ROLE OF INTERVENTIONAL RADIOLOGY IN THE MANAGEMENT OF COMPLICATIONS OF DIALYSIS SHUNT

Thesis
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دور الأشعة التداخلية في علاج مشاكل الوصلة الشريانية الوريدية في مرضى الفشل الكلوي

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INTRODUCTION

Arteriovenous fistulas are the most common form of vascular access for hemodialysis in patients with end-stage renal disease *(Le Blanche et al., 2002)*. Maintenance of acceptable vascular access is one of the most vexing problems for those patients, whose lives depend on hemodialysis *(Turmel-Rodrigues et al., 2000)*. Therefore, every reasonable effort should be made to preserve existing access sites *(Ryan et al., 2003).*

The short-term complications of vascular access surgery are venous stenosis, stenosis at the site of suture, or thrombosis *(Le Blanche et al., 2002)* ,however, infection and outflow vein stricture resulting in thrombosis are the most common causes of loss of vascular access in patients with synthetic arteriovenous hemodialysis grafts *(Zaleski et al., 2001).* Thrombosis of a patient's dialysis shunt is a matter of medical urgency, and failure to obtain access for hemodialysis will ultimately lead to death *(Turmel- Rodrigues et al., 2000).*

Interventional radiology is a dynamic new field of medicine that offers many helpful capabilities. The advantages of interventional radiology over surgery

include much smaller incisions, less risk to the patient, much shorter hospitalization and recovery time and lower costs than with surgery *(Ryan et al., 2003).*

Various procedures of interventional radiology can be applied for treatment of stenotic or occluded hemo-dialysis shunt like pharmacomechanical thrombolysis, balloon angioplasty and placement of intragraft stent.

Cooper, (2003) mentioned that pulse-spray pharmacomechanical thrombolysis with streptokinase, urokinase or rt-PA can be an effective method for efficient percutaneous recanalization of thrombosed hemodialysis access grafts.

Percutaneous treatment of outflow stenosis using balloon angioplasty prolongs graft patency and overall access life *(Funaki et al., 2002).*

The placement of intragraft stents was useful in prolonging graft function in patients who had limited or no surgical options. Intragraft stent placement should be considered in patients if an intragraft stenosis is causing recurrent thrombosis *(Zaleski et al., 2001).*

By the use of these procedures, the resumption of efficient dialysis is accomplished, and surgery or abandonment of the graft is avoided *(Ryan et al, 2003).*

AIM OF THE WORK

Aim of the work is to evaluate and compare different procedures of interventional radiology in the management of complicated hemodialysis shunt highlighting their different abilities, advantages and disadvantages.

ANATOMY

I- Arteries of upper limbs

1) Axillary artery:

This is the continuation of the third part of the subclavian artery. It enters the apex of the axilla by passing over the 1st digitations of serratus anterior, at the outer border of the 1st rib, behind the midpoint of the clavicle. It is invested in fascia, the axillary sheath, projected down from the prevertebral fascia. At the lower border of teres major muscle it becomes the brachial artery .It is conveniently divided into three parts by pectoralis minor: the part above, the part behind and the part below (Fig. 1) (*McMinn, 1994).*

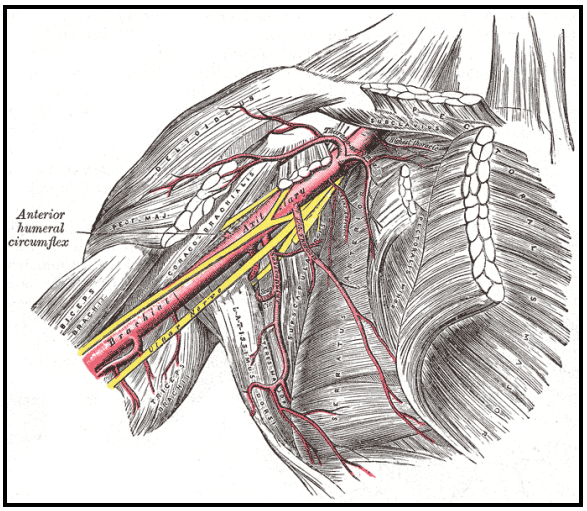

Fig. (1): The axillary artery and its branches *(Quoted from William et al, 1995)*

Branches:

- From the 1st part: The superior thoracic artery.
- From the 2nd part: Thoraco acromial and lateral thoracic arteries.
- From the 3rd part: Subscapular, anterior and posterior circumflex humeral arteries.

