The Relationship Between Arteriovenous Fistula And Cardiac Abnormalities In Haemodialysis Patients

"Thesis"

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By

Eyad Mohammed Mohammed Abdelwahab

M.B.B.Ch-Al Azhar University

Under supervision of

Dr. Tarek Zakaria El Baz

Prof .of internal medicine
Faculty of medicine, Al Azhar University

Dr. Tarek Abdelhamid Elziat

Prof. of radiology
Faculty of medicine, Al Azhar University

Dr. Wael Mohammed Attia

Lecture of cardiology
Faculty of medicine, Al Azhar University

Faculty of medicine

Al Azhar University

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LIST OF ABBREVIATIONS

Abbreviations	Meaning of abbriviations
AVF	arteriovenous fistula
AVG	Arteriovenous graft
BAM	Balloon-assisted maturation
CDUS	Color Doppler ultrasonography
CKD	chronic kidney disease
CO	Cardiac output
CVC	central venous catheters
CTC	Cuffed tunnel catheter
DOPPS	Dialysis outcomes and practice patterns study
DSA	digital subtraction angiography
EF	Ejection fraction
ESRD	End stage renal disease
EBPG	European best practice guideline
FS	Fractional shortening
HD	Hemodialysis
K/DOQI	Kidney Foundation Dialysis Outcomes Quality Initiative (K/DOQI)
LVH	Left ventricular hypertrophy
LVM	Left ventricular mass
LVMI	Left ventricular mass index
LVEDd	Left ventricular end diastolic diameter
LVESd	Left ventricular end systolic diameter
MDCT	Multidetector row computed tomographic
PTEF	polytetrafluoroethylene graft
Qa	Access blood flow
RWT	Relative wall thickness
SV	Stroke volume

VA	**Vascular access**
VABF	**VA blood flow**
VAT	**VA thrombosis**

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Introduction

Angioacess is the life line for haemodialysis patient.Although the arteriovenous fistula (AVF) is an unphysiological encroachment upon the cardiovascular system. it is seldom considerd a cardiovascular risk factor in haemodialysis patients.***(Macrea et al., 2010).***

Several authors suggested the association between AVF and left ventiricular hypertrophy, high cardiac output failure and other cardiovascular abnormalities ***(Martien et al., 2010).***

Duplex ultrasound is a non invasive sensetive method for evaluation of haemodialysis acess ***(Basile et al., 2008).***

Measurment of acess blood flow (Qa) has become common over the past decade.Qa might serve as a marker of cardiovascular health and may be used to predict clinical outcomes in dialysis patients ***(Mohammed et al., 2008)***

Aim of the work

To assess the effect of high flow AVF on cardiac functions and to study the cardiac functions in relation to the AVF sites.

Vascular access of dialysis

The number of patients with end-stage chronic kidney disease (CKD) requiring renal replacement therapy has increased progressively worldwide ***(Egger., 2011)***.

Permanent vascular access (VA) is the life-line for the majority of these patients when hemodialysis (HD) is the treatment of choice. Thus, the successful creation of permanent VA and the appropriate management to decrease the complications is mandatory. A good functional access is also vital in order to deliver adequate HD therapy in end-stage renal disease (ESRD) patients.

Despite the advances that have taken place in the field of nephrology and particularly in dialysis, few things have changed in recent years with regards to VA, mainly the introduction of the polytetrafluoroethylenegraft(PTEF), and the cuffed double lumen silicone catheter. However, the cost of VA related care was found to be more than five-fold higher for patients with arteriovenous graft (AVG) compared to patients with a functioning arteriovenous fistula (AVF) ***(Lee et al., 2002).***

It seems that the native AVF that Brescia and Cimino described in 1966 still remains the first choice for VA ***(Santoroet al., 2006).***

Thereafter, VA still remains the "Achilles' heel" of the procedure and HD VA dysfunction is one of the most important causes of morbidity in this population ***(Allon., 2002*).**

It has been estimated that VA dysfunction in patients under regular HD is responsible for 20% of all hospitalizations. The annual cost of placing and looking

after dialysis VA in the United States exceeds 1 billion dollars per year ***(Royet al., 2003).***

Nowadays, three types of permanent VA are being used: AVF, AVG and cuffed central venous catheters (CVC). They all have to be able to provide enough blood flow to deliver adequate HD, to have a long use life and a low rate of complications. The native forearm AVF has the longest survival and requires the fewest interventions. For this reason, the forearm AVF is the first choice, followed by the upper-arm AVF, the AVG and lastly the cuffed CVC as the last option ***(Grapsa et al., 2000).***

Historical background ofangioaccess:

The history of HD VA is closely associated with the history of dialysis**.** ***Kolff., (1956),*** performed the first HD treatment in humans using glass cannulae to acquire blood from the radial artery and reverting it to the cubital vein in 1924. In 1943, venepuncture needles were used by ***Kolff., (1956),*** for blood acquisition from the femoral artery and its reinfusion to the patient by vein puncture. ***Quinton et al., (1960),*** developed the arteriovenous teflon shunt in the 60s. In 1966, Brescia, Cimino, Appel and Hurwich published their paper about AVF.

In 1968, ***Röhl et al., (1968),*** published thirty radial-artery-side-to-vein-end anastomoses. Today, the artery-side-to-vein-end anastomosis has become the standard procedure ***(Konner et al., 2003).***

Bakeret al., (1976), presented the first results with expanded PTFE grafts in 72 HD patients.

