

SURGICAL AND TRAUMATIC URETERAL INJURIES

ESSAY

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By

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INTRODUCTION

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INTRODUCTION

Ureteral injuries are often considered uncommon entities. However, it is important to realize that, trauma to the ureter not only is a war-time entity but may also be associated with injuries occurring in today's violent society. They occur during violence, either blunt or penetrating.

The ureter is at risk in any pelvic surgical procedures for benign as well as malignant conditions particularly those procedures done deep in the female pelvis. It is subjected to iatrogenic injuries with much greater frequency than external trauma.

The true incidence of ureteral injury is difficult to evaluate. There may be reluctance of the operator to report this mishap, but many injuries probably go unrecognized too.

Proper treatment of injury to the ureter depends upon a precise knowledge of the anatomy of the ureter and its relationship to the abdominal organs. One must thoroughly understand ureteral blood supply and have some concept of the normal physiology of ureteral healing.

With the recent technical developments in endo-

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I- ANATOMY OF THE URETER

Course:

The renal pelvis tapers down into a muscular tube "the ureter" on each side. The ureter lies in retroperitoneal adipose tissue and usually adheres to the peritoneum during mobilization (Pearse and Hodges, 1976).

The average ureter is about 30 cm in length and may be divided into approximately equal abdominal and pelvic portions. Each portion, in turn, may be further classified, somewhat artificially, into two divisions. The abdominal ureter consists of lumbar and iliac divisions, each approximating 8 cm in length traversing the lumbar and iliac fossae respectively. The pelvic ureter is divided into the longer parietal and shorter intravesical divisions (Olsson, 1986).

The abdominal ureter assumes a vertical course downward and medially on the anterior surface of the psoas muscle, which separates it from the trans-

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verse processes. The pelvic ureter on each side is approximately 15 cm in length. 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 the common iliac arteries. It descends posterolaterally between the hypogastric artery and the peritoneum, and is separated by the hypogastric artery from the pelvic musculature and nerves. As it approaches the bladder base, the superior vesical artery crosses above the ureteral course, which then becomes medially directed once again (approximately at the level of the ischeal spine) to reach the urinary bladder (Olsson, 1986).

The ureter is not of uniform caliber, but rather displays three points of physiological narrowing at: 1) the ureteropelvic junction, 2) the crossing of the iliac artery, and 3) the ureterovesical junction. The internal diameter of the ureter tends to be smallest at the, ureterovesical junction (Olsson, 1986) (Fig. 1).

Ureteral Relations:

A- Abdominal Ureter:

On the right side, the abdominal ureter

lies deep to the peritoneum of the right mesocolon and the right infracolic compartment. Above, it lies behind the descending and transverse portions of the duodenum. More distally, it is crossed anteriorly by the gonadal artery and vein as well as the right colic and ileocolic vessels. The abdominal portion of the right ureter is also crossed by the root of the mesentery and terminal ileum below (Olsson, 1986).

On the left side, the gonadal vessels are initially parallel and then cross the ureteral course, and the left colic and sigmoid vasculature cross over the ureter anteriorly. Portions of the sigmoid colon approach in juxtaposition with the abdominal ureter (Olsson, 1986).

B- Pelvic Ureteral Relations:

The anatomic relations of the pelvic ureter depend on sex. In the male, the ureter is crossed in a lateral to medial direction anteriorly by the vas deferens. The vas at this point separates the ureter from the peritoneum. The ureter then continues medially to reach the seromuscular layer of the bladder in the lateral aspect of the angle formed by the vas and seminal vesicle (Olsson, 1986).

In the female, the parietal division of the pelvic ureter enters the pelvis in close association with the suspensory ligament of the ovary containing the ovarian vessels. It then descends along the posterior peritoneal surface of the broad ligament. It enters the parametrium, through which it proceeds forward around the cervix and, coursing anteromedially, reaches the urinary bladder. Typically, it is separated laterally from the cervix by approximately 2 cm and is about 1 cm above the vaginal fornix at this point. In this region, it is enveloped by the veins of the vaginal and perivesical plexus of venous drainage. The anteromedial direction of the ureteral course from the cervix to the bladder results in the distal-most ureter lying anterior to the vaginal wall just prior to reaching the urinary bladder (Olsson, 1986).

Blood Supply of the Ureter:

The arterial supply of the ureter arise from the renal, abdominal aorta, gonadal, hypogastric, vesical, and uterine arteries (Figs. 2, 3).

Branches from the main renal artery or renosuprarenal plexus serve as a rich contribution to proximal

ureteral and renal pelvic blood supply. Similarly, the numerous branches to the pelvic ureter from hypogastric, vesical, and uterine arterial sources result in a heavily vascularized region (Olsson, 1986).

The intermediate, or iliac abdominal, region of the ureter receives the fewest direct arterial contributions. However, there is a richly intercommunicating anastomotic network of smaller vessels surrounding the ureter throughout its length that ensures its nutrition and viability (Pearse and Hodges, 1976; Olsson, 1986).

The most constant vessel supplying the pelvic ureter in the female is the uterine artery. Vessels from the uterine and vesical arteries reach the ureter on its lateral aspect; therefore, during pelvic surgery, vessels should be ligated medial to the ureter if possible (Pearse and Hodges, 1976).

Interruption of the arterial supply does not afford significant ureteral ischemia, which explains the well known surgical fact that the ureter may be freed with relative impunity, and also the rather remarkable property of being able to withstand interruption of one or both its ends without serious damage (Lich et al., 1978).

branches follow the small ureteral artery which arises from either the common iliac or the internal iliac artery. These nerves are closely associated with the spermatic nerve.

- An inferior group of nerves: The lower end of the ureter receives its nerve supply by fibers from the hypogastric nerve and the inferior hypogastric plexus. These nerves connect with fibers which supply the vas deferens and seminal vesicles (Colby, 1961) (Fig. 6).

Lymphatic Drainage of the Ureter:

There is a freely interconnecting plexus of vessels draining the submucosa, muscularis, and adventitia of the ureter along its entire length. Various collecting vessels may be found from these plexuses:

- In the upper third of the ureter, the collecting vessels either intercommunicate with the four or five lymphatic trunks draining the kidney or drain directly into the lateral aortic lymph nodes.
- In the middle third of the ureter, the collect-

ing vessels empty into the common iliac node chain.

- From the pelvic portion of the ureter however, the lymphatic drainage merges with that of the urinary bladder to drain into the internal iliac lymph node group, outlying members of which include the presacral lymph nodes and the obturator nodes (Olsson, 1986).

Surface Markings of the Ureter:

On the anterior abdominal wall it can be marked from the tip of the ninth costal cartilage to the bifurcation of the common iliac artery. This latter point is found by joining the point of bifurcation of the abdominal aorta (2 cm below and to the left of the umbilicus) to a point midway between the anterior superior iliac spine and the symphysis pubis. The common iliac artery bifurcates one-third of the way down this line (Last, 1978).

The line of projection of the ureter on an X-ray film lies medially to the tips of the transverse processes of the lumbar vertebrae and crosses the pelvic brim at the sacro-iliac joint. From here its pelvic shadow passes to the ischial spine and thence, forshortened, to the pubic tubercle (Last, 1978).