

B. STUDY COMPONENT

SESSION II: Clinical Anatomy of the Urinary System

UNIT THEME 2: THE UROGENITAL SYSTEM

SUB-SPECIFIC OUTCOMES:

The clinical anatomy component of block XI is designed to enhance the development of multi-disciplinary knowledge and problem-orientated learning abilities in order to integrate anatomical concepts applicable to the urogenital system.

SUB-UNITS:

1. Bladder
 - a. Bladder neck
 - b. Ureterovesical junction
 - c. Trigone
2. Prostate
 - a. Relations
 - b. Structure
 - c. Zones
3. Membranous urethra
4. Female urethra

EMBEDDED KNOWLEDGE:

The student must know and understand the following:

The basic anatomy of the urinary and genital systems covered in Syllabus theme two and three of GNK 288 (SA4) (Dissection Block).

ASSESSMENT CRITERIA:

Self assessment

1. Make a thorough study of the parts of the urogenital system during the session.
2. Identify and provide labels for diagrammatic sketches, radiological images and wet specimens illustrating any of the above-mentioned aspects or structures.

Peer assessment

You must be able to discuss the subunits with your fellow students.

Formative and summative evaluation

1. One test is written during the block.

ASSESSMENT PORTFOLIO:

Identification of the urogenital system and solving clinico-anatomical problems related to these systems.

CRITICAL SKILLS:

The student must be able to:

1. Identify and name the parts of the urinary system, and describe its macroscopic appearance and most important relationships.
2. Write short notes on the male and female urethra.
3. Describe the course and relations of the ureter with specific reference to places where obstructions may occur.
4. Describe the external and internal appearance of the urinary bladder with special reference to the:
 - Uretero-vesicular junction
 - Trigone
 - Bladder neck in males and females
5. Explain the anatomy of the uretero-vesicular junction and how it is adapted to prevent ureteral reflux.
6. Identify and name the surfaces and angles of the urinary bladder.
7. Name the blood supply and innervation of the parts of the urogenital system.
8. Label a diagrammatic sketch, radiological image or wet specimen regarding any part of the urogenital system.
9. Explain the relationship between the surface anatomy of the urogenital tract and the radiographic procedures used to demonstrate the system.
10. Explain the clinical importance and organization of the blood supply with special reference to normal variants of the renal arteries.
11. Explain the innervation of the urogenital system with specific reference to visceral referred pain of the kidneys and ureters.
12. Explain the concept of the falx inguinalis.
13. Give an overview of the inguinal canal and name its contents.
14. Explain the difference between inguinal, direct and femoral hernias.
15. Describe the perineum with emphasis on the content and clinical importance of the anal and urogenital triangles.
16. Integrate clinical examination methodology to the surface anatomy of the urinary system.
17. Explain the anatomical basis of the extravasation of urine to the perineum and peritoneal cavity.
18. Describe the anatomy of the prostate under the following headings:
 - Macroscopic structure
 - Internal structure
 - Prostatic urethra
19. Briefly describe the anatomy involved in the digital rectal examination of the prostate gland.
20. Interpret the three dimensional structure of the urinary organs and their relation to anatomical landmarks as seen on standard radiographic images.
21. Identify, understand and interpret the relationships of the urinary system as seen by special radiographic procedures and imaging techniques.

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TERMINOLOGY:

accessory renal artery
 chronic prostatitis
 falx inguinalis
 obstructive uropathy
 prepuce
 trigone
 ureteral reflux
 Waldeyer's sheath

BPH
 excretory urography
 fascia transversalis
 periuretral glands
 prostatic utricle
 referred pain
 uretero-vesicular junction

Denonvilliers fascia
 extravasation
 IVP
 preprostatic sphincter
 prostatic sinuses
 urachus
 verumontanum

Block XI: Session 2

Station 1: Kidneys

1. The marked nerves lie posterior in relation to the kidneys.

a) What is the root values of this/these nerve(s)?

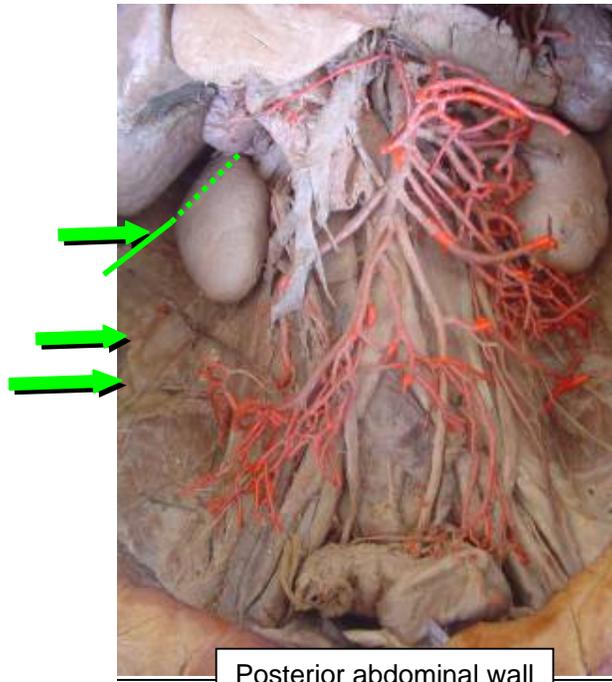
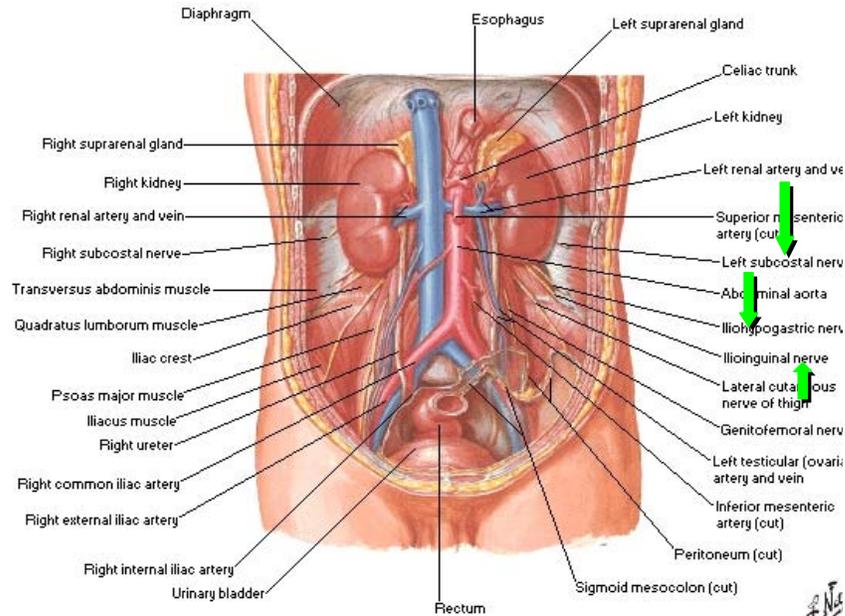
Subcostal n: T12; Iliohypogastric & ilioinguinal nn: L1

b) Explain visceral referred pain of the kidneys and ureters.

The referred pain sites are the small of the back (lumbar area), extending to the groin (inguinal region) and genitals. Nerves arise from the renal plexus and consist of sympathetic, parasympathetic and visceral afferent fibres from the thoracic and lumbar splanchnic nerves and vagus nerve. Spinal cord segments involved: T11 & T12.

