RENAL IMPAIRMENT IN PEDIATRIC OPEN HEART SURGERY

Essay
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in Pediatrics

BY

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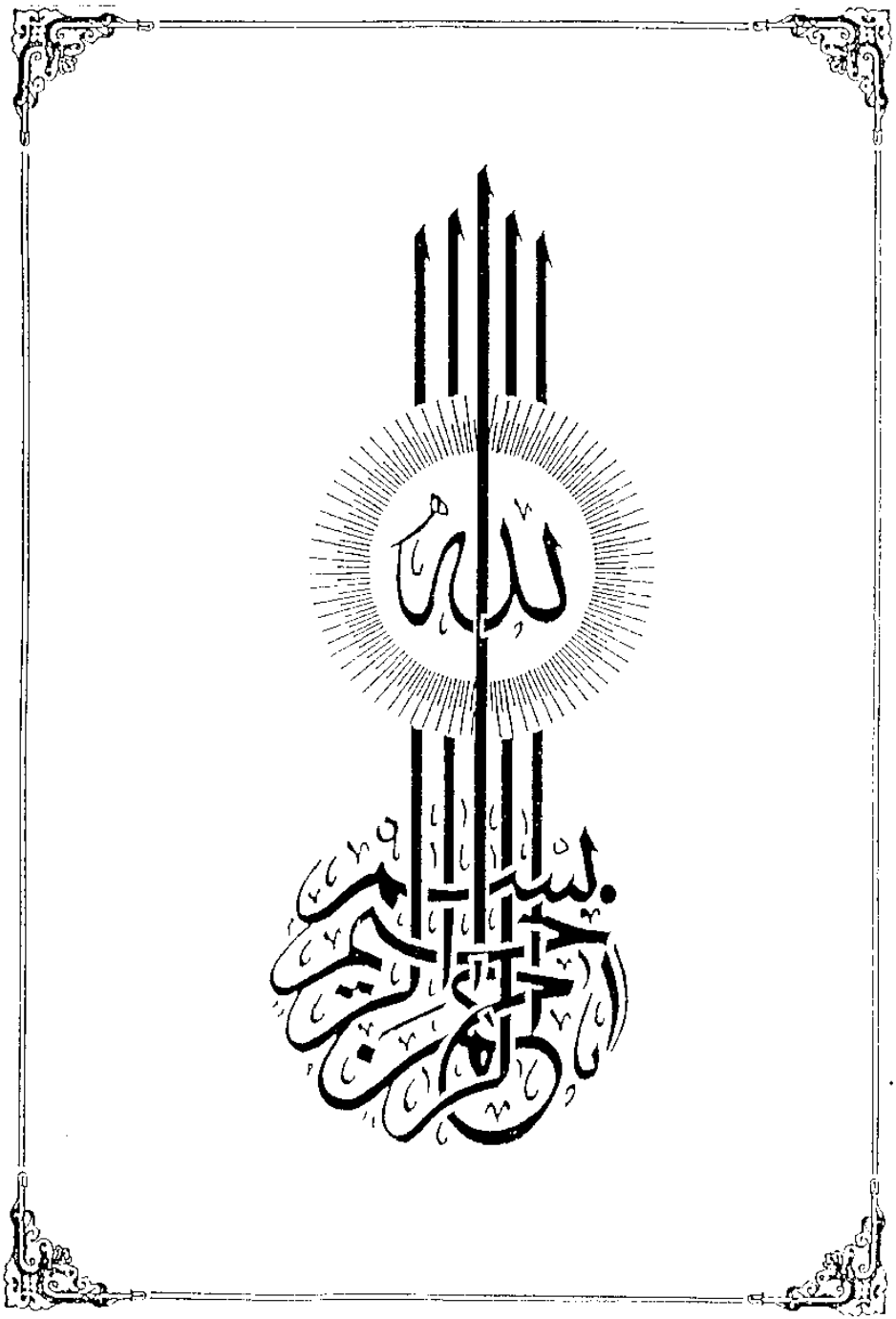

Acknowledgment

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Omayma Attia

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List of Abbreviations

ADH	:	Antidiuretic hormone
ANF	:	Atrial natriuretic factor
ARF	:	Acute renal failure
ATP	:	Adenosine triphosphate
ATPase	:	Adenosine triphosphatase
BUN	:	Blood urea nitrogen
CPB	:	Cardiopulmonary bypass
CVP	:	Central venous pressure
FE_{Na}	:	Fractional excretion of sodium
GOS	:	Great Ormond Street
GFR	:	Glomerular filtration rate
MUF	:	Modified ultrafiltration
PG	:	Prostaglandin
RBCs	:	Red blood cells
RBF	:	Renal blood flow
RFI	:	Renal failure index
Tm	:	Transport maximum
TMP	:	Transmembrane pressure