Prevalence rate of different types of VA:

Vascular access type differs in different countries. Furthermore within the same country vascular access differs according to many factors like: age, gender, presence of diabetes, is vascular access done for incident HD (less than 150 days), or prevalent HD (more than 150 days), or other vascular disease, when patient was firstly seen by nephrologist.

There are many differences worldwide regarding the most common type of VA being used. In Australia among adults patients on HD, separated into incident (< 150 d since first dialysis) and prevalent cohorts (≥ 150 d), AVF was used in 61% *vs.* 77%, AVG was used in 11% *vs* 19%, and CVC was used in 28% *vs.* 4% in the both group of cohorts, respectively ***(Polkinghorne et al., 2003).***

A direct broad-based comparison of VA use and survival in Europe (EUR) and the United States was reported in a representative study [Dialysis outcomes and practice patterns study, (DOPPS)] which used the same data collection protocol for more than 6400 HD patients to compare VA use at 145 United States dialysis units and 101 units in five European countries (France, Germany, Italy, Spain and the United Kingdom).

AVF was used by 80% of European and 24% of United States prevalent patients and was significantly preferred for younger age, male gender, lower body mass index, non-diabetic status, lack of peripheral vascular disease and no angina.

After adjusting for these factors, AVF *vs.* graft use was still much higher in Europe than United States (83% *vs.* 21%). For patients who were new to HD, access use was: 66% AVF in Europe *vs.* 15% in United States, 31% catheters in Europe *vs.* 60% in United States and 2% grafts in Europe *vs.* 24% in United States. In addition, 25% of European and 46% of United States incident patients did not have a permanent access placed prior to starting HD.

In Europe, 84% of new HD patients had seen by a nephrologist for more than 30days prior to ESRD compared with 74% in the United States. pre-ESRD care was associated with increased use of AVF *vs* graft use. AVF and grafts each displayed better survival if used when initiating HD compared with being used after patients began dialysis with a catheter ***(Pisoni et al., 2002)***

According to the study done by ***Ethier et al., (2008),*** based on data from DOPPS, from more than 300 HD units from 12 countries and more than 35 000 patients, international trends in VA use and trends in patient characteristics and practices associated with VA use from 1996 to 2007 were examined.

Since 2005, a native AVF was used by 67%-91% of prevalent patients in Japan, Italy, Germany, France, Spain, the UK, Australia and New Zealand, and 50%-59% in Belgium, Sweden and Canada. From 1996 to 2007, AVF use rose from 24% to 47% in the United States but declined in Italy, Germany and Spain. Moreover, graft use fell by 50% in the United States from 58% use in 1996 to 28% by 2007.

Across three phases of data collection, patients consistently were less likely to use an AVF *vs*. other VA types if female, of older age, having greater body mass index, diabetes, peripheral vascular disease or recurrent cellulitis or gangrene. In addition, countries with a greater prevalence of diabetes among HD patients had a significantly lower percentage of patients using an AVF.

Despite poorer outcomes for central vein catheters, catheter use rose 1.5 to 3-fold among prevalent patients in many countries from 1996 to 2007, even among 18-70 years old non-diabetic patients.

Furthermore, 58%-73% of patients new to ESRD used a catheter for the initiation of HD in five countries, despite 60%-79% of patients having been seen by a nephrologist > 4 monthes prior to ESRD.

Compared to patients using an AVF, patients with a catheter displayed significantly lower mean Kt/V levels. A secondary analysis of the Membrane Permeability Outcome (MPO) study by ***Martin et al., (2012),*** roped participating countries according to geographical location; thus study centers in France, Greece, Italy, Portugal and Spain were allocated to southern Europe (*n* = 499), and those in all other countries (Belgium, Germany, Poland and Sweden) to northern Europe (*n* =

In patients from the northern European countries, a higher prevalence of diabetes mellitus and cardiovascular disease was observed than in those from southern Europe (diabetes 35.1% *vs*. 21.0%; cardiovascular disease 40.5% *vs*. 22.8%).

In northern Europe, 23% of patients started HD with a catheter for VA, while in southern European centers, only 13% did so.

According to a nationwide statistical survey of 4081 dialysis facilities in Japan at the end of 2008, the number of patients undergoing dialysis was determined to be 283 421. Regarding the type of VA in patients treated by facility dialysis, in 89.7% of patients an AVF was used and in 7.1% an AVG was used ***(Nakai et al., 2010).***

According to a single center study in China done by ***Yu et al., (2010),*** on 376 maintenance HD patients, 97.87% had native AVFs, 1.33% had AVG and only 0.80% had cuff catheter.

Swarnalatha et al., (2011), in their study from a tertiary care center in India on 237 new HD patients during three years period, report that AVF was secured in 29.95% of patients at presentation and internal jugular catheter was the most common form of VA at initiation of HD, taking into account that 65.40% of patients had emergency HD.

Temporary VA:

This type of access is used when urgent HD has to be performed and the need for an appropriate VA becomes immediate. Two types of such accesses are currently available: non-tunneled dialysis catheters and cuffed, tunneled dialysis catheters.

Double-lumen, non-cuffed, non-tunneled HD catheters are the most frequently used for acute HD when long-term access is not available. They are made of polymers