Kidneys in Situ

Anterior View

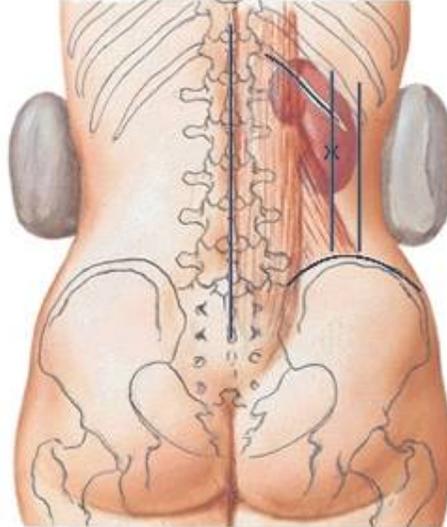


c) Where is a kidney biopsy usually taken?

Renal Biopsy - 1 Preparation and Selection of Biopsy Site

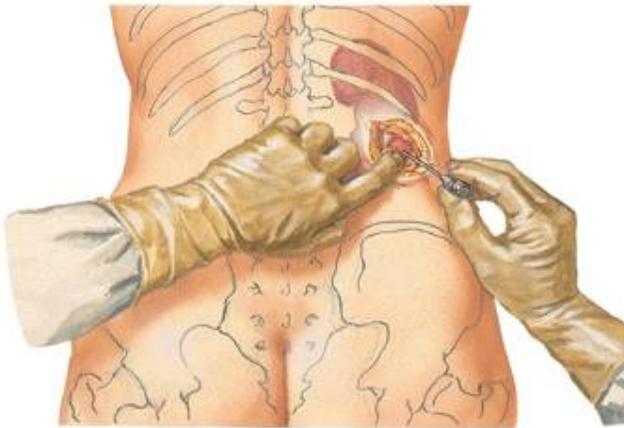


Proposed biopsy site (X) selected on radiograph and its topography defined by measurement from lines of spinous processes, iliac crest, and 12th rib

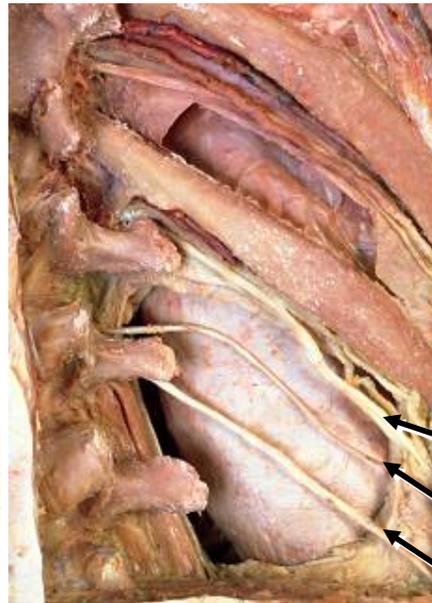


Site identified on patient's back by identical measurements from same reference lines drawn in 1% crystal violet. Patient lies prone with sandbags under abdomen to fix kidney against back. Blood pressure and pulse monitored

Renal Biopsy - 3 Surgical Biopsy



A 2-inch incision is made below outer end of 12th rib. Musculature and fascia are penetrated by blunt dissection. Lower pole of kidney identified by index finger of left hand, which then guides needle into kidney parenchyma. Biopsy specimen then obtained in usual manner



subcostal n
iliohypogastric n
ilioinguinal n

Posterior view of right kidney

Renal Biopsy - 2 Needle Biopsy Technique

Skin disinfected, anesthetic wheal raised, and subcutaneous tissues and muscles of back anesthetized below wheal; 6", 22-gauge exploring needle introduced toward kidney, passing through back muscles. Resistance felt as needle penetrates renal capsule and needle swings in wide arc with respiration; its motion should not be restricted. Depth marked off and needle withdrawn; procaine again injected (but not in kidney substance) as needle withdrawn

Small skin incision made in wheal at biopsy site

If Franklin-Silverman needle used, cannula, with obturator in place, introduced to premeasured depth along procaine-infiltrated tract entry into kidney (recognized by touch and also by characteristic swing of needle as patient breathes). With use of disposable needle, it is similarly introduced with cutting edge closed

As patient holds breath, obturator of Franklin-Silverman needle removed, and cutting prongs inserted to full depth. With use of disposable needle, cutting tip is extended at this point

Patient holds breath again. F-S cannula pushed down over cutting prongs without advancing the latter; prongs withdrawn slightly to allow small amount of blood to enter cannula, and needle rapidly withdrawn. With use of disposable needle, cutting tip closed and needle withdrawn

F. Netter
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d) Renal vasculature plays an important role in finding an appropriate donor for transplantation. Briefly describe the anatomy relevant to this procedure.

1. Presence of atypical or accessory renal arteries:

Normal renal arterial pattern (red latex)

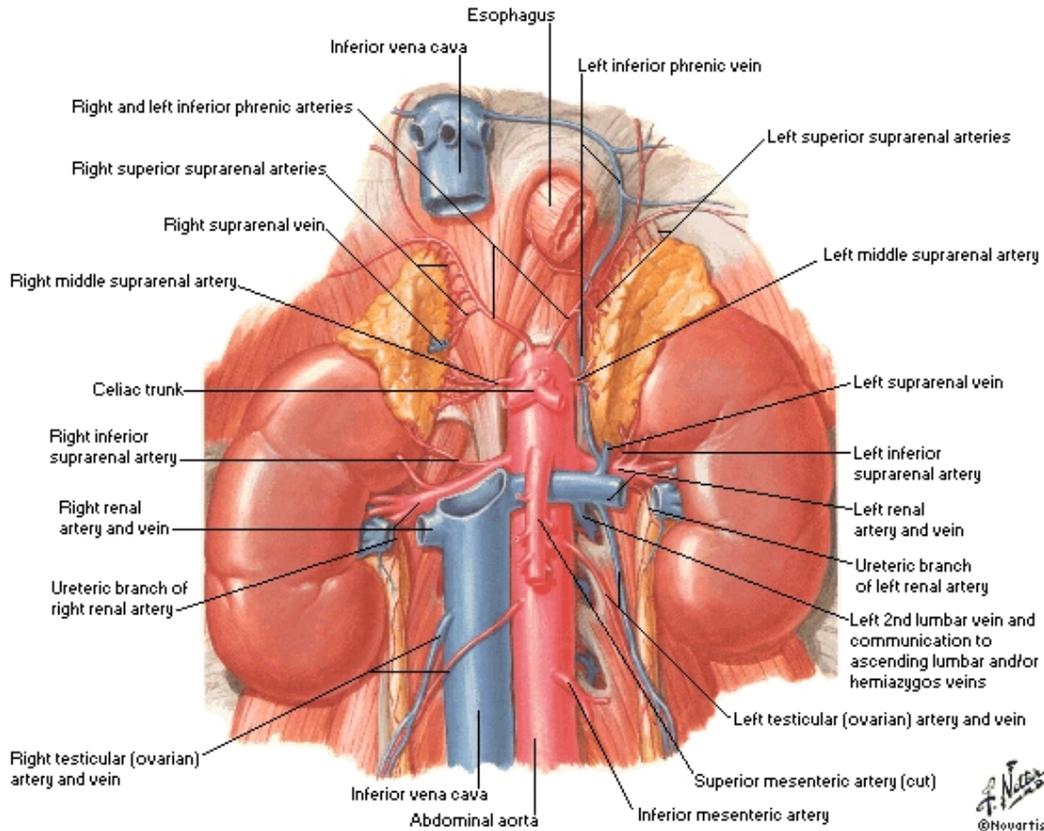
A) Low accessory right renal artery may pass in front of inferior vena cava instead of behind it