1- The superior thoracic artery:

It arises from the first part and runs forward to supply both pectoral muscles.

2- The Thoracoacromial artery:

Pierces the fascia and ends as four terminal branches (clavicular, deltoid, acromial, and pectoral).

3- The lateral thoracic artery:

Passes over the serratus anterior to supply the pectoralis major and minor; a contributor of blood supply to the breast in females.

4-The subscapular artery:

The largest branch of axillary and runs down the posterior axillary wall.

5 –The anterior circumflex humeral artery:

It winds around the front of the humerus.

6- The posterior circumflex humeral artery:

It is a large branch that passes backward to supply the deltoid, triceps and shoulder joint ***(McMinn, 1994).***

2) Brachial artery:

The brachial artery, a continuation of the axillary, begins at the distal (inferior) border of the tendon of teres major and ends about a centimeter distal to the elbow joint (at the level of neck of radius) by dividing into radial and ulnar arteries. At first it is medial to humerus, but gradually spirals anterior to it until it lies midway between the humeral epicondyles (Fig. 2) ***(William et al, 1995)***.

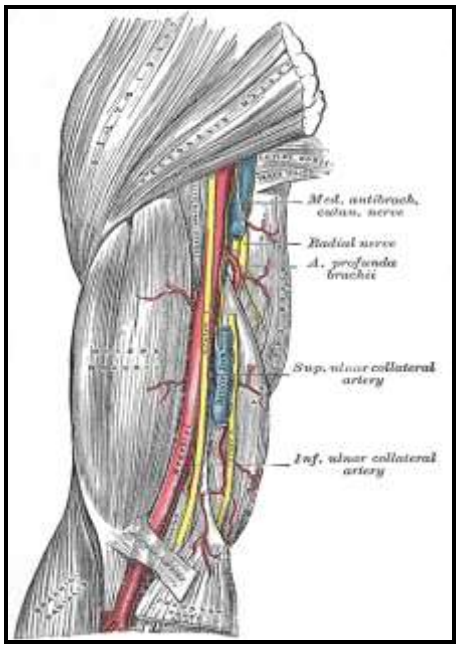

Fig. (2): The brachial artery. ***(Quoted from William et al., 1995)***

Branches:

1) Profunda brachii artery:

It arises from the back of the brachial artery near its origin and leaves to run in the radial groove with the radial nerve. It ends as anterior and posterior anastomotic branches at the cubital fossa.

2) Superior and inferior ulnar collaterals:

They take part in the cubital anastomosis.

3) Nutrient artery: To the humerous.

4) Muscular brnches: to muscles of the arm.

5) Terminal branches: the radial and ulnar arteries.

(Mc Minn, 1994)

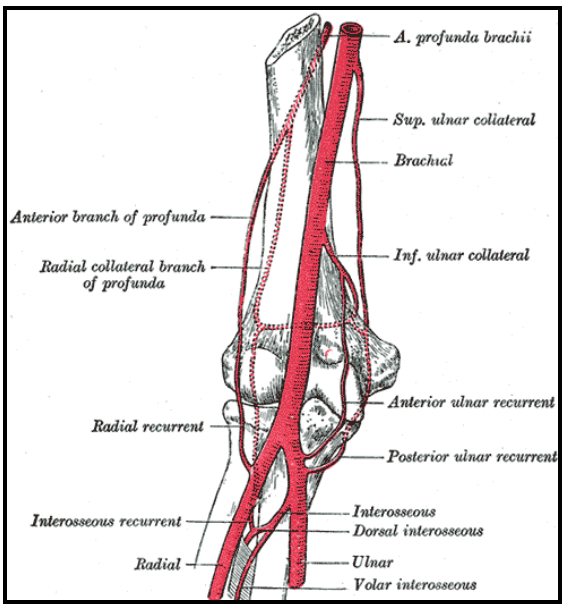

Fig. (3): Radial artery & its branches - Anastomosis around the elbow joint ***(Quoted from William et al, 1995)***

