PREDICTION OF VASCULAR ACCESS MALFUNCTION IN CHRONIC RENAL FAILURE PATIENTS ON MAINTENANCE HEMODIALYSIS

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Master degree in Pediatrics

By

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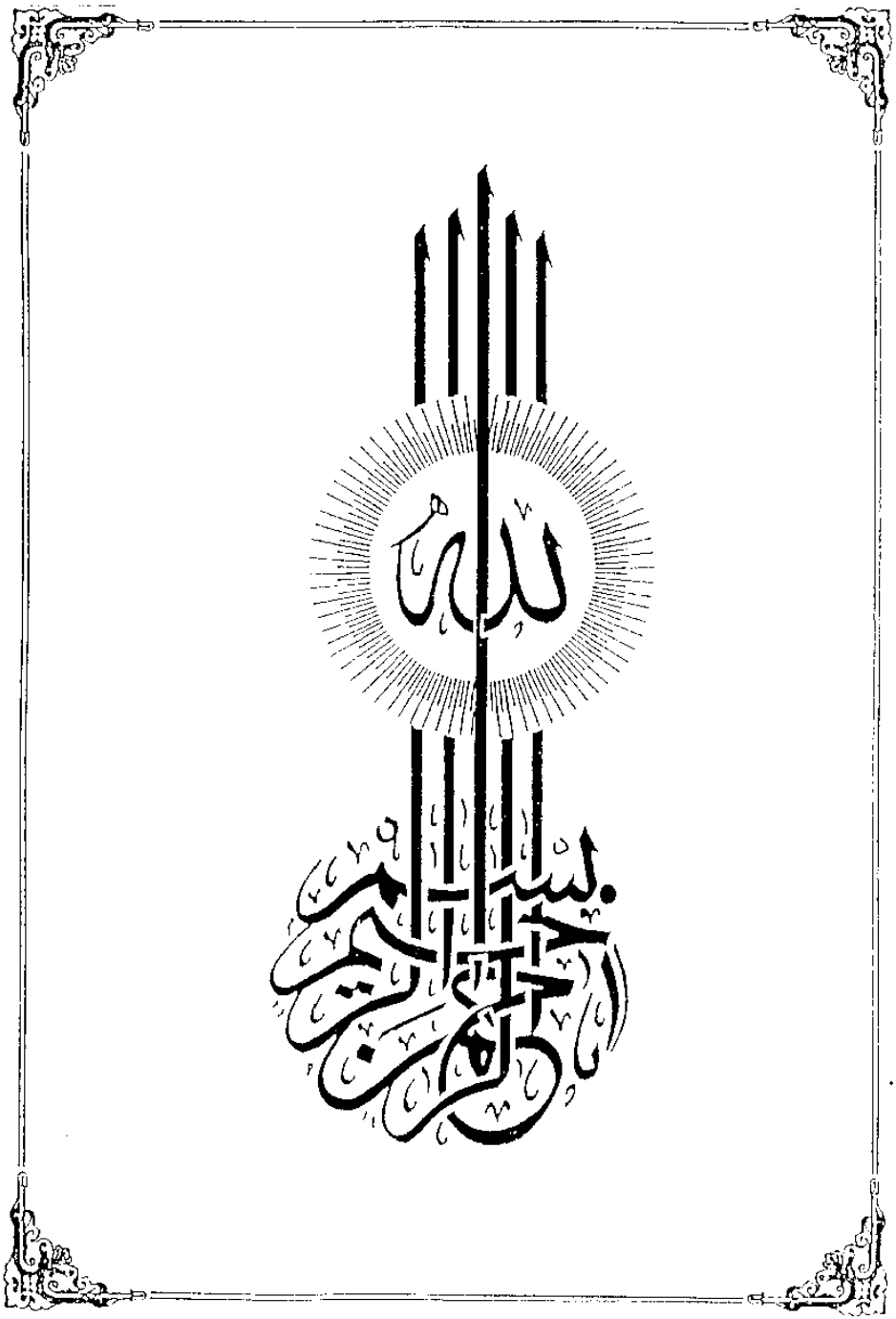

