SURGERY OF THE RENAL VASCULATURE

ESSAY

Submitted For Partial Fulfilment of

M.S. in Urology

Presented by

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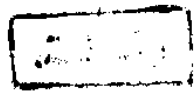

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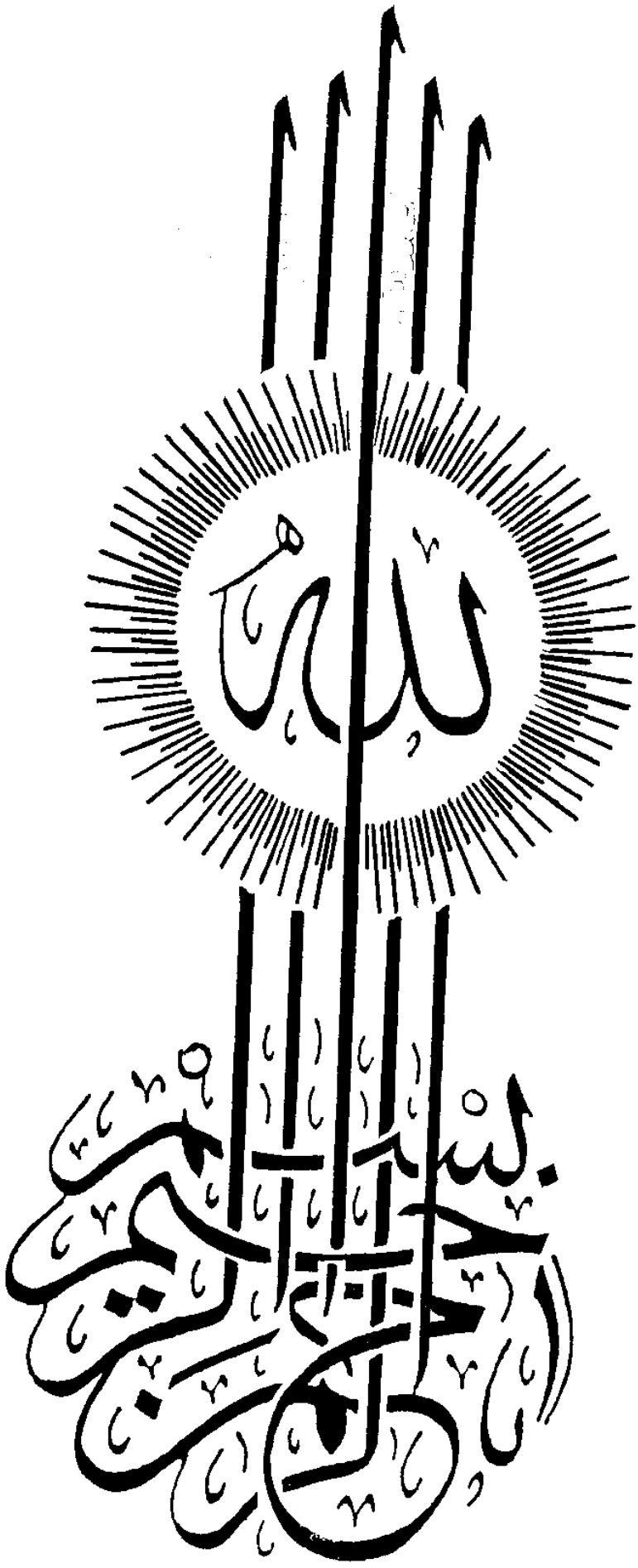
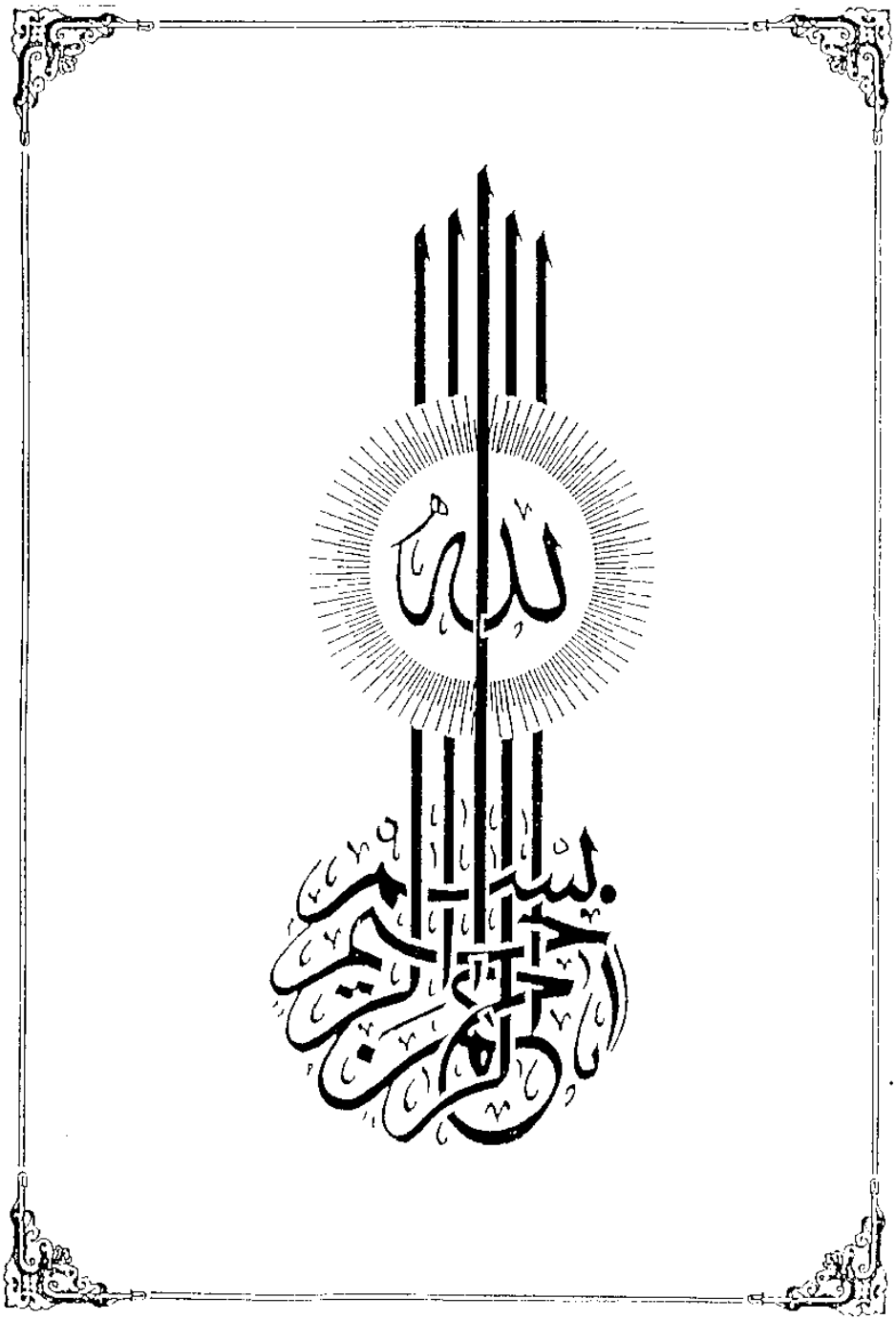
(1989)