3) Radial Artery:

The radial artery appears, from its direction, to be the continuation of the brachial, but it is smaller in caliber than the ulnar. It commences at the bifurcation of the brachial, just below the bend of the elbow, and passes along the radial side of the forearm to the wrist. It then winds backward, around the lateral side of the carpus, beneath the tendons of the Abductor pollicis longus and Extensores pollicis longus and brevis to the upper end of the space between the metacarpal bones of the thumb and index finger. Finally it passes forward between the two heads of the first Interosseous dorsalis, into the palm of the hand, where it crosses the metacarpal bones and at the ulnar side of the hand unites with the deep palmar branch of the ulnar artery to form the deep palmar arch *(William et al, 1995).*

Branches:

1- Muscular branches to the neighboring muscles

2- Recurrent branches which take part in the anastomosis around the elbow.

3- Superficial palmar branch: It descends to the thenar muscles and anastomoses with the ulnar artery to complete the superficial palmar arch.

4- Palmar and dorsal carpal branches.

5- Princips pllicis

6- The radialis indicis artery

7- The deep pulmar arch: It is deep complete archade formed by the terminal branch of radial artery anastomosing with the deep branch of the ulnar artery.

(Mc Minn, 1994)

4) Ulnar artery:

The ulnar artery, the larger of the two terminal branches of the brachial, begins a little below the bend of the elbow, and, passing obliquely downward, reaches the ulnar side of the forearm at a point about midway between the elbow and the wrist. It then runs along the ulnar border to the wrist lateral to the pisiform bone. Distal to this it has a deep branch and then continues across the palm as the superficial palmar arch *(William et al, 1995).*

Branches:

1- Muscular branches: distribute to the muscle of the ulnar region.

2- Common interoseous artery: It passes back to the proximal border of the interosseous

membrane diving into anterior and posterior arteries.

3- Anterior and posterior ulnar recurrent arteries.

4- Palmar and Dorsal carpal branches.

5- Deep palmar branch: It anastomoses with the radial completing the deep palmar arch.

6- Superficial palmar arch: It is fed mainly by the ulnar artery anastomosing with the superficial palmar branch of radial artery.

(Mc Minn, 1994)

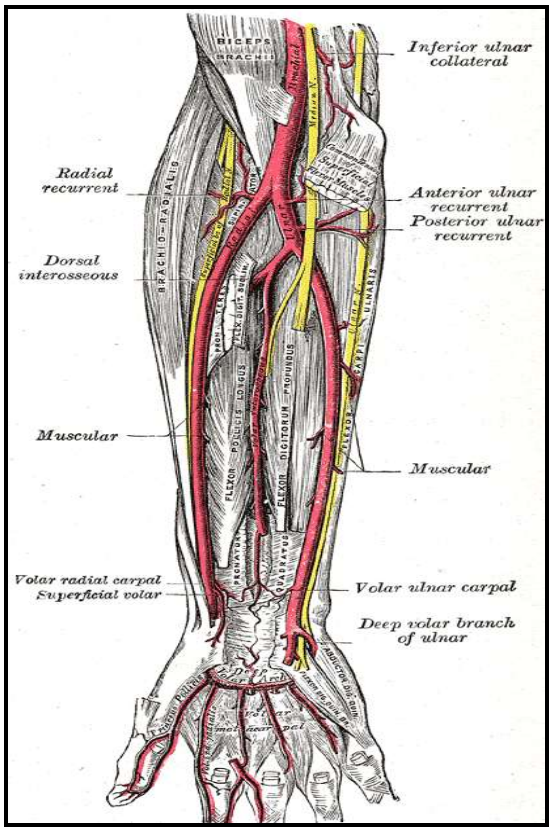

Fig. (4): Radial and ulnar arteries *(Quoted from William et al., 1995)*

II- Venous drainage of upper limbs

Veins are conveniently grouped into superficial and deep but these are widely interconnected. The superficial veins are subcutaneous in the superficial fascia; deep veins accompany arteries between the muscles of the limb. Both groups have valves, which are more numerous in deep veins *(William et al., 1995).*