B) Inferior phrenic artery with suprarenal arteries may arise from renal artery

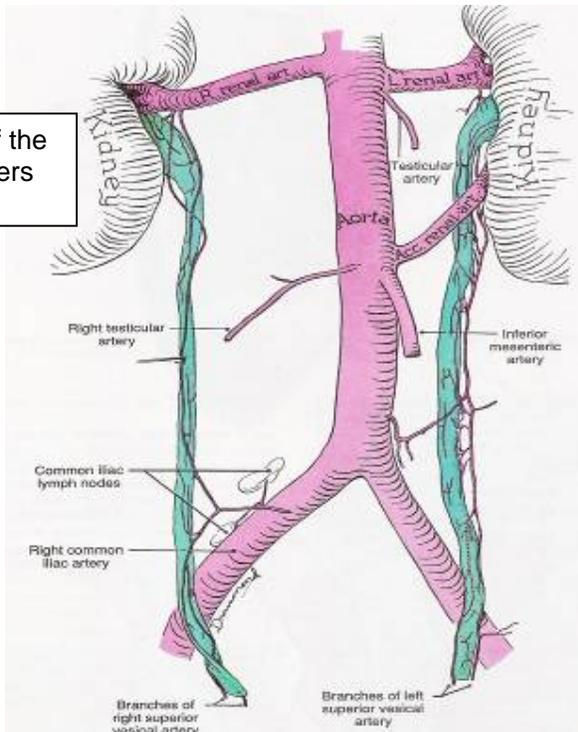
Proximal subdivision of renal artery

2. Detail of renal arteries:

Renal Artery and Vein in Situ

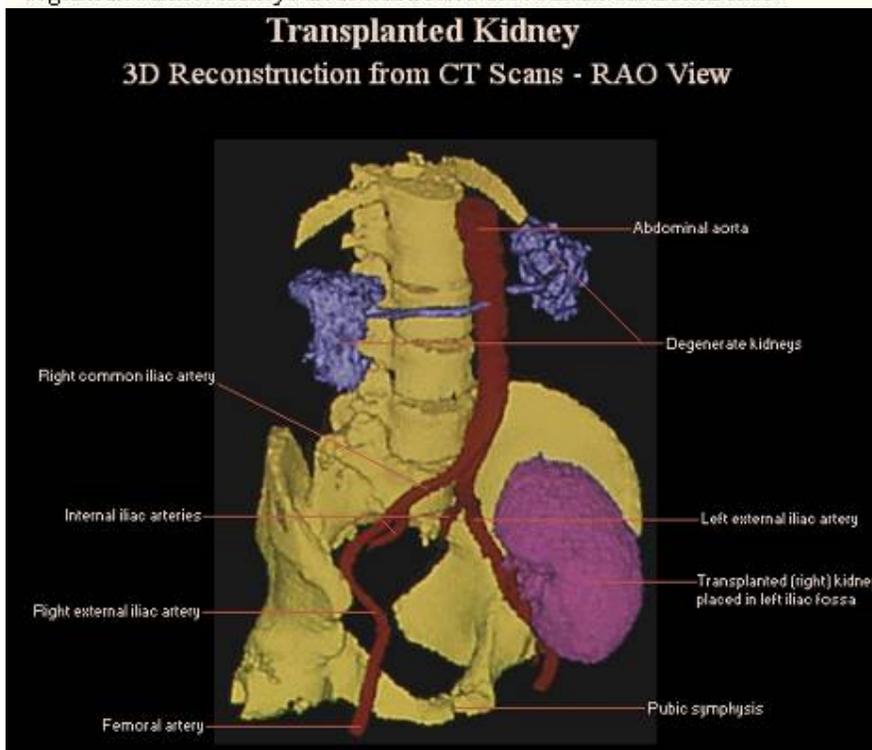


Blood supply of the kidney & ureters



3. Renal transplants:

Once considered a revolutionary surgical procedure, transplantation of the kidneys has become relatively commonplace as an acceptable clinical treatment for chronic end-stage renal failure. For several reasons, including availability of vasculature, proximity to the bladder, and physical support (to prevent nephroptosis, which would stretch the vascular anastomoses), the transplanted kidney is placed retroperitoneally in the iliac fossa. The ureter of the donor kidney is usually implanted in the bladder through a submucosal tunnel. The transplanted kidney shown here appears to be thriving. The degenerated native kidneys are reconstructed above in the usual renal sites.



Transplanted Kidneys

The iliac fossa on the posterior abdominal wall is the usual site chosen for transplantation of the kidney. The fossa is exposed through an incision in the anterior abdominal wall just above the inguinal ligament. The iliac fossa in front of the iliacus muscle is approached retroperitoneally. The kidney is positioned and the vascular anastomosis constructed. The renal artery is anastomosed end-to-end to the internal iliac artery and the renal vein is anastomosed end-

to-side to the external iliac vein (Fig. 5-80). Anastomosis of the branches of the internal iliac arteries on the two sides is sufficient so that the pelvic viscera on the side of the renal arterial anastomosis are not at risk. Ureteronephrostomy is then performed by opening the bladder and providing a wide entrance of the ureter through the bladder wall.

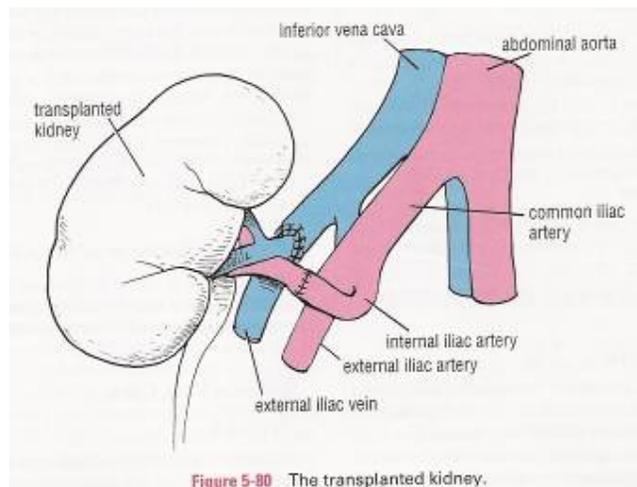
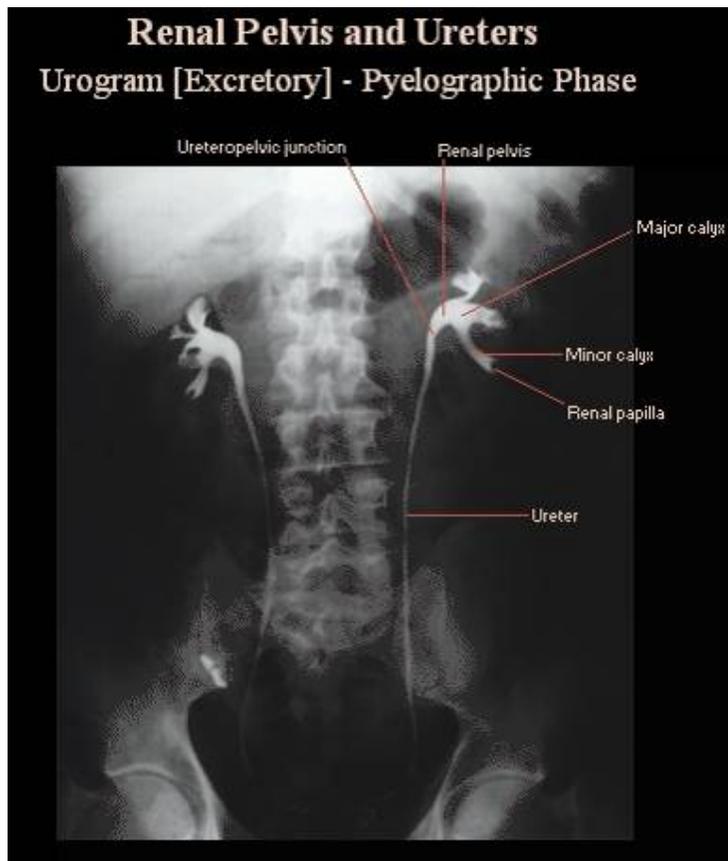


Figure 5-80 The transplanted kidney.