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CONTENTS

LIST OF ABBREVIATIONS

ARF	Acute Renal Failure
AV	Arteriovenous
AVF	Arteriovenous Fistula
BSF-2	B Cell Stimulating Factor-2
CRF	Chronic Renal Failure
ESRD	End Stage Renal Disease
HD	Hemodialysis
ICAM-1	Intercellular Adhesion Molecule-1
IL-1	Interleukin-1
IL-6	Interleukin-6
IVUS	Intravascular Ultrasound
MCP-1	Monocyte Chemoattractant Protein-1
PBMC	Peripheral Blood Mononuclear Cells
PDGF	Platelet Derived Growth Factor
PTFE	Polytetrafluroethelyene
TM	Thrombomodulin
TNFα	Tumor Necrosis Factor alpha
VCAM-1	Vascular Adhesion Molecule-1
VSMC	Vascular Smooth Muscle Cells

LIST OF TABLES

LIST OF FIGURES

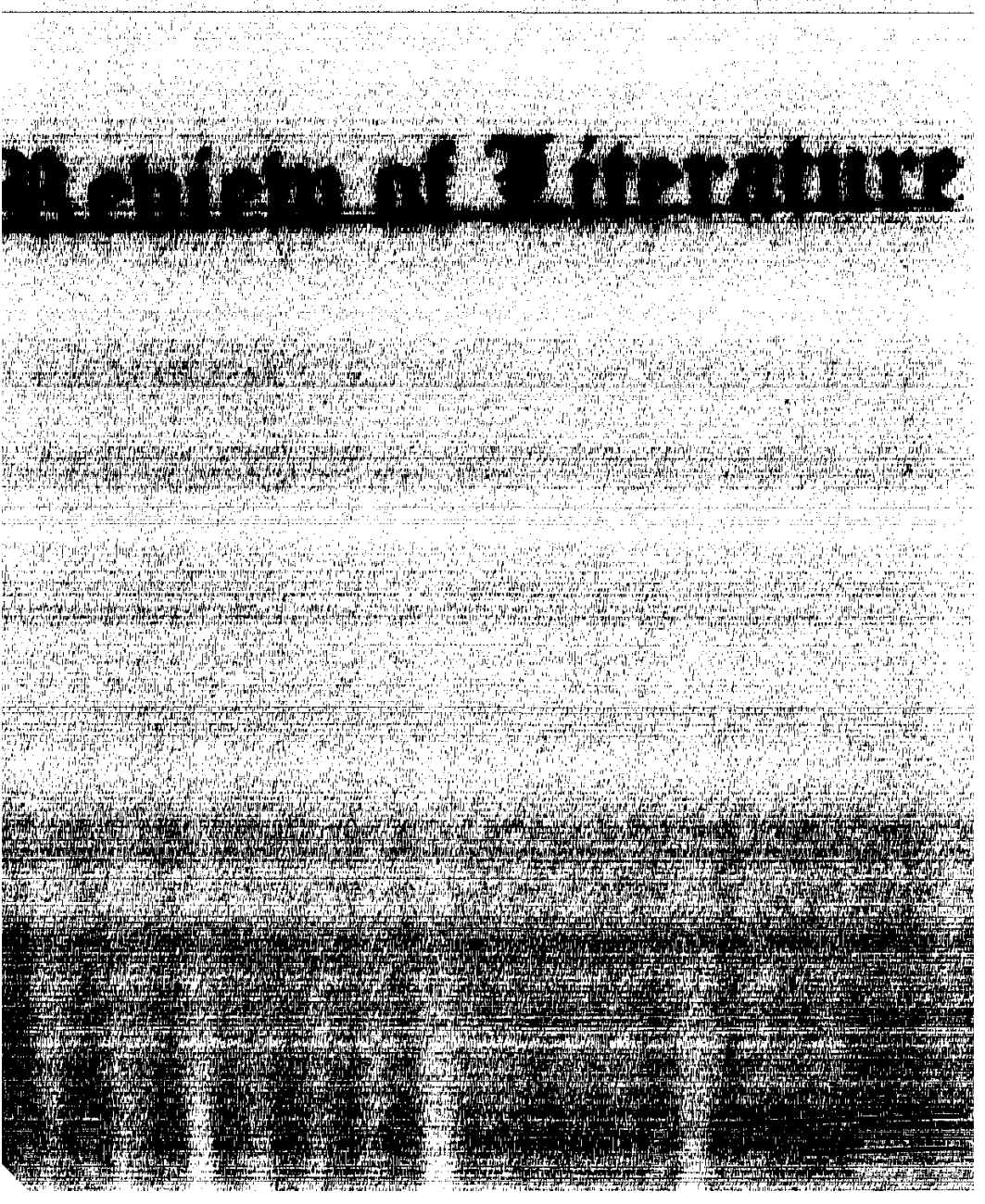
INTRODUCTION

Vascular access dysfunction is an important cause of morbidity for dialysis patients and a major contributor to HD cost *(De Marchi et al., 1996)*. Thrombosis is a leading cause of vascular access