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التوثيق الالكتروني والميكروفيلم

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2005

**Haemodynamic Evaluation of the Upper Limb after
Creation of Proximal Forearm Arteriovenous Fistula for
Haemodialysis in Patients with Chronic Renal Failure**

Thesis submitted to
The Faculty of Medicine
University of Alexandria

In partial fulfillment of the
Requirements of the degree of

MASTER OF GENERAL SURGERY

By

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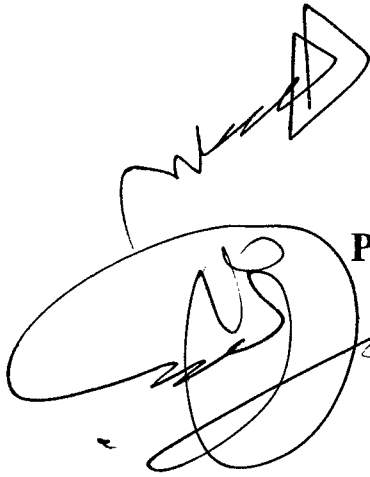
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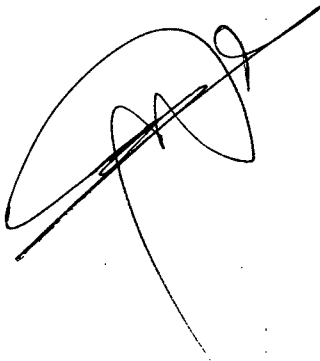


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Introduction

INTRODUCTION

Chronic Renal Failure:

Chronic renal failure is a progressive disease characterized by gradual and progressive impairment of both glomerular filtration and tubular functions, so that the kidneys are no longer able to keep normal internal environment. ⁽¹⁾

Chronic renal impairment ranges from mild dysfunction to severe kidney failure, progression may continue to end stage renal disease. ⁽²⁾ The course of progression of the disease can be divided into four stages: ⁽³⁾

1. Reduced functional reserve:

When glomerular filtration rate (GFR) declines to 50-60ml/minute.

2. Marked renal insufficiency:

As the glomerular filtration rate falls to 25-40ml/minute.

3. Renal failure:

As the glomerular filtration rate (GFR) falls below 25ml/minute.

4. End stage renal disease (ESRD):

This is the most advanced stage of chronic renal failure in which virtually the renal functions are lost and the glomerular filtration rate (GFR) is below 10ml/minute.

Guidelines to initiate haemodialysis in chronic renal failure:

The guidelines for the initiation of dialysis are based primarily on the serum creatinine concentration or creatinine clearance. Dialysis is initiated when creatinine clearance falls below 10 ml/min for non diabetic patients while for diabetic is below 15 ml/min as they exhibit uraemic signs and symptoms earlier. In 1997, the National Kidney Foundation (NKF) published clinical practice guidelines for initiation of dialysis depending on clinical signs and symptoms. ⁽⁴⁾

Dialysis in patients with chronic renal failure is either:

A) Peritoneal dialysis:

This is one of the renal substitutional therapies applied by introduction of a catheter midway between the umbilicus and symphysis pubis and infusion of the dialysis solution into the peritoneal cavity. ^(4, 5)

B) Haemodialysis:

The principle of Haemodialysis is based on the diffuse exchange of uremic solute, through a semipermeable membrane along a concentration gradient. ⁽⁶⁾

The number of patients on chronic haemodialysis is increasing dramatically. Currently the population of dialysis patients has been increasing at a rate of 10% per year. ⁽⁴⁾

The cornerstone of haemodialysis is a set of operations known as dialysis access surgery including: haemodialysis catheter procedures, AV fistulae and AV bridge grafts. Dialysis access is now the most common vascular operation and as a consequence it may account for as much as 40-50% of the practice of a busy general vascular surgeon. ⁽⁷⁾

VASCULAR ACCESS (ANGIOACCESS)

Vascular access or angioaccess may be defined as any technique that allows removal from and delivery of fluids into the circulatory system at a rate of 200ml/min or more for lengthy intervals without complications.⁽⁸⁾

The National Kidney Foundation (NKF) published clinical practice guidelines for vascular access in 1997. According to these guidelines, surgical referral for placement of vascular access should occur when the patients' creatinine clearance falls below 25ml/min, serum creatinine above 4 mg/dl or within one year of the anticipated need for dialysis.⁽⁵⁾

The need for vascular access in patients with end stage renal disease (ESRD)⁽⁵⁾ can be either:

A. Temporary (Acute haemodialysis access):

Temporary access may vary from several hours (single dialysis) to months (if used to dialyze while waiting for an arteriovenous fistula (AV) fistula to mature).⁽⁹⁾ The temporary access is established by the percutaneous insertion of a catheter whether rigid catheter or cuffed soft catheter into a large vein (femoral, internal jugular, less desirably subclavian vein).