Superficial veins

1- Cephalic vein

It passes on the lateral side of the wrist across the anatomical snuff box and winds around onto the anterior aspect of the forearm. It then ascends into the arm in the superficial fascia and runs along the lateral border of the biceps in the deltopectoral groove. It ends by piercing the clavipectoral fascia to drain into the axillary vein *(Ellis, 1997).*

Distal to the elbow, it gives off the median cubital vein which receives a communicating branch from the deep veins of the forearm and passes across to join the basilic vein *(William et al., 1995)*.

As the cephalic vein passes up in the upper limb, it receives a variable number of tributaries from the lateral and posterior surfaces of the limb *(Ellis, 1997)*.

Sometimes the median cubital vein is large, transferring most blood from the cephalic to the basilic vein, the proximal cephalic vein then being absent or much diminished *(William et al., 1995).*

2- Basilic vein

Begins medially in the hand's dorsal venous network, it ascends posteromedially in the forearm inclining forwards to the anterior surface distal to the elbow, where it is joined by the median cubital vein, it ascends obliquely in the groove between the Biceps brachii and Pronator teres .It then runs upward along the medial border of the Biceps brachii, perforates the deep fascia a little below the middle of the arm, and ascends on the medial side of the brachial artery to the lower border of the teres major, is continued onward as the axillary vein *(William et al, 1995).*

3-The median antibrachial vein

It drains the venous plexus on the palmar surface of the hand. It ascends on the ulnar side of the front of the forearm and ends in the basilic vein or in the vena mediana cubiti; in a small proportion of cases it divides into two branches, one of which joins the basilic, the other joins the cephalic, below the elbow *(William et al., 1995).*

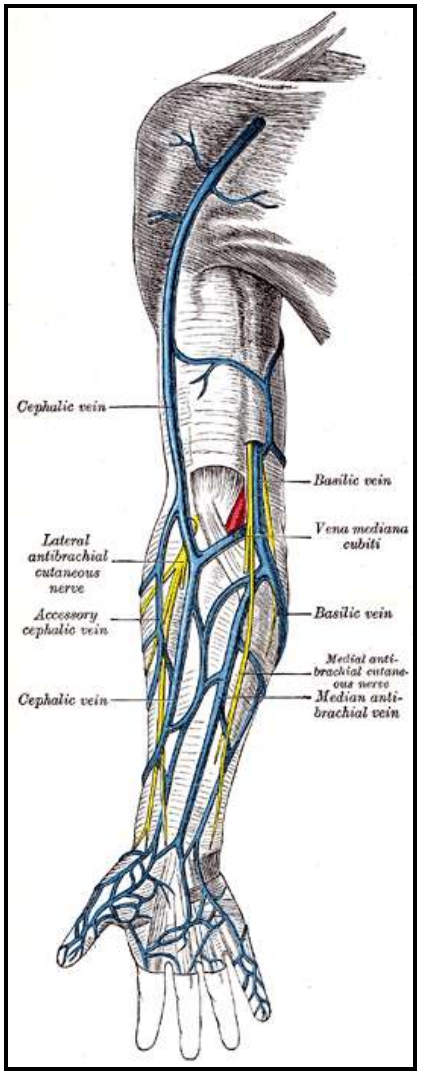

Fig. (5): The superficial veins of the upper extremity ***(Quoted from William et al., 1995)***.

Deep veins

These veins are plentiful and accompany the arteries, usually by double venae comitants, which anastomose freely with each other. They drain the forearm but bring relatively little blood from the hand ***(Mc Minn, 1994).***