RENOVASCULAR HYPERTENSION

Essay

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M. S. Degree in General Surgery

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CONTENTS

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INTRODUCTION

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INTRODUCTION

Hypertension is defined as a diastolic blood pressure greater than 100 mm Hg in a person more than 60 years of age. WHO criteria require pressures exceeding 160/95 mm Hg.

In most cases the cause is unknown and the disease is termed *"Essential hypertension"*, but in 10 - 20% of cases a specific cause can be detected by investigations, Invasive and non-invasive, and the disease is called *"Secondary Hypertension"*.

Renal artery stenosis is a common cause of 2ry hypertension and is called ***"Renovascular hypertension"***.

The purpose of this study is to present current informations on the theories of etiology, the different types of hypertension with stress on renovascular diseases, to discuss the modern invasive and non-invasive investigations, and different lines of treatment.

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Anatomy

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ANATOMY OF THE KIDNEY

The kidneys are paired solid organs situated on each side of the mid line in the retroperitoneal space. Each kidney is bean-shaped, though thicker and rounded at the upper pole. The size and weight of the kidneys are generally proportionate to body dimensions.

In the newborn, the two kidneys constitute 1/80 of the total body weight, whereas in the adult the proportion of both kidneys to the total body weight is 1/240. Thus, in the adult male the average weight of each kidney is about 150 gm, and in the adult female the average weight of each kidney is 135 gm.

The kidneys measure approximately 12 x 7 cm, with thickness of approximately 3 cm.

The left kidney is usually longer and narrower than the right *(Olsson, 1986)*.

Renal vasculature

Variations in the renal vasculature are very common and usually so complex that the standard concept of simple renal pedicel is erroneous in most instances *(Olsson, 1986)*.

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The renal arteries are two large trunks branching from the sides of the aorta immediately below the superior mesenteric, and both cross the corresponding crus of the diaphragm nearly at right angles to the aorta.

The right is longer, on account of the position of the aorta, it passes behind the inferior vena cava, right renal vein, head of the pancreas, and the descending part of the duodenum.

The left is a little higher. It lies behind the left renal vein, the body of the pancreas, and Splenic vein, and may be crossed anteriorly by the inferior mesenteric vein ***(Olsson, 1986)***.

Surface anatomy

1. The abdominal aorta

It can be represented by a band about 2 cm wide extending from a point in the median plane 2.5 cm above the transpyloric plane to the point where it divides about 1 cm below and to the left of the umbilicus.

When the abdominal wall is relaxed the lowest portion of the aorta may be felt pulsating just above this point.

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2. The renal arteries

They can be represented by broad lines running laterally for 4 cm from the lateral margins of the aorta just below the transpyloric plane.

** In the case of the artery of the left side the line should incline upwards across the transpyloric plane.

Each renal artery gives off some small inferior suprarenal branches, and supplies the ureter and the surrounding cellular tissue and muscles ***(Williams - Warwick, 1980)***.

Just before the hilus of the kidney, each artery separates into a larger and lower anterior branch that supplies more than one half of the circumference of the kidney, and a smaller but more superiorly placed posterior branch.

The anterior division crosses between the renal pelvis and the renal vein, whereas the posterior division crosses posteriorly behind the upper portion of the renal pelvis or superior infundibulum.

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Primary branches of each division are known as segmental arteries, distributing blood flow to various vascular segments of the kidney.

Various classifications are used to describe the division of the kidney into vascular segments. Most authorities accept the division into **Five** vascular segments.

Intra-renal arterial circulation

1. The apical segment
2. The upper segment
3. The middle segment
4. The lower segment
5. The posterior segment

1. The apical segment

The artery usually arises from the anterior division or from the artery to the upper segment, but it may arise from the posterior division, or from the point where divisions themselves arise from the main renal artery.

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2. The upper segment

The artery to this segment arises from the anterior division. It enters the segment at its base and soon divides into upper and horizontal, or lateral, branch. The size of the two branches depends largely upon the size and shape of the upper calyx.

3. The middle segment

Its artery arises from the anterior division and occupies the central area beneath the upper segment.

4. The lower segment

It occupies the lower pole of the organ. Its artery is the most interesting of all segmental vessels.

Usually, it arises from the anterior division and passes in front of the pelvis of the ureter, it then divides into anterior and posterior branches.

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 and supplies the posterior aspect of the lower pole.

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5. The posterior segment

Its artery is the continuation of the posterior division. It crosses over the back of the renal pelvis and is in close association with the junction of the later and the superior calyx.

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Each segment is supplied by separate branch of the renal artery and there is no anastomosis between adjoining segments.

The intra-renal veins, on the other hand, have no segmental arrangement and there is free anastomosis between venous channel throughout the kidney *(Olsson, 1986)*.

The initial branches of the segmental arteries provide the lobar branches, usually one for each pyramid, which again divide just before entering the kidney substance into 2 or 3 interlobular arteries extending towards the cortex on each side of the pyramid.

At the junction of the cortex and the medulla, the interlobular arteries divide dichotomously into arcuate arteries which diverge at right angles from the parent stem.

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As they persue there curved courses between cortex and medulla, each arcuate artery undergoes several further divisions, and from each of these branches a series of interlobular arteries ascend radially into the cortical substance.

Also some interlobular arteries arise from the stem vessels and even from the terminal part of interlobar arteries ***(Williams - Warwick, 1980)***.

The interlobular arteries may follow a simple course toward the superficial part of the cortex, or they may branch few times en-route, whilst some pursue a more tortuous course recurving towards the medulla once or twice before again proceeding toward the renal surface.

The afferent glomerular arteries are mainly side branches from the interlobular arteries, but a few arise directly from the arcuate and interlobular arteries.

From the majority of the glomeruli the afferent glomerular arterioles seen divide to form a fine meshed peritubular capillary plexus, which run between and around the proximal and distal convoluted tubules.

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From the venous ends of the peritubular plexus fine radicles converge to join interlobular veins, one of which accompanies each artery of the same name ***(Williams - Warwick, 1980)***.

The blood supply for the kidney medulla is derived from the vasa recta, few of which arise from the arcuate or interlobular arteries but the majority arise from the efferent arterioles of the juxtamedullary glomeruli. These straight branches, as their names imply, descend in straight course into the renal medulla contributing side branches to a capillary plexus closely applies to the descending and ascending limbs of Henle's loop, as well as to the collecting tubules ***(Olsson, 1986)***.

The venous ends of this capillary plexus converge to form ascending vasa recta that drain into interlobular or intra-arcuate veins.

The parallel relationship of this descending and ascending vasa recta with themselves and with the duct system result in anatomic basis for a counter current exchange mechanism. This is important in renal physiology ***(Olsson, 1985)***.

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