, resisted active supination and extension of the long finger extensors cause pain. Weakness and numbness usually are not demonstrated ***(Rosenbaum, 1999 and Mark S. et al., 2002).***

Patients may also complain of generalized proximal lateral forearm aching, occasionally with pain in the dorsum of the hand ***(Crawford and Narakas, 1978).***

When examining patients for radial tunnel syndrome, histories may include paresthesia in the hand and lateral forearm, pain over the forearm

extensor mass, wrist aching, and middle or upper third posterior humeral pain *(Crawford, 1984).*

* TENNIS ELBOW :

Pain and tenderness over the lateral epicondyle of the elbow is a common complaint among tennis players but even more common in nonplayers *(Connrad and Hooper, 1973).*

Tennis elbow is the commonest elbow disorder, which is only occasionally due to tennis. Most cases follow minor trauma, sharp flexion of the wrist while the extensors are contracted, often by hitting a tennis ball and unrecognized trauma. The common extensor origin is damaged and subsequent adhesions bind torn to untorn fibres and to the joint capsule. Other possible explanations include tendinitis, fibrillation of the radial head and entrapment of a branch of the radial nerve *(Graham, A. 1977 and David, D. 1993).*

Causes of tennis elbow:

In most cases, tennis elbow is caused by repetitive elbow movement *(Connrad and Hooper, 1973).*

Also tennis elbow is the result of a compression syndrome of the radial nerve and its branches *(Wilhelm, 1999).*

The two most common causes of tennis elbow which may be either distinct or coexisting, are lateral epicondylitis and radial tunnel syndrome. Lateral epicondylitis is not limited to tennis players; 95% of the reported cases occurs in non-players. The presenting symptoms are pain over the origin of extensor carpi radialis brevis and weakness of the wrist and digital extensors *(Burgess, 1990).*

The radial tunnel syndrome is one of the causes of the lateral elbow pain *(Werner et al., 1980).* This syndrome is often confused with tennis elbow, although the patient may have both problems *(Younge and Moise, 1994).* It is occasionally accompanies inflammation of the common wrist extensors and lateral epicondylitis (Tennis elbow). *(Bracker and Ralph, 1995).*

Excessive rotational movements of the forearm over an individual's life time due to occupational demands may cause lateral elbow pain, edema and inflammatory responses in the surrounding structures that decrease the already narrow space in the radial tunnel *(Fred and Lutz, 1991).*

In the refractory cases of tennis elbow, the symptoms may no longer be caused by muscle strain or edema from overuse but, rather, by an entrapment of the radial nerve and its branches in the radial tunnel *(Somerville, 1963).*

It is often difficult to differentiate between tennis elbow and the early stages of radial tunnel syndrome *(Fred and Lutz, 1991).*

Radial tunnel syndrome is often seen in patients who must repetitively pronate and supinate the forearm. In contrast, tennis elbow is often associated with forceful, repeated wrist extension, as needed in various racquet sports *(Connrad and Hooper, 1973).*

* POSTERIOR INTEROSSEOUS NERVE SYNDROME:

The most common level of entrapment of the posterior interosseous nerve is at its entrance into the supinator muscle and also, it may be entrapped at its exit from this muscle *(Sponseller and Engber 1983).*

Compression of the posterior interosseous nerve within and just distal to the anatomic region known as the radial tunnel is responsible for a constillation of signs and symptoms known as radial tunnel syndrome. There are four structures commonly implicated, which include the fibrous adhesions between the brachialis and brachioradialis, the fibrous edge of the extensor carpi radialis brevis, the arcade of Frohse and fibrous bands associated with the supinator muscle ***(Barnum et al., 1996).***

The etiology of posterior interosseous nerve syndrome is similar to that of radial tunnel syndrome. Compression is thought to occur after take off the branches to the radial wrist extensors and the radial sensory nerve. Other possible etiologies for posterior interosseous nerve dysfunction include trauma (Monteggia fractures), synovitis (rheumatoid), tumors and iatrogenic injuries. Patients with this syndrome present with weakness or paralysis of the wirst and digital extensors. Pain may be present, but it is not usually a primary symptom. Attempts at active wrist extension often result in weak dorsoradial deviation due to preservation of the radial wrist extensors but invovlement of the extensor carpi ulnaris and extensor digitorum. These patients do not have a sensory deficit ***(Mark Stern et al., 2002).***

* WARTENBERG'S SYNDROME:

It is due to entrapment of the superficial sensory branch of the radial nerve. Many factors may contribute to the development of this syndrome as post surgical injury, external compression, trauma, secondary irritation and in patients with de Quervain tendovaginitis. The anatomic site of compression corresponds to the transit of the nerve from its submuscular position, beneath the brachioradialis to its subcutaneous position on the extensor carpi radialis longus. Especially with pronation,

these two muscles can create a scissorlike effect compressing the sensory branch of the radial nerve. Patients with the diagnosis of this syndrome complain of pain over the distal radial forearm associated with paresthesias over the dorsal radial hand *(Mark, S. et al., 2002).*

* SATURDAY NIGHT PALSY :