Station 2: Radiology of the kidneys

1. Study the IVP below and briefly explain how the image was obtained. Add a note on the visible structures.



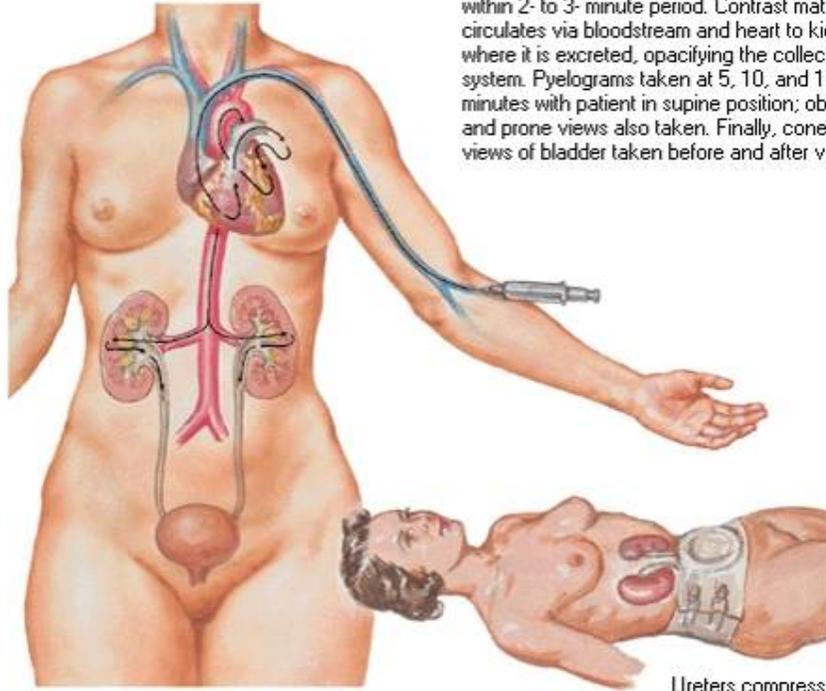
Intravenous pyelograms (also known as excretory urograms) are the product of the most frequently used imaging examination of the urinary tract, enabling visualization of the renal parenchyma, the renal collecting systems (calyces and pelves), the ureters, and the urinary bladder, while providing a rough test of renal function. Starting at 1 minute after intravenous injection of the contrast medium, serial films are obtained at 5-minute intervals for the next 15 minutes as the medium is excreted by the kidneys.

Slight obstruction of the ureters by means of an abdominal compression band retains some opacified urine in the kidneys, enhancing visualization of the pelves and calyces. [For specific information about the procedure, see the Procedural Correlation C420 "Intravenous Pyelography: Excretory Urography."]

Intravenous Pyelography

Excretory Urography

30 ml contrast medium injected intravenously within 2- to 3- minute period. Contrast material circulates via bloodstream and heart to kidneys, where it is excreted, opacifying the collecting system. Pyelograms taken at 5, 10, and 15 minutes with patient in supine position; oblique and prone views also taken. Finally, coned-down views of bladder taken before and after voiding



Station 3: Ureters

1. Describe the course and relations of the ureter with specific reference to places where obstructions may occur.

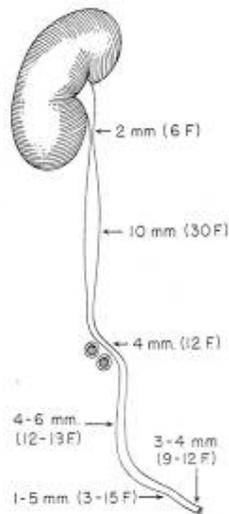
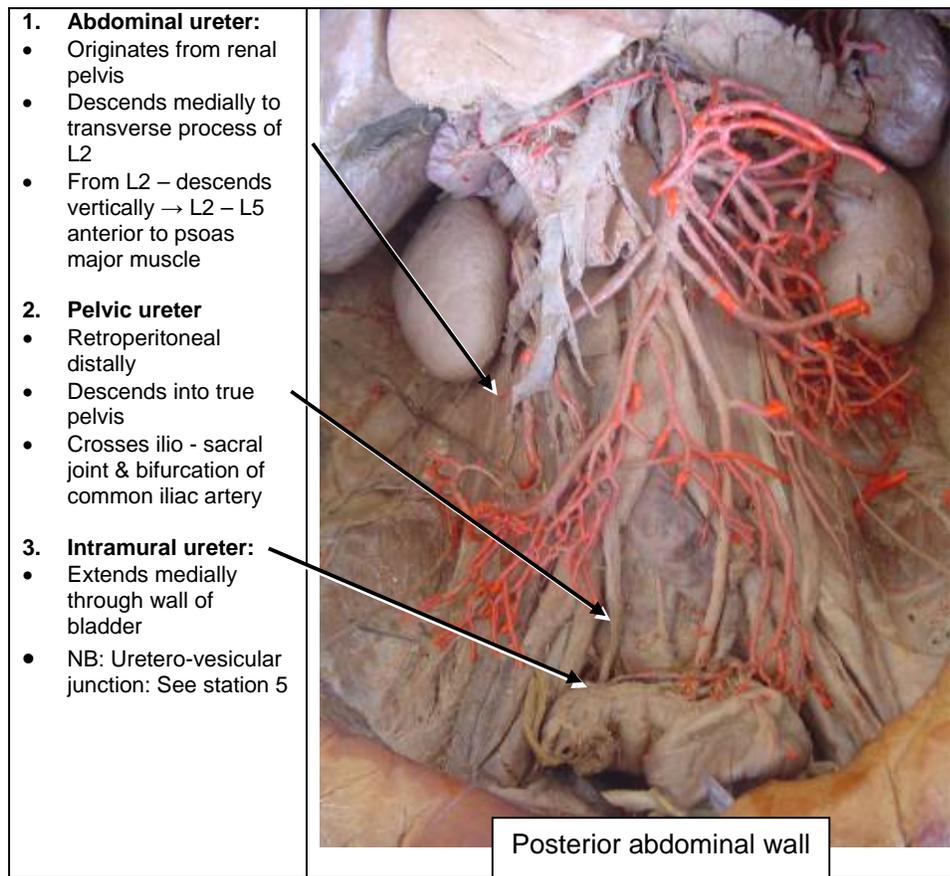
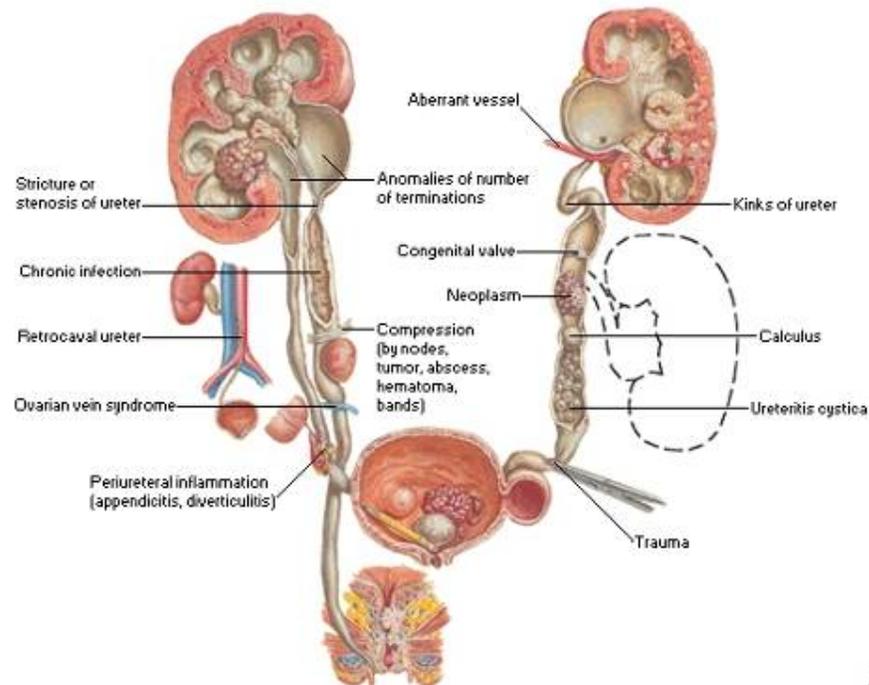


