

TECHNICAL ASPECTS OF INTERVENTION ULTRASONOGRAPHY IN VASCULAR ACCESS

Thesis

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Radiodiagnosis***

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالَ

سُبْحَانَكَ لَا عِلْمَ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْعَظِيمُ

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Abstract

Background: Real-time US guidance reduces time to access, number of attempts, and complications in vascular access (during needle advancement) with a sterile technique, The needle is observed on the image display and simultaneously directed toward the target vessel.

Purpose: To evaluate the effectiveness and safety of two-dimensional ultrasound guided puncture techniques for vascular access catheter insertion in adults and children.

Patient and methods: 30 patients undergo vascular access under ultrasound guidance for different indication.

Results: Vascular access were provided for 30 patients. There were 13 males (43%) and 17 females (57%) with a mean age of 25.3 years (Range 1-69 years). The right internal jugular vein was the main site of entrance for 13 cases (43%); 5 of the port cases, one patient coming for central line for BMT & 7 patients on hemodialysis, The left internal jugular vein was used for one hemodialysis case (3%), The right femoral vein was used in 3 cases (10%); two dialysis patient and one Inferior petrosal sinus sampling, The left femoral vein used in one case IPSS (3%), The left subclavian vein was used for one dialysis patient (3%), The right femoral artery was used for 3 cases (10%); one renal artery embolization and two for 4 vessel angiography. The portal vein was used in one case (3%), Direct to vessel for sclerotherapy in 7 cases (25%).

Key word:

(Anatomy, Artery, vein, Cannulation, Femoral, Guidelines, Internal jugular, Pediatric, Peripheral, Ultrasound, Vascular access)

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List of Abbreviations

CVC	Central Venous Catheter
IJV	Internal Jugular vein
IRs	Interventional Radiologists
IV	Intravenous
L	Liter
SVC	Superior Vena Cava
US	Ultrasound
IPSS	Inferior Petrosal Sinus Sampling
MOsm	Milliosmole
BMT	Bone marrow transplantation
SMV	Superior mesenteric vein
PVI	Peripheral vascular intervention
RCTs	Randomized control trials
FLR	Future liver remanent
ED	Emergency departments
ESRD	End-stage renal disease
PTPE	Percutaneous transhepatic portal embolization
NICE	National Institute for Health and Care Excellence

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INTRODUCTION

Access to an artery or a vein can sometimes be difficult and associated with severe complications. Techniques involving the use of anatomic landmarks for the veins and palpation of the pulse have been the traditional mainstay of accessing a vein or an artery. Portable and affordable ultrasound (US) devices for vascular access have changed the role of the traditional landmark techniques in vascular access. Real-time US guidance reduced complications, number of attempts, and time to access in central venous cannulation. (Murat G et al, 2013) .

Central Venous Access :Ultrasound guidance for central venous catheter placement compared with the landmark technique for placement of internal jugular and subclavian central venous catheters, ultrasound guidance significantly increases the probability of successful catheter placement, significantly reduces the number of complications encountered during catheter placement, and significantly decreases the need for multiple catheter placement attempts (Christopher L , 2014) .

Arterial Access :Arterial catheterization is a commonly performed invasive procedure in the ICU that enables accurate hemodynamic monitoring and frequent blood sampling. The insertion, especially in patients with hypotension, edema, and obesity, often is difficult and may require multiple attempts. Repeated attempts at catheterization may become progressively more difficult due to arterial spasm. Although generally it is a safe procedure, mechanical, infectious, and thromboembolic complications occur in 1% to 5% of cases. T he radial artery is the most common site for

arterial catheterization because of its superficial course and dual arterial supply to the hand by the ulnar artery. (Ariel L et al, 2011).

Difficult or Failed Peripheral Access :Ultrasound guidance may not be necessary as a first-line adjunct for peripheral venous access. However, when the landmark technique fails, ultrasound guidance used by emergency physicians for peripheral intravenous (IV) access has been shown to improve the success rate, decrease the time required to obtain access, and increase patient satisfaction with the procedure (Christopher L , 2014).

US-guided Percutaneous Thrombin Injection Of Post Catheterization Pseudo aneurysms :The US guided injection of thrombin has become the first-line treatment for pseudoaneurysms, and it is increasingly popular for the treatment of iatrogenic pseudoaneurysms in many institutions.US-guided thrombin injection was most successful within the first two weeks, and the supplemental compression might aid in the closure of partially thrombosed pseudoaneurysms (**Kamil G et al, 2012**).

Ultrasound-guided Foam Sclerotherapy (UGFS) For Varicose Veins:Ultrasound-guided foam sclerotherapy has become increasingly popular throughout the world , UGFS leads to significant improvements in symptoms, venous hemodynamics and is also associated with high levels of patient satisfaction and significantly less morbidity and a quicker return to normal activities than surgery. UGFS is probably more cost-effective. (Andrew W , 2010).

Treatment of Low-flow Vascular Malformations by Ultrasound-guided Sclerotherapy :Ultrasound-guided sclerosis with foam has been proposed as an alternative treatment for low-flow malformations, especially when surgery cannot achieve a complete resection or seems too damaging (Blais S , 2011).

AIM OF THE WORK

- Evaluate the role of ultrasound in intervention radiology in vascular access in patients' needs vascular access and to explore how ultrasound facilitates access and decrease time and complication of vascular access.
- Have the technical understanding and ability to guide a needle under real-time ultrasound guidance into a target vessel using:
In-plane technique Out-of-plane technique



COMMONELY ACCESSED VASCULAR

ANATOMY

Knowledge of vascular anatomy in the body is important for clinical examination, medical procedures and diagnosis of diseases. The body vasculature can be divided into arterial and venous systems; only major vessels will be discussed here.

Cross section anatomy of arteries and veins:

Arteries and veins have the same layers of tissues in their walls, but the proportions of these layers differ. Lining the core of each is a thin layer of endothelium, and covering each is a sheath of connective tissue, but an artery has thick intermediate layers of elastic and muscular fiber while in the vein, these are much thinner and less developed, they do not have the need for the strength and elasticity of the arteries, so the walls of the veins are thin and almost floppy. To make up for this, many veins are located in the skeletal muscles, and the least movement of a limb squeezes the vein and drives the blood toward the heart. One-way valve ensure flow in the right direction (Praveen B , 2014).