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RENAL COLIC

ESSAY

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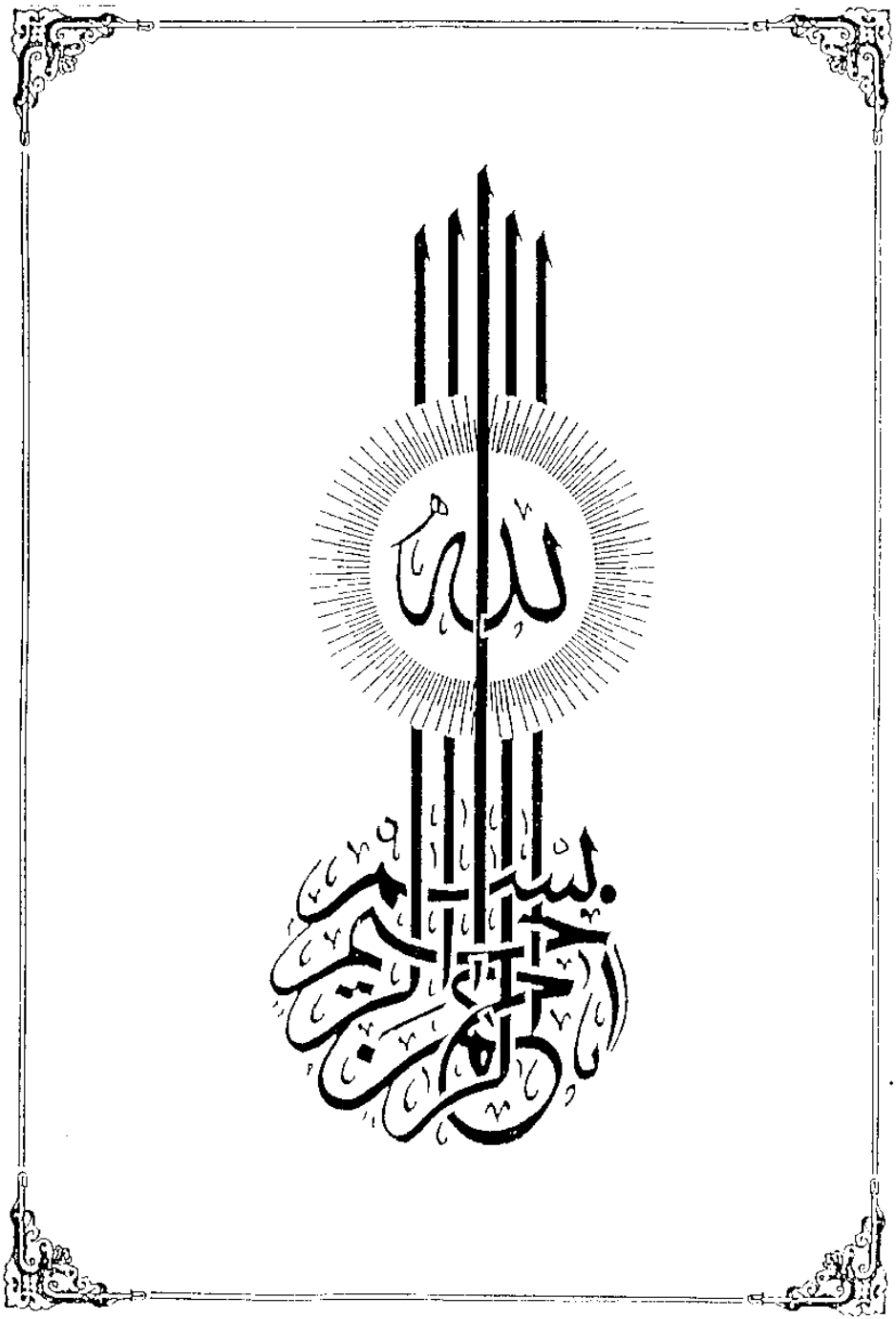

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INTRODUCTION

Renal colic is one of the most intense forms of pain encountered in clinical practice.

Urologist and emergency ward physicians, are presented daily with cases of renal colic. Provision of safe quick pain control remains one of their major duties.

In order to treat pain of renal colic properly, anatomy of the pelvicalyceal system and ureter should be clear, the vast majority of causes and differential diagnosis should be in mind. This is the aim of this work.

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ANATOMY OF THE PELVI-CALYCEAL SYSTEM

The renal hilum is a vertical fissure in the medial renal border through which the renal vessels, the nerves, the lymphatics and a portion of the renal pelvis traverse.