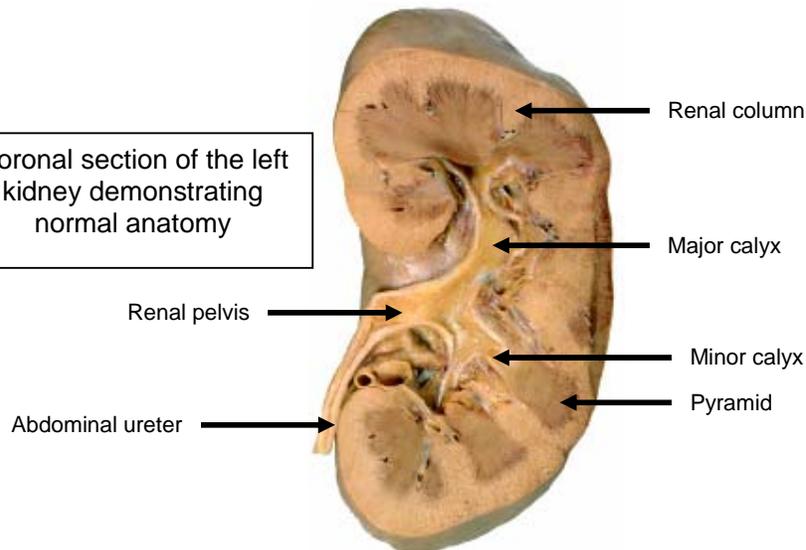
Figure 2-47. The ureter, demonstrating variations in caliber, including three normal anatomic narrowings—at the ureteropelvic junction, the iliac vessels, and the ureterovesical junction. Note also the anterior displacement of the ureter, which occurs over the iliac vessels, shown here diagrammatically.

Obstructive Uropathy

Obstruction of Ureters



Coronal section of the left kidney demonstrating normal anatomy



Obstruction to the flow of urine causes pathologic changes in the urinary tract referred to as obstructive uropathy, which, if uncorrected, will cause obstructive necropathy (tissue death or gangrene as a consequence of the urinary obstruction). The seriousness of the clinical situation is increased enormously if infection is also present. Obstructive uropathy is one of the common causes of the morbidity and mortality associated with renal disease.

Both congenital and acquired lesions may cause obstructive uropathy. The point or area of obstruction may be located anywhere from a renal calyx to the urinary meatus. [See the Clinical Correlations C135 "Obstructive Uropathy: Obstruction at Level of Kidneys and Renal Pelvis," C137 "Obstructive Uropathy: Obstruction of Bladder," C138 "Obstructive Uropathy: Obstruction of Female Urethra," and C139 "Obstructive Uropathy: Obstruction of Male Urethra."] Depending on the site of the obstruction, the condition may be unilateral or bilateral.

The obstruction produces a compensatory hypertrophy of the muscular wall proximal to it. However, when this is insufficient to overcome the obstruction, decompensation and dilation occur, followed in time by pressure atrophy of renal tissue. Urinary stasis also favors precipitation of dissolved salts, and the resulting calculi may aggravate the destructive process. Nevertheless, the prime danger of obstruction lies not solely in the direct effect of altered urodynamics but in the consequent increased risk of superimposed infection, which can greatly accelerate and amplify the destruction of renal parenchyma.

Although acute urinary tract obstruction is often manifested clinically by obvious symptoms, chronic obstruction can be much more insidious and is often silent. The first manifestation of long-standing obstructive uropathy is frequently the onset of infection or the occurrence of acute urinary retention; renal destruction may already be far advanced. This is especially true in children, and even if symptoms are present in the younger age group, they often take the form of vague abdominal discomfort rather than flank pain or urinary complaints. In adults, symptoms may vary from vague, nonspecific complaints to severe, colicky pain associated with acute urinary retention.

It is therefore important to detect even minor indications of obstructive uropathy, such as a decrease in urinary concentrating ability, enuresis (urinary incontinence), dysuria (difficult or painful urination), polyuria (excessive urination), change in size and force of the urinary stream, and nocturia (urinating at night; waking to urinate). Hematuria (blood in the urine) and other abnormalities found on examination of the urine also provide diagnostic clues. Urinary tract infection often indicates more serious underlying pathology.

Obstructive uropathy must be diagnosed as early as possible, when treatment may still be simple and permanent damage preventable. It is a challenge well worth the prize of salvaging renal tissue. Drug treatment of urinary tract infections without correction of any existing obstructive uropathy usually fails to eliminate the infection. Often it only complicates adequate therapy and may, in fact, endanger the patient's life.

4. As in the case of knife wounds to the posterior abdominal wall, the ureter is also in danger during surgical procedures:

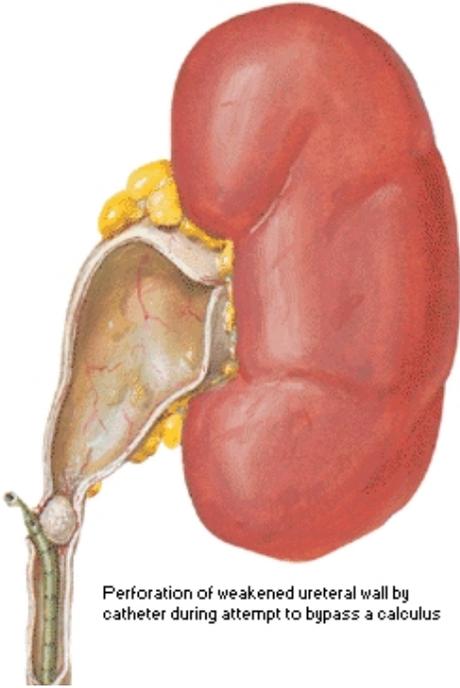
Ureteral injury is most commonly the result of surgery, although it may also be caused by penetrating wounds from knives or firearms.

Surgical injury to the ureter can occur as a result of ureteral catheterization, especially if the ureter is the site of pathologic changes secondary to a stone or neoplasm. Injury can also occur during open surgical procedures [see the Clinical Correlation C140 "Surgical Injury to Ureter: Injury During Open Surgical Procedures"] and from attempted endoscopic stone removal with baskets or loops.

The most important aspect of treating surgical injury to the ureter is to recognize it early so that proper corrective measures can be instituted quickly enough to avoid severe complications. Injuries caused by a ureteral catheter are usually readily recognized at the time they occur, since adequate radiographic studies are generally part of the procedures in which such catheterization is performed.