ACKNOWLEDGEMENT

First and foremost I thank Allah for enabling me to attain new knowledge and experience through this work. I pray that he will guide me through the mysteries of his creation.

I am deeply indebted to **Prof. Dr. Abdel Wahab Elkasaby,** Prof. of Urology,for his kind supervision, valuable help, constant support, wise criticism and generous participation that made this work become possible.

No words can convey my deep gratitude to Dr. **Mohamed A. ElBaz,**Lecturer of Urology,for his close supervision, continuous encouragement, constant guidance and overwhelming kindness throughout every stage of my study.

I am also indebted and grateful to all members of the **Urology Department,**for offering all facilities and guidance.

Finally, no words can express the warmth of my feelings to my **mother** and my **brother** for their understanding and patience.

To
My Father's Soul
God Bless Him

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INTRODUCTION

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The modern urologist must deal with major vessels in his surgical practice. Mastery of vascular techniques and understanding of renal tolerance to ischemia are basic prerequisites to performing many urologic operations such as removal of renal or retroperitoneal neoplasms, partial excision of the kidney, extraction of upper urinary tract calculi, repair of traumatic renal injuries, vascular reconstruction of kidneys with diseased blood vessels, and renal transplantation. The recent application of microvascular techniques to clinical and investigative urology, which has already expanded the surgical horizons within urology, undoubtedly foretells even more exciting developments in the future.

It should be emphasized that training in vascular surgical techniques does not mean that all urologists should do renovascular surgery and/or transplantation, but rather that they should be able to apply these techniques in their surgical practice in order to deal more effectively with the complex problems that would be encountered.