The hilum of the kidney leads into a central cavity called the renal sinus, this cavity expands radially within the renal substance and at its innermost aspect is studded with cone like projection termed the renal papillae. Each papillary projection is encompassed by smooth muscular sleeves, calyces, leading to renal pelvis.

Within the renal sinus, the renal pelvis divides into two or three branches termed the major calyces which in turn divide into several shorter minor calyces, 8 - 12 minor calyces, that expand distally to encompass one or two renal papillae.

The necks of renal calyces often termed the infundibulae of the renal pelvis.

Outside the hilum, the renal pelvis tapers abruptly to merge imperceptibly with the ureter. The pelvi-ureteral junction is a transition zone between low pelvic pressure and high ureteral pressure only few millimeters

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long and its localization may vary according to rate of urine flow, as it moves distally with diuresis. In radiographs; it may not be possible to define the exact position of the pelvi-ureteral junction (Struthers, 1982).

Variations of the calyceal and pelvic anatomy are possible. The renal pelvis may lie entirely within the renal sinus, whereas in other circumstances the calyceal branches are sufficiently long that the entire pelvis is extra-renal. Also, there is tendency for variations in the renal pelvic and calyceal anatomy to be symmetric bilaterally. Despite the foregoing variations, the inter-relationship of hilar structure remains relatively constant, with the renal vein situated anteriorly and the renal pelvis posteriorly. The main renal artery occupies position inbetween, but gives off major anterior and posterior divisional branches that flank the upper portion of renal pelvis.

With anomalies of incomplete ascent or rotation of the kidney, the entire anatomy of the renal sinus may be significantly altered in such instances that the relation-ship between the resultant extrarenal calyces and renal vasculature is highly variable.

The kidney is covered by fibro-elastic membranous capsule that extends within the renal sinus, merging with

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the expanded ends of the renal calyces as they encompass the papillae preventing leakage of urine to extra-renal tissues and diffuse distally within adventitia of the ureter.

The relationship of the renal arteries and veins as they cross the upper portion of renal pelvis, or superior infundibulum, may be misinterpreted as renal pelvic filling defect during intravenous or retrograde urographic examination and must be differentiated from other radiolucent filling defects by digital substraction or standard angiographic examination.

If the renal pelvis is partially extr-renal, it lies along the lateral border of psoas muscle. The left renal pelvis lies at the level of 1st or 2nd lumber vertebra. The right is a little lower.

The calyces and pelvis are lined by transional cell epithelium under which lies loose connective and elastic tissue "Lamina propria".

~Renal Nerve Supply :-

The renal plexuses are collections of nerve cells situated behind the origin of the renal artery. It is subdivisions of the celiac plexus and contributing to it

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are branches from the aortico-renal ganglion, aortic plexus, lowest thoracic nerves (11th and 12th), as well as 1st lumbar splanchnic nerve.

Efferent nerves from the renal plexus are continued into the kidney along the course of the renal arteries supplying the vessels, glomerular structures and tubules of the kidney particularly in region of renal cortex.

Efferent fibers are thought to be predominantly vasomotor in nature (Warwick and Williams, 1973). However, recent observation demonstrates that acute unilateral renal denervation results in diuresis and natriuresis without alteration in glomerular filtration rate. Suggesting non-vascular functions as well.

Afferent fibers through the same pathway, some travelling with sympathetic nerve distribution and some with vagus nerve, conduct sensory stimuli responsible for renal pain. Thus renal pain is perceived in a vague fashion in the region of the costo-vertebral angle. In addition, somatic sensory nerve fibers from the groin and thigh entering the spinal cord at the same level as the autonomic afferent fibers, resulting in referred pain to these regions. Also, the nausea, vomiting and intestinal hypoperistalsis that are seen with renal pain are possibly due to travelling of some of the afferent sensory fibers along the course of the vagus nerve.

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~Gross Anatomy Of The Ureter.

The renal pelvis tapers down into a muscular tube, the ureter, this tube extends through the retroperitoneum to deliver urine from the kidney to the urinary bladder.

The average adult ureter is about 30 cm length divided into approximately equal abdominal and pelvic portions.

The abdominal ureter consists of lumbar and iliac divisions, each approximately 8 cm in length, traversing the lumbar and iliac fossae.

The pelvic ureter is divided into loger parietal and shorter intra-vesical divisions.

The abdominal ureter assumes a vertical course, down and medially, on the anterior surface of the psoas muscle, which separates it from the transverse processes. Lateral bowing of the ureters may be seen with retroperitoneal lymph nodes enlargement by neoplastic processes, with aortic aneurysmal dilatation or with hypertrophy of psoas muscle in athletic individuals.

