

ROLE OF MULTISLICE CT ANGIOGRAPHY VERSUS COLOR DOPPLER ULTRASOUND IN EVALUATION OF THE HEMODIALYSIS ARTERIOVENOUS FISTULAS

THESIS

*Submitted for partial fulfillment of Master degree in
Radio-diagnosis*

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أعوذ بالله من الشيطان الرجيم

"قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ"

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List of Abbreviations

AA	Autogenous access.
AV	Arteriovenous
AVF	Arteriovenous fistula
AVG	Arteriovenous graft
BB	Brachio-basilic
BC	Brachio-cephalic
CDU, CDUS	Colour Doppler ultrasound
CFDU	Colour flow Doppler ultrasound
CFDUS	Colour flow Doppler ultrasound
CHD	Chronic hemodialysis
CHF	Chronic heart failure
CKD	Chronic Kidney Disease
CRF	Chronic renal failure
CT	Computed Tomography
CTA	Computed Tomography angiography
CW	Continuous wave
DASS	Dialysis associated steal syndrome.
DHIS	Distal hypoperfusion ischemic syndrome
DAVF	Direct arteriovenous fistula
DSA	Digital subtraction angiography
EDV	End diastolic velocity.
ESRD	End stage renal disease.
ESRF	End stage renal failure.

GAVF	Graft arteriovenous fistula.
HD	Hemodialysis.
HU	Hounsfeild unit
HUV	Human umbilical vein.
HUVG	Human umbilical vein graft.
IV	Intravenous
IMT	Intima media thickness.
IMN	Ischemic monomelic neuropathy
MDCT	Multidetector Computed Tomography
MDCTA	Multidetector CT angiography
MSCT	Multislice CT
PRF	Pulse repetition frequency.
PSV	Peak systolic velocity.
PTFE	Polytetrafluoroethylene.
PW	Pulsed wave.
RC	Radio-cephalic.
RC-AVF	Radio-cephalic arteriovenous fistula.
RI	Resistivity index.
ROI	Region of interest.
RRT	Renal replacement therapy.
SD	Standard deviation.
US	Ultrasound.
VA	Vascular access.
VP	Venous pressure

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Abstract

Background: to evaluate the role and usefulness of Multislice CT angiography and color Doppler US in assessment of vascular tree of AVFs and comprehensive evaluation of possible shunt complications in ESRD patients on hemodialysis.

Methods: Prospective analysis of vascular access related data were obtained from 30 patients (10 Male, 20 Female and age range 18-80 years) referred from hemodialysis unit in Cairo University hospitals for CTA and CDUS examination in upper limbs. All patients were examined to identify the different types of fistula shunt complications with Doppler indices (PSV, EDV and RI) and different 2D image reconstruction & 3D volume rendering techniques of CTA.

Results: The majority of patients were female (66.7%) with male (33.3%). The majority of patients (16 patients) had brachio-cephalic fistulae (53.3%), 12 patients had a radio-cephalic fistula (40%), 1 patient had brachio-basilic fistula (3.3%) and 1 patient had a brachio-axillary synthetic graft (3.3%). The study showed 15 patients with shunt related complications; aneurysm 33.3% (10 patients) followed by venous thrombosis 23.3% (7 patients), and arterial steal syndrome 13.3% (4 patients), and finally venous hypertension 6.6% (2 patients).

Conclusions: Color Doppler US is readily available and noninvasive method, and without radiation exposure. It allows assessment of both anatomy and hemodynamics of an AVF. However some of its backwards are the inaccurate detection of central venous obstruction, and the absence of an angiographic map, which may be desired for surgery.

Multislice CT angiography is minimally invasive. It is clinically feasible for evaluating the complete vascular tree of AVFs and in showing uncommon complications including central vein lesions. In addition, the 3D capability of CT angiography that can offer freely rotated projection angiograms.

Keywords: ESRD, CTA, CDUS, Hemodialysis, AVF and Complications.



INTRODUCTION

The introduction of hemodialysis has prolonged the lives of patients with end-stage-renal disease (ESRD). To maintain them on long-term dialysis, vascular access procedures are required. (*Yiltok SJ, 2005*).

The long-term survival and quality of life of patients on hemodialysis (HD) is dependent on the adequacy of dialysis via an appropriately placed vascular access (*Malovrh M, 2005*).

The upper extremities are most commonly used for dialysis access. An arteriovenous access (AVA) is created by connecting a vein to an artery (AV fistula or AVF) or by interposing a conduit, between an artery and a vein (AV graft or AVG). This provides a high flow circuit, which may be percutaneously cannulated for hemodialysis access when sufficiently mature. A matured AVF outperforms AVG, in terms of higher patency rates, freedom from infection and decrease in maintenance costs. (*Victoria Teodorescu, 2012*).

The creation and maintenance of a patent and well-functioning arteriovenous fistula (AVF) is essential for the maintenance of haemodialysis in patients with chronic renal failure. It has become a real challenge to nephrologists and vascular surgeons. (*Konner K, 2002 and Pietura R, 2005*).