These venous access catheters can be placed percutaneously or by venous cutdown surgically using purse string sutures on the anterior venous wall to attain haemostasis.⁽⁹⁾

Once the catheter has been placed, intra-operative venography is advisable to be sure of the location of the catheter, the tip of the catheter should be at the junction of the right atrium and superior vena cava. Also, upright chest X-ray is obtained to exclude presence of haemothorax or pneumothorax. ⁽¹⁰⁾

B. Chronic (Permanent haemodialysis access):

The permanent methods allow vascular access for months to years and they include subcutaneous anastomosis of an extremity artery to a nearby vein (arteriovenous fistula), subcutaneous interposition of a tube graft between an extremity artery (donor) and vein (recipient) which is known as arteriovenous graft or (arteriovenous bridge fistula) and finally implantation of a soft cuffed double or triple lumen catheter into a central vein mainly internal jugular (long term venous access). ⁽¹⁰⁾

Historical aspects:

The first clinical report of Haemodialysis for renal failure is credited to Wilhelm Kolff ⁽¹¹⁾ in 1933. Although the dialysis was effective in controlling azotemia, this access for dialysis was a significant problem since it required surgical exposure and ligation of the arteries and veins during each dialysis sessions. ⁽¹¹⁾

The Scribner ⁽¹²⁾ shunt was developed by Quinton ⁽¹²⁾ et al in 1960. Patients could be dialyzed repeatedly for long time without the necessity of a surgical cannulation of the vessels. The shunts were designed to pass through the skin and thus could be placed at bed side.

The original cannula used was made of polytetrafluoroethylene (Teflon) and rarely could be used for more than three months because of problems with infection and thrombosis.⁽¹²⁾

In the same year 1960, Shaldon⁽¹³⁾ and associates introduced the technique of the first percutaneous dialysis catheter using a Teflon single lumen catheter. Two catheters were placed in an artery and a vein at the time of dialysis sessions and removed when the session is completed.⁽¹³⁾

In 1966, Brescia⁽¹⁴⁾ et al reported their experience with the radio-cephalic arteriovenous fistula (Brescia-Cimino fistula) constructed subcutaneously at the wrist which allowed long term haemodialysis access with dramatic reduction in the complications such as thrombosis, infection and bleeding. It became the gold standard for haemodialysis access.⁽¹⁴⁾

The major determinants for a successfully created Brescia-Cimino fistula were creation of the fistula before starting dialysis as well as good quality of both artery and vein.⁽¹⁵⁾

Chronic Permanent Haemodialysis Access

The chronic haemodialysis access could be achieved either by:

- A) **Primary procedure** using direct arteriovenous fistula where union of a vein and artery in such a way as to allow blood flow from the artery into the vein, returning blood to the central venous circulation.

There are different sites for these primary procedure and these includes:

Upper extremity:

A- Distal fistula:

1. Brescia-Cimino fistula:^(14,15)

The Brescia-Cimino ^(14, 15) fistula is by far the most popular one. It is usually performed under local anesthesia.

A longitudinal skin incision of about 5cm is made roughly midway between the cephalic vein and the radial artery at the wrist figure (2).

Dissection of both cephalic vein and radial artery is done and the distal cephalic vein may be left intact if a side to side anastomosis is planned which is the classic Brescia-Cimino ^(14,15) fistula but most divide the vein distally to do end to side anastomosis. Other anastomotic configurations that may be used are end to side, artery-to-vein fistula or end to end artery to vein. Then controlling both artery and vein by vascular clamp is done and a longitudinal arteriotomy about 8-10mm is made and the anastomosis is performed using double needle (ended) 6/0 polypropylene sutures. Closure of the skin is the last step without subcutaneous closure and without a drain. ^(14, 15)

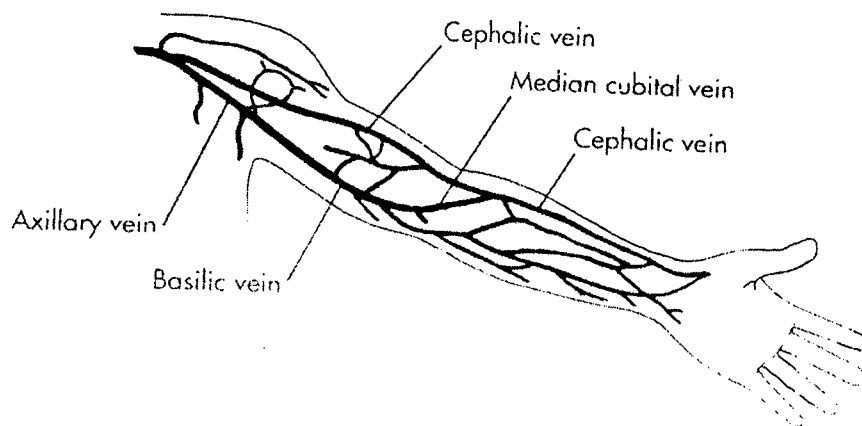


Figure 1: *Venous anatomy of the upper extremity.*