failure, and usually results from stenotic lesions in the venous outflow system. This kind of lesions predisposes to changes in both the vessel's wall and the blood flow *(Owen et al., 1993)*.

Interleukin-6 was found to have an important role in regulating the proliferation of vascular smooth muscle cells which has the key role in the pathogenesis of the access stenosis. So, estimation of serum IL-6 may help in early detection of vascular access stenosis *(De Marchi et al., 1996)*. Doppler ultrasound is a new non invasive technique that allows imaging of flow through the vascular access and detection of stenosis that predisposes later on to thrombotic occlusion of the access *(Raja, 1994)*.

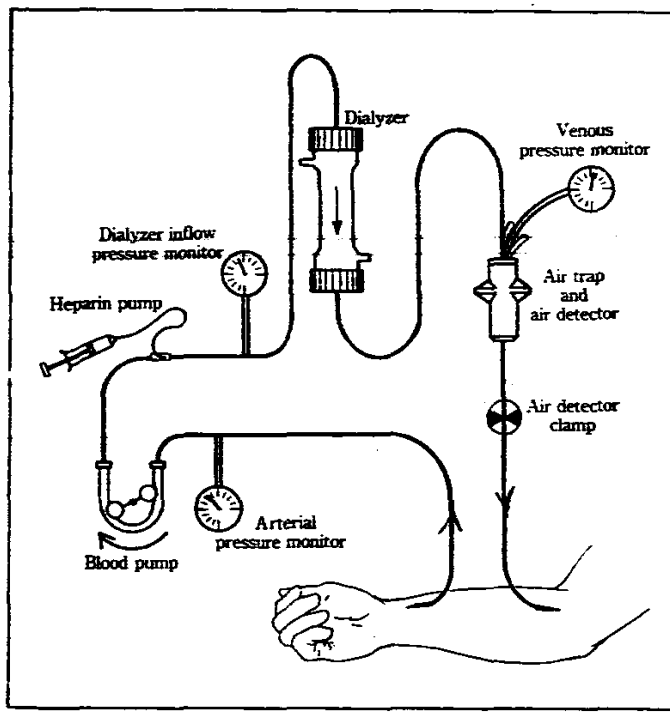
AIM OF THE WORK

This study aimed at speculation of a suitable tool that may help in the early detection of vascular access malfunction in pediatric patients with CRF on regular HD.