Surgical Injury to Ureter

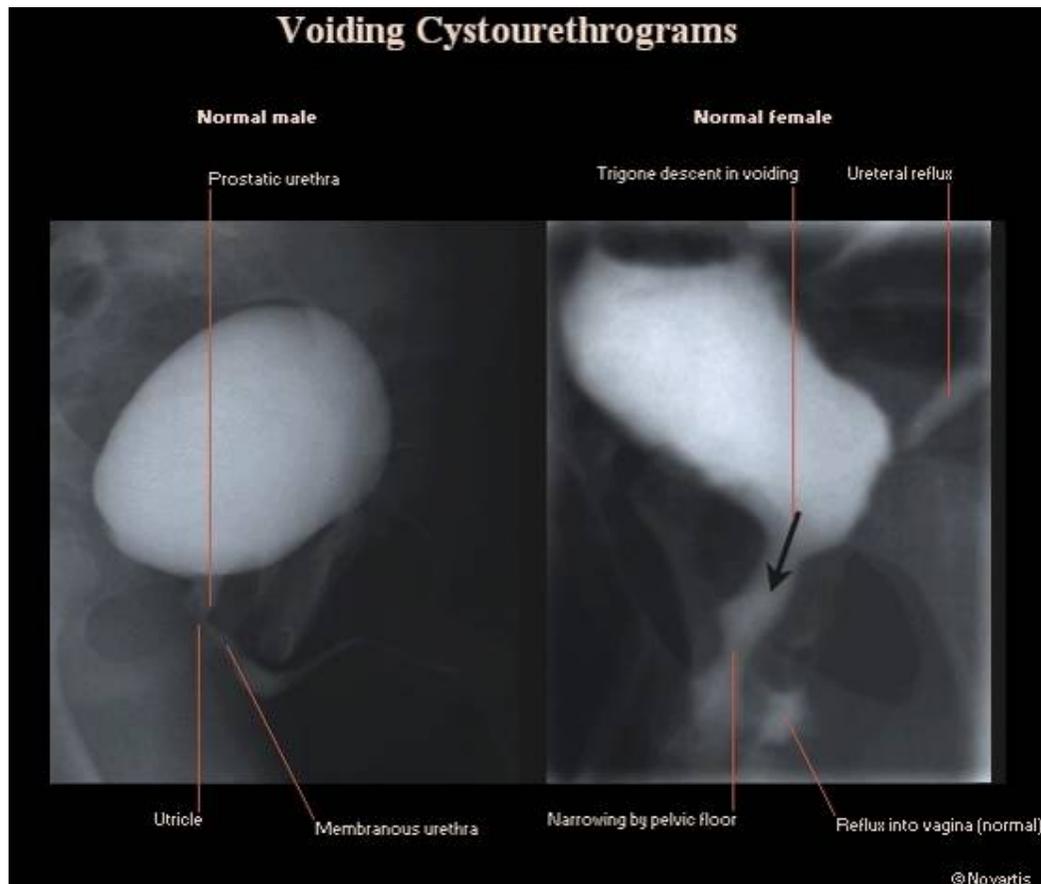
Injury During Ureteral Catheterization



Intravenous pyelogram, delayed phase.
Urinary extravasation from left ureter
injured by catheterization

Station 4: Bladder

1. Study the cystogram below and briefly explain how the image was obtained. Add a note on the visible structures.

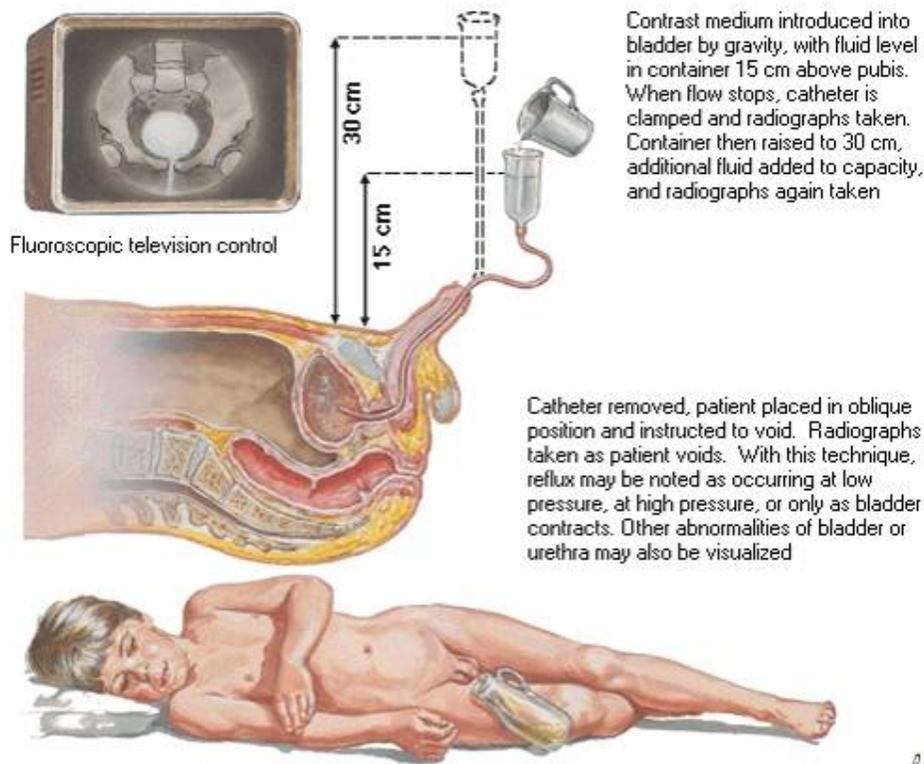


Cystourethrography is the radiographic study of the bladder and urethra by injection of contrast medium (radiopaque dye). [See the Imaging Correlation C314 "Voiding Cystourethrograms."] Reasons for performing cystourethrography include suspicion of a filling defect within the bladder (e.g., bladder stones or constriction or indentation by a tumor) and demonstration of abnormal patterns of urinary flow, such as abnormal communications (bladder diverticula or fistulas) or backflow of urine from the bladder into the ureters (vesiculoureteric reflux). Urethrography is indicated in suspected cases of urethral stricture, valves, diverticula, calculi, or fistulas.

With the patient in the supine position, a catheter is passed under aseptic conditions. Alternatively, a percutaneous suprapubic puncture of the bladder may be used, particularly if bacteriuria (presence of bacteria in the urine) is suspected and urine samples are to be collected [see the Procedural Correlation C425 "Suprapubic Bladder Puncture and Catheterization."]

After the bladder is adequately distended, spot films are exposed in supine, oblique, and lateral projections. With the patient in the right posterior oblique position, the catheter is removed. When the patient begins to void, multiple spot films are taken that include the bladder as well as the urethra.