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Introduction and Aim of the Work

Aim of the Work:

The purpose of this work is to understand the effect of cardiopulmonary bypass (CPB) on kidney function. Review of methods of diagnosis of acute renal failure that commonly complicates open heart surgery in children will be discussed. This essay also aims to put guidelines for prevention and management of this serious and potential lethal problem.

Introduction

Advances in surgical technique will allow more patients with heart disease who are young and have small body weights or with more tenuous medical condition to be operated upon.

Postoperative acute renal failure is a frequent complication of open heart surgery ***(Koning and Leusick, 1989)***.

The onset of acute renal failure carries a poor prognosis, not only because of loss of renal function per se, but also because of life-threatening complications including sepsis and cerebral vascular system dysfunction ***(Abel et al., 1976)***.

The causes of such acute renal failure are several; however, it is usually attributed either to postoperative cardiac dysfunction or to events that occur during cardiopulmonary bypass (CPB) ***(Abel et al., 1976)***. Also, it is found that there is a proportional relation between preoperative renal function and the incidence of postoperative renal failure ***(Koning and Leusick, 1989)***.

Structure and Functions of the Kidney

Structure of the Kidney

The functional unit of the kidney is the nephron (figure 1). Each kidney contains approximately 1.2 million nephrons. This number does not increase after birth. The two components of nephrons are the glomerulus and the renal tubule *(Lippold and Cogdell, 1991)*.

Glomerulus:

The glomerulus is a network of capillaries originating from afferent arteriole. These capillaries are surrounded by the dilated blind end of the nephron, known as Bowman's capsule. Each tuft of capillaries arise from a single afferent arteriole and is drained by an efferent arteriole. Therefore, glomerular capillaries are unique because they are the only capillaries anatomically interposed between two sets of arterioles. As a consequence of anatomic arrangement, the hydrostatic pressure inside these capillaries can be varied by changing the tone of either afferent or efferent arterioles *(Lippold and Cogdell, 1991)*.

Renal Tubule:

Proximal convoluted tubule is a direct continuation of the Bowman's capsule that lies in the cortex of the kidney with the glomerulus. It is considered the bulk reabsorber as it is responsible for reducing the volume of glomerular filtrate by 80%.

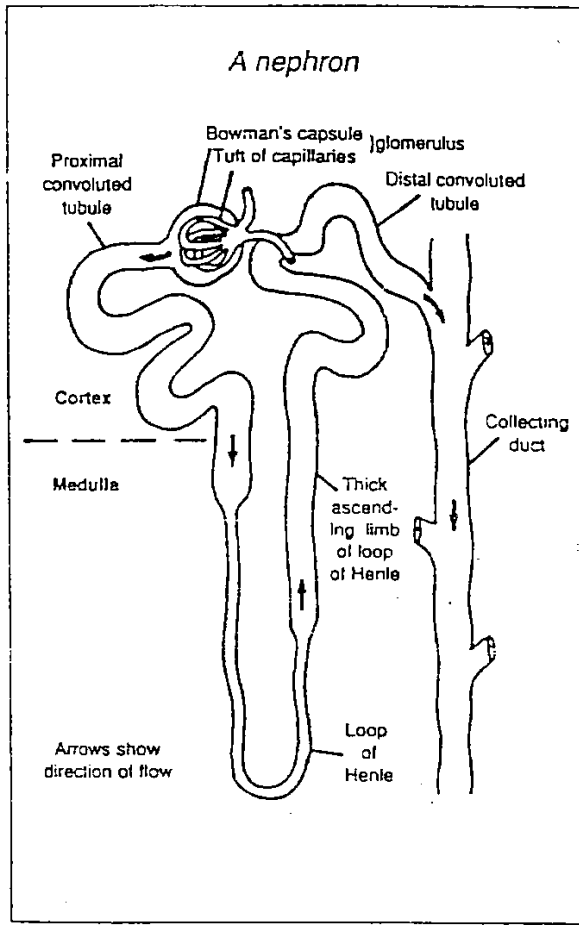

Figure (1): The functional unit of the kidney (the nephron)
(Lippold and Cogdell, 1991).