VASCULAR ACCESS In HEMODIALYSIS

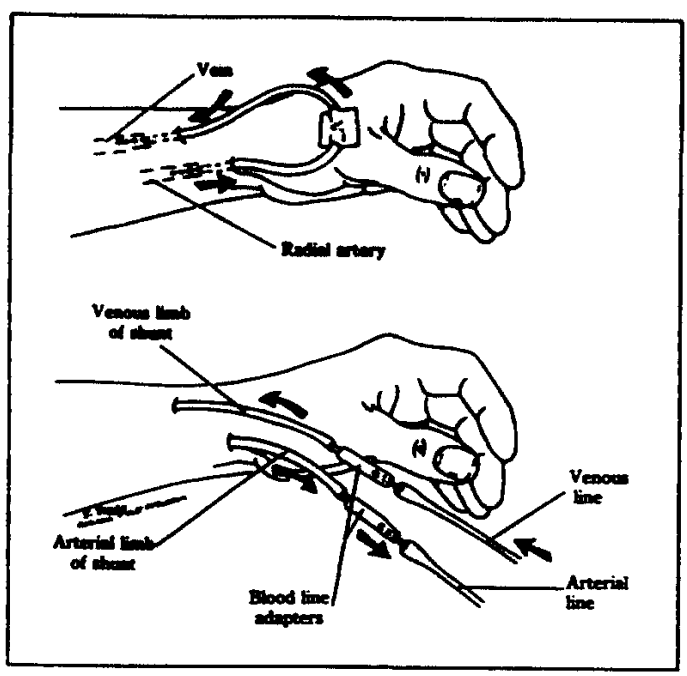
Hemodialysis (HD) is of the modalities of therapy for patients with renal failure. It uses extracorporeal perfusion to transfer fluids and solutes by diffusion and ultrafiltration between blood and dialysate. This is accomplished by allowing blood and dialysate to flow by each other separated by a semipermeable membrane. Solutes are primarily removed from the blood by diffusion occurring along a concentration gradient. Continual flow of blood and dialysate regenerates this concentration gradient, permitting maximal removal of solutes. Fluid is removed by ultrafiltration across the semipermeable membrane. Ultrafiltration occurs because a transmembrane hydrostatic pressure gradient is created from the blood to the dialysate compartment. This hydrostatic pressure gradient is a result of both venous outflow resistance from the dialyzer and negative pressure exerted on the dialysate compartment (*Evan et at., 1995*). HD process needs suitable dialyzer, machine, and good vascular access to the patient's circulation. The principal of blood circuit in hemodialysis could be simplified as in Figure(1).



Figure(1): The Blood Circuit in Hemodialysis .

Chronic HD requires repeated reliable access to the systemic circulation *(Schwab et al., 1997)*. Vascular access failure is a significant source of morbidity in chronic HD patients *(Feldman et al., 1993)*. HD access failure continues to be the most frequent cause of hospitalization in end stage renal disease (ESRD) patients *(Schwab et al., 1997)*. In some centers it accounts for the largest number of hospital days *(Mayers et al., 1992)*.

The first technical advance in establishing repeated vascular access was the development of Quinton - Scribner shunt in 1960 (*Quinton et al., 1960*). It is an external arteriovenous shunt. It consists of two hard plastic cylinders (vessel tips). One vessel tip is implanted into an extremity artery and the other into a nearby vein. The opposite vessel tip ends are connected to pieces of silicone elastomer tubing. After implantation, the two silicone tubes are connected with each other to establish the external shunt (Figure 2). The Scribner shunt is now largely obsolete (*Michael et al., 1996*).



Figure(2): Quinton-Scribner Shunt.

The subsequent development of the internal fistula made chronic HD possible and easier. Later on improvements in vascular accesses, such as the polytetrafluroethylene (PTFE) graft, expanded the availability of HD. With the increasing survival of the HD population, it has become evident that patients who survived 10 or more years on HD had significantly fewer vascular access than those who survived less than 10 years *(Fan and Schwab, 1992)*.

Ideal Vascular Access

Ideally, access to the systemic circulation should accommodate a flow rate adequate for the HD prescription, remain usable for a long period of time, and have a low complication rate. No access meets all these criteria (*Schwab et al., 1997*). Native arteriovenous fistula (AVF) comes closest, but even it is associated with complications. As the number of patients undergoing dialysis for ESRD has grown, the use of native AVFs has declined and the use of synthetic arteriovenous (AV) graft for permanent vascular access has increased (*Albers, 1994*). Unfortunately, patency rates for AV grafts are inferior to those of native AVFs, and complication rates are at least three fold greater *(Feldman et al., 1996)*.