Cystourethrography

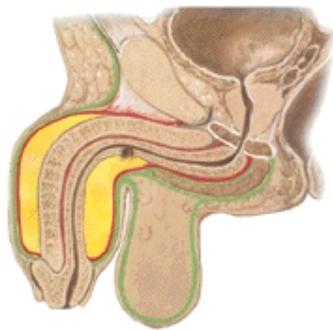
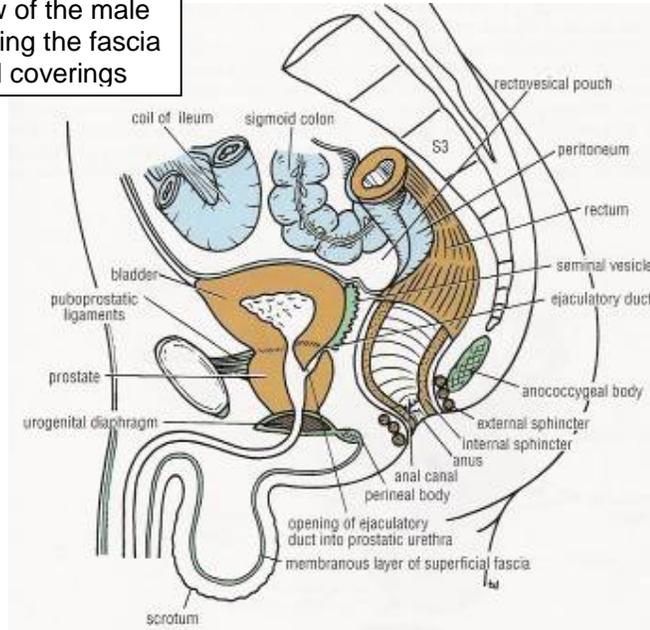


2. A 40 year old man is admitted to the trauma unit following a serious motor vehicle accident. His condition is firstly stabilised. His scrotum was swollen as well as the dorsal side of the penis (See arrows ↓ on diagram next page). As he has not passed urine since his admission, he was catheterised and blood was noted in the urine. Radiographic contrast studies indicate extravasation of urine. Explain, anatomically, why the urine will not spread into the thigh and gluteal areas.

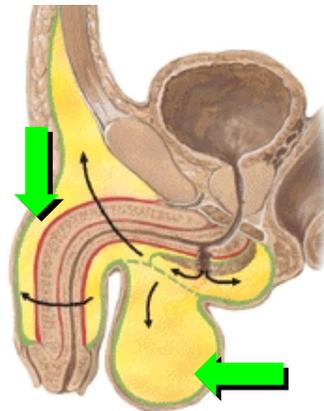
Rupture of the spongy or bulbous urethra may occur as a result of a straddle injury (e.g., crushing of the urethra between a rigid object, such as a hurdle while running track or the crossbar of a bicycle, and the pubic arch) or false passage of an instrument inserted into the urethra. With each urination, some of the urine escapes into the superficial perineal space [Plates 342A, 342B and 359A] between the perineal membrane and the superficial perineal (Colles') fascia. From here it may seep (1) into the loose connective tissue (dartos fascia) of the scrotum or penile shaft, or (2) superiorly, along the inferior anterior abdominal wall, deep to the membranous (Scarpa's) layer of superficial abdominal fascia. The urine cannot pass into the thighs because the membranous layer of superficial fascia of the abdomen (Scarpa's) and perineum (Colles') blends with the deep fascia of the thigh (fascia lata) just below the inguinal ligaments on each side. Likewise, urine cannot pass posteriorly into the ischioanal (ischioanal) fat body of the anal triangle because the two layers of perineal fascia (Colles' and the perineal membrane) fuse at the posterior border of the deep transverse perineal muscles. In the case illustrated here, the intense inflammation has resulted in the development of gangrene in the penile tissues. The bacterial flora of the normal urethra consists of both aerobic and anaerobic organisms, which are harmless saprophytes of this region.

However, when they are carried into remote tissues by extravasated urine, they evidently become pathogenic and are capable of producing acute gangrenous and gas-containing inflammations. Thus, urinary extravasation constitutes a medical emergency. Prompt use of antibiotics with surgical diversion of the urine has made possible a low mortality of this formerly serious situation.

Sagittal view of the male pelvis indicating the fascia layers and coverings



Perforation of urethra without penetration of deep (Buck's) fascia of penis



Perforation of urethra with penetration of deep (Buck's) fascia of penis



Straddle injury



Clinical appearance of urinary extravasation

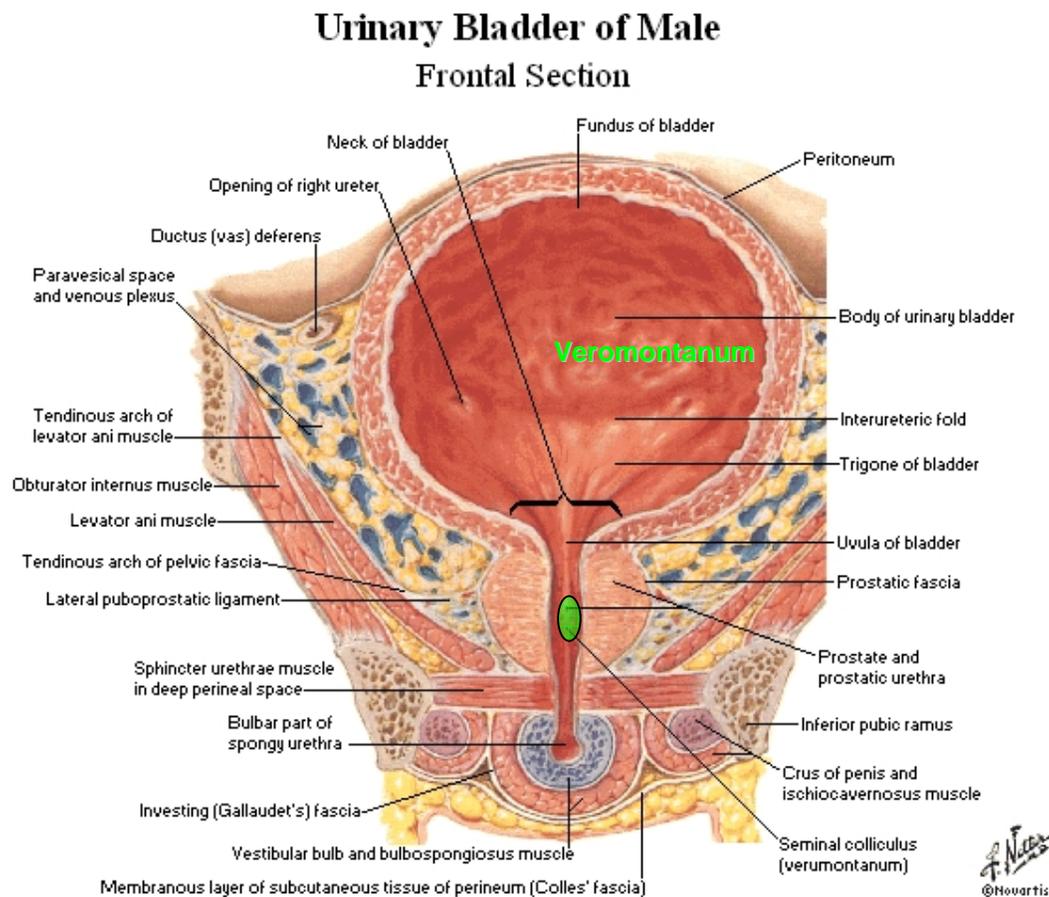


Injury from within (false passage)

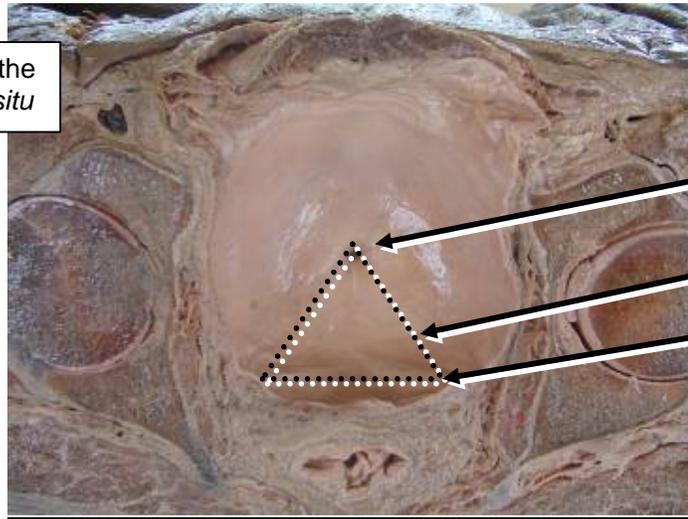
Station 5: Internal structure of the bladder and bladder neck