It is produced by compression of the radial nerve as it spirals around the humerus. Most commonly it occurs when a person falls a sleep or, intoxicated, held up by his arm thrown over the back of a chair. The characteristic lesion is wrist drop with inability to extend the wrist and metacarpophalangeal joints, but the interphalangeal joints can still be straightened by the action of the interossei and lumbricals. The triceps is usually spared. Sensory loss is minimal and usually confined to a coin – shaped area overlying the first dorsal interosseous, a much smaller area than the distribution of the nerve as seen in dissections; because there is apparently much overlap from the median and ulnar nerves *(McMinn, 1994; George, T. et al., 1995 and Craig, F. et al., 2002).*

* RADIAL NERVE INJURY:

1- Radial nerve injury in the axilla:

Complete interruption of the radial nerve in or above the axilla cuases paralysis and wasting of all muscles it supplies. Paralysis of the triceps leads to inability to extend the elbow. Paralysis of the brachioradialis is detected through failure of this muscle to contract, when the patient flexes the elbow with the forearm midway between pronation and supination, the brachioradialis acting as a flexor of the elbow and not as a supinator. Paralysis of the supinator leads to loss of supination. Paralysis of the extensors of the wirst and fingers causes

wrist-drop and finger- drop. Following a pressure palsy of the radial nerve, sensory loss is variable and may be absent but if present, it is found usually on the dorsum of the hand between the thumb and index finger ***(Downie and Scott, 1967).***

Radial nerve injury in the axilla and upper arm is associated with stretch to the distal brachial plexus outflow, sometimes as a result of a gunshot wound or a penetrating injury. Compression of the axilla can also result in proximal damage, such as with crutch palsy or "Saturday night palsy" and fracture of the humeral shaft. Damage to the radial nerve at this level results in weakness of the triceps muscle and inability to extend the forearm ***(Sunderland, 1978 and George, T. et al., 1995).***

2- Radial nerve injury in the arm :

The radial nerve compression has been attributed to an accessory head of the triceps that forms a fibrous ring that the radial nerve must pass through ***(Lotem et al., 1971 and Streib 1992).***

The radial nerve also is often injured in mid-shaft fractures of the humerus, due to its close relationship to this bone without paralysis of the triceps. The nerve may also be contused against the bone by kicks or blows or be divided in incised wounds. Dislocations and epiphysial separations at the elbow and supracondylar fractures of the humerus in children often lead to ulnar, median or posterior interosseous nerve injury ***(Williams et al., 1995).***

The radial nerve is frequently more involved in entrapment syndromes than the ulnar and median nerves. Common sites of compression are, at the junction of the middle and distal thirds of the arm (especially with fractures of the humerus), just distal to the elbow (radial

tunnel), and proximal to the wirst between the brachioradialis and extensor carpi radialis longus ***(Kleinert and Mehta, 1996).***

The radial nerve may be involved in multi-neuropathic processes forming part of a systemic illness (Vasculitis, diabetes, etc.) or of a purely neuro-muscular disorder, (acute neuropathy of the brachial plexus, neuropathy due to the effect of pressure and motor multifocal neuropathy) ***(Rodriguez-Gomez, 1998).***

Chuangsuwanich et al., (2000) found that the branches of the radial collateral artery, beneath the lateral head of triceps are one of the causes of the radial nerve compression.

The compression of the radial nerve in the arm may be due to fibrosis of the triceps muscle as a complication of chronic intramuscular injection ***(Midroni and Moulton, 2001).***

The radial nerve may be compressed by the lateral inermuscular septum and less commonly by an accessory subscapularis, teres and latissimus muscles and also, may be compressed at the fibrous arch of the lateral head of the triceps ***(Mark Stern, et al., 2002).***

Radial nerve palsy in the middle third of the arm is characterized by paralysis of all extensors of the wirst and digits, as well as the forearm supinators. Very proximal lesions also may affect the triceps. Numbness occurs on the dorsoradial aspect of the hand and the dorsal aspect of the radial three and half digits. Sensation over the distal and lateral forearm is preserved ***(Mark, S. et al., 2002).***

3- Radial Nerve injury in the forearm:

Radial nerve compression or injury may occur at any point along its anatomical course. The most frequent site of compression is in the proximal forearm in the area of the supinator muscle which involves the posterior interosseous branch ***(Mark, S. et al., 2002)***.

The radial nerve can be involved in fractures of the radial head and fractures of the radius and ulna; in these cases, wrist drop results ***(George, T. et al., 1995).***

The posterior interosseous nerve distal to the supinator muscle may be compressed by various structures. These include the distal border of the supinator muscle, the ramifications of the anterior and posterior interosseous vessels, and the septum between the extensor carpi ulnaris and the extensor digiti minimi ***(Portilla, M. et al., 1998).***

The sensory branch of the radial nerve may be damaged when the cephalic vein is cannulated. So, the vein should be punctured at least 12 cm above the level of the styloid process of radius. ***(Edwards and Fleming, 1981 and Vialle et al., 2001).***

The nerve injury secondry to compression was classified into three categories:

1- Neuropraxia is a transient episode of motor paralysis with little or no sensory or autonomic dysfunction. No disruption of the nerve or its sheath occurs. With removal of the compressing force, recovery should be complete.

2- Axonotmesis is a more severe nerve injury with disruption of the axon but with maintenance of the Schwann sheath. Motor, sensory and autonomic paralysis result. Recovery can occur if the