The pelvic ureter is approximately 15 cm in length, the intravesical course begins where the ureter pentrates

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the base of the bladder and runs obliquely 2-4 cm through the vesical wall. The intravesical ureteral segment is composed of longitudinal muscle fibers only, as these smooth muscle fibers approach the ureteric orifice those fibers from the roof swing to either side to join fibers from its floor, then they spread out and join equivalent muscle bundles from the other ureter forming the superficial trigon. The superficial trigon passes over the neck of the bladder ending at verumontanum, 2-3 cm above the bladder, an external layer of longitudinal smooth muscle surrounds the ureter "Waldeyer's sheath". This sheath passes through the vesical wall to which it is connected by a few detrusor fibers. As it enters the vesical lumen its roof fibers diverge to join its floor fibers which then spread out joining contralateral fibers and forming the deep trigon, ends at bladder neckj (Tanago, 1963).

The longer parietal division of the pelvic ureter continues in its close relationship with the peritoneum, crossing the brim of the pelvis just lateral to the bifurcation of common iliac arteries. It descends postero-laterally between the hypogastric artery and peritoneum and separated by the artery from pelvic musculature and nerves. Becomes medially directed at the level of the ischeal spine and crossed anteriorly and medially by the vas before reaching the bladder base.

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The ureter shows variations of its caliber and displays three points of physiologic narrowing. The narrowest internal diameter is the intramural portion 1-5 mm (3-15 F); next to it is the ureteropelvic junction 2 mm (6 F) and at site of crossing the iliac artery 4 mm (12 F). Some authors add the external ureteric orifice 3-4 mm (9-12 F) as a point of physiological constriction. The mid-abdominal ureter has the widest internal diameter 10 mm (30 F) (Eisendrath and Rolnick)

~Structure Of The Ureter.

The ureter is composed of three layers:- fibrous, muscular and mucosal.

The fibrous layer "Adventitia"; forms a complete investment around the entire ureter and continues up with the renal capsule, within the renal sinus, and continues down with the tissues surrounding the urinary bladder.

During peristaltic activity, the ureter slides and moving freely within the adventitia. Ureteral vascular and nerve supply come from several segmental sources and run longitudinally beneath the adventitia, so stripping and overmobilization of adventitia should be avoided particularly in iliac fossa.

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The mucosal layer; composed of transitional epithelium, 4-6 layers thick, and lies over a layer of connective tissue fibers, lamina propria, that allows easy distention. The mucosa is characterized by 4-6 longitudinal folds that become unfolded during ureteral dilatation and exaggerated in patients with ureteritis, giving striated appearance on urographic examination.

The fact that the ureter and renal pelvis share the same mucosa with the urinary bladder explains the relationship of urothelial cancers of upper and lower urinary tract. Because of either distal seeding of tumour cells or the effect of similar carcinogenic stimuli on similar epithelium, approximately 50% of patients with upper urothelial cancer develop bladder cancer and 3% of bladder cancer develop upper tract malignancy.

The muscular layer: the musculature of the renal pelvis continues into the upper ureter imperceptibly in the funnel shaped uretero-pelvic junction 85%. In 15% there is sharp transition between the pelvis and ureteral musculature resulting in box-shaped pelvis. The ureter has one muscle coat and its fibers are interwoven in every direction. Fibers are neither purely circular nor purely longitudinal. The result of lengthening, stretching and rotation of the develping ureteral bud is that muscle bundles assume spiral or helical orientation (Tanago, 1971)

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Each muscle bundle is one long irregular helix and combination of several of these fibers result in the unique arrangement of ureteral musculature which appear in transverse section as composed of circular and longitudinal arranged fibers with predominance of one or the other according to degree and direction of growth.

The pelvis has predominance of circularly oriented fibers because its growth is more along the transverse axis, i.e. broadening. The ureteropelvic junction with gradual change from broadening to lengthening with more circular fiber orientation than longitudinal orientation resulting in funnel shaped pelvis. In box-shaped pelvis, there is little or no stretching at the level of uretero-pelvic junction with predominance of circularly oriented fibers. The ureter proper has equal mixture of fiber orientation. The intravesical ureter is purely longitudinal arrangement due to pulling force along longitudinal axis during embryological development.

The helical arrangement is the most effacious way of providing the unique ueteral prestaltic wave.

As the terminal ureter approaches ureteral orifices its helical loops become widely open and changes from a tubular to a sheath like structure offering an efficient adaptable sphincter mechanism to guard against reflux.

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