In the following review, a trial will be done to highlighten the importance and current application of vascular procedures in urologic surgery. In particularly,

the different surgical techniques in dealing with renovascular diseases will be discussed. Also, some light will be put on the vascular considerations during surgery of renal calculi, and finally the fine role of renovascular surgery in renal transplantation will be considered.

ANATOMY OF THE RENAL VASCULATURE

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The vascular supply of the kidney is about 20 times greater than that of any other organ. The renal pedicle approaches the kidney in a plane anterior to the renal pelvis, entering the kidney in its medial depression or renal sinus (Fig.1-1)

The renal arteries

The renal artery, a large vessel, arises at right angles from the aorta opposite the body of L2. The left artery is a little shorter than the right; it crosses the left crus and psoas muscle, behind and somewhat above the left renal vein both of which are covered by the tail of pancreas and splenic vessels. The longer right artery crosses the right crus and psoas muscle behind the inferior vena cava and short right renal vein;these structures separate the artery from the head of pancreas and common bile duct and from the second part of the duodenum (Last, 1978).

The main renal artery divides at any point between the aorta and the hilum into two trunks-the anterior and posterior divisions. The anterior division divides into four branches which supply areas on the front of the kidney. The posterior division continues over the back of the pelvis to

supply a large central area on the back of the kidney (Graves, 1982).

Experimental injection of renal artery with resin was done, and 40 casts were made of normal human kidneys. After studying the first twelve specimens Graves (1954) realized that a constant arterial pattern was present. On the basis of this he concluded that the kidney could be divided into five segments and these he named: (Fig 1-2,3).

The apical segment:

This is a small cap of tissue on the medial side of the upper pole which occupies areas on both anterior and posterior surfaces of the kidney. The artery usually arises from the anterior division or from the artery of the upper segment , but it may arise from the posterior division or form the point where the divisions themselves arise from the main renal artery. If,however,the apical segment artery arises outside the hilum,thus its origin may be more proximal and more varied. In this respect it is very similar to the lower segment artery.

The upper segment

This lies solely in the anterior plane. It covers an area which includes the remainder of the upper pole and part of the central area of the kidney. The artery to the segment arises from the anterior division. It enters the segment at its base and soon divides into an upper branch and a horizontal or lateral branch. The size of these two

branches depends largely upon the size and shape of the upper calyx. If the pelvicaliceal system is large and narrow then both arterial branches are usually well formed.

The middle segment

This occupies a central area beneath the upper segment. It lies solely in the anterior plane and the artery to it arises from the anterior division.

The lower segment

This forms the lower pole of the organ and occupies areas on both anterior and posterior surfaces of the kidney. The artery to the segment is perhaps the most interesting of all segmental vessels. Usually it arises from the anterior division and passes in front of the pelvis or ureter. It then divides into an anterior and a posterior branch. The anterior branch divides into smaller branches which supply the anterior surface of the lower pole. The posterior branch passes under the neck of the inferior calyx to supply the posterior aspect of the lower pole.

Variations in the lower segment artery include :

Group I: It arises first from the main stem of the renal artery or from the anterior division,the latter continues and then divides to supply the upper and middle segments.

Group II: It arises with the artery to the upper segment and as it courses downwards across the hilum it gives rise to the artery to the middle segment.

Group III: All three arteries upper, middle, and lower arise

from the same point.

The posterior segment

This occupies an area entirely on the posterior surface of the kidney between the posterior part of the apical segment above and the posterior part of the lower segment below. The artery to the segment is the continuation of the posterior division.

It courses over the back of the renal pelvis and is in close association with the junction of the latter and the superior calyx. Like that of the posterior branch of the lower segment artery to the inferior calyx, this relationship is an important and constant feature. The artery there runs in a curve from the convex border of which three groups of branches radiate:an upper group which supplies the posterior part of the upper calyx; a middle group: which is small but supplies the posterior aspect of the middle calyx;and a terminal group which supplies the upper portion of the posterior aspect of the lower pole. Its area is,of course, adjacent to that supplied by the posterior branch of the lower segment artery (Graves,1982).

There are many important issues for the urologic surgeon to consider regarding renal arterial blood supply. First the various vascular segments of the kidney are supplied by end arteries that do not intercommunicate with neighboring segments,this is in contrast to the extensive intercommunications found in the intrarenal veins. The lack