1. Describe the internal structure of the bladder with specific reference to the trigone.

The trigone is a triangle of smooth urothelium between the internal ureteral orifices and the internal urethral meatus leading to the neck of the bladder. Longitudinal fibres from each ureter meet to form a triangular sheet of muscle underlying the smooth urothelium of the trigone. F; this anchors the ureter to the bladder. Thickening of the edges of the muscular sheet creates the interureteric crest. The trigone has three distinct muscle layers: Superficial layer, derived from the longitudinal layer of the ureter, that inserts in to the verumontanum; Deep layer, that continuous from Waldeyer sheath and inserts into the bladder neck. The anatomical space between the superficial layer and deep layer is filled with loose fibrous ct. Function: This means that the intravesicular length of the ureter can increase and then tension is applied to the ureteral orifice that prevents reflux; Detrusor layer, formed by outer longitudinal and inner circular smooth muscle fibres of the bladder wall.



Superior view of the male bladder *in situ*



Urethral opening at the bladder neck
Trigone
Ureter opening

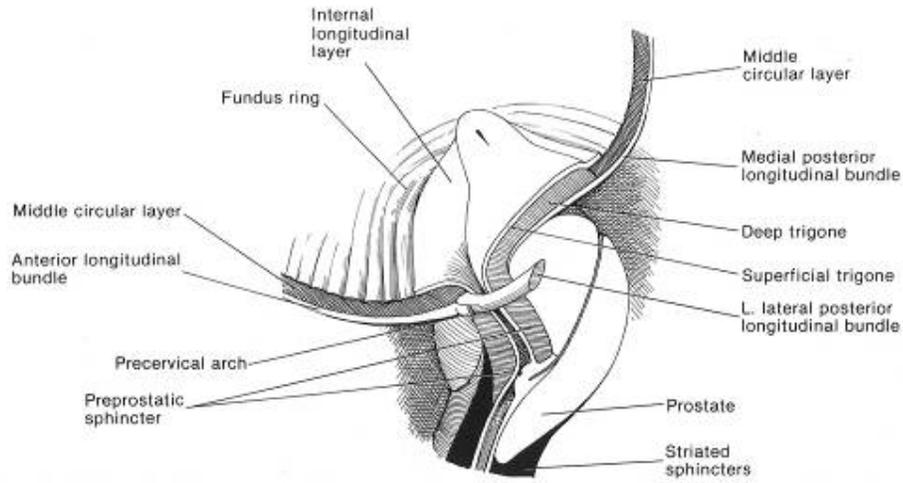
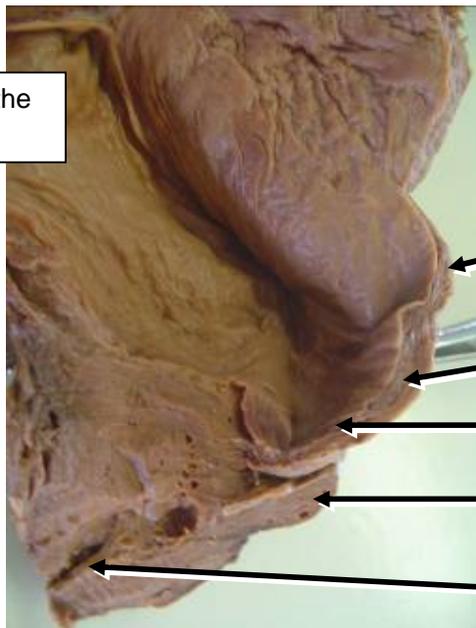


Figure 3-25. The male bladder base and preprostatic sphincter. (From Hinman F Jr: Atlas of Urosurgical Anatomy. Philadelphia, W.B. Saunders Company, 1993, p 336.)

Lateral view of the male bladder

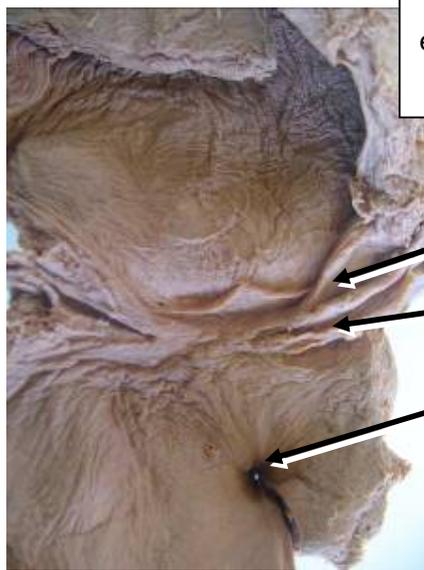
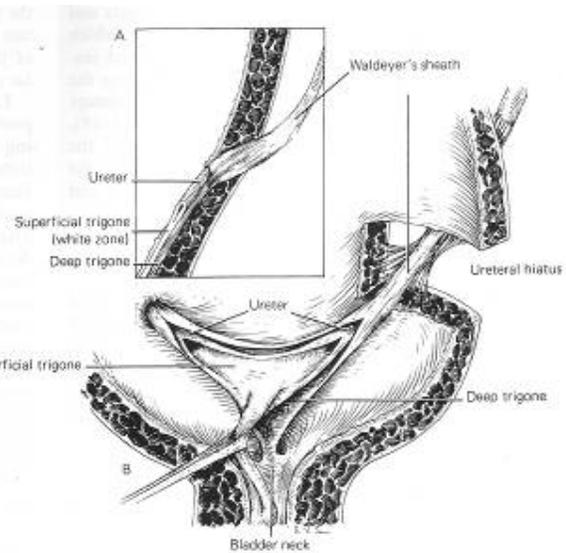


Middle circular layer
Deep trigone
Superficial trigone
Seminal vesicle
Prostatic urethra

2. Briefly explain the anatomy of the uretero-vesicular junction and how it is adapted to prevent ureteral reflux.

As ureter approaches the bladder, its spirally mural longitudinal smooth muscle fibres become longitudinal. Two to 3 cm before entering the bladder wall, a fibromuscular sheath (Waldeyer) extends longitudinally over the ureter and accompanies it to the trigone. The ureter pierces the bladder wall obliquely, becomes the mural ureter and terminates in the ureteral orifice of the trigone. As it passes through the bladder wall it is compressed and narrows considerably, therefore it is a common site for lodging of ureteral stones. This intravesicular ureter that lies beneath the bladder urothelium, and is also very pliant. It is backed by a strong plate of detrusor muscle. This arrangement is thought to result in a flap valve that will passively close with filling of the bladder and thus prevent reflux of urine into the ureters. Vesicoureteral reflux is often the result of insufficient length of the ureter's submucosal layer and poor detrusor plate support.

Figure 3-26. The normal ureterovesical junction and trigone. *A*, Section of the bladder wall perpendicular to the ureteral hiatus shows the oblique passage of the ureter through the detrusor and also shows the submucosal ureter with its detrusor backing. Waldeyer's sheath surrounds the prevesical ureter and extends inward to become the deep trigone. *B*, Waldeyer's sheath continues in the bladder as the deep trigone, which is fixed at the bladder neck. Smooth muscle of the ureter forms the superficial trigone and is anchored at the verumontanum. (From Tanagho EA, Pugh RCB: Br J Urol 1963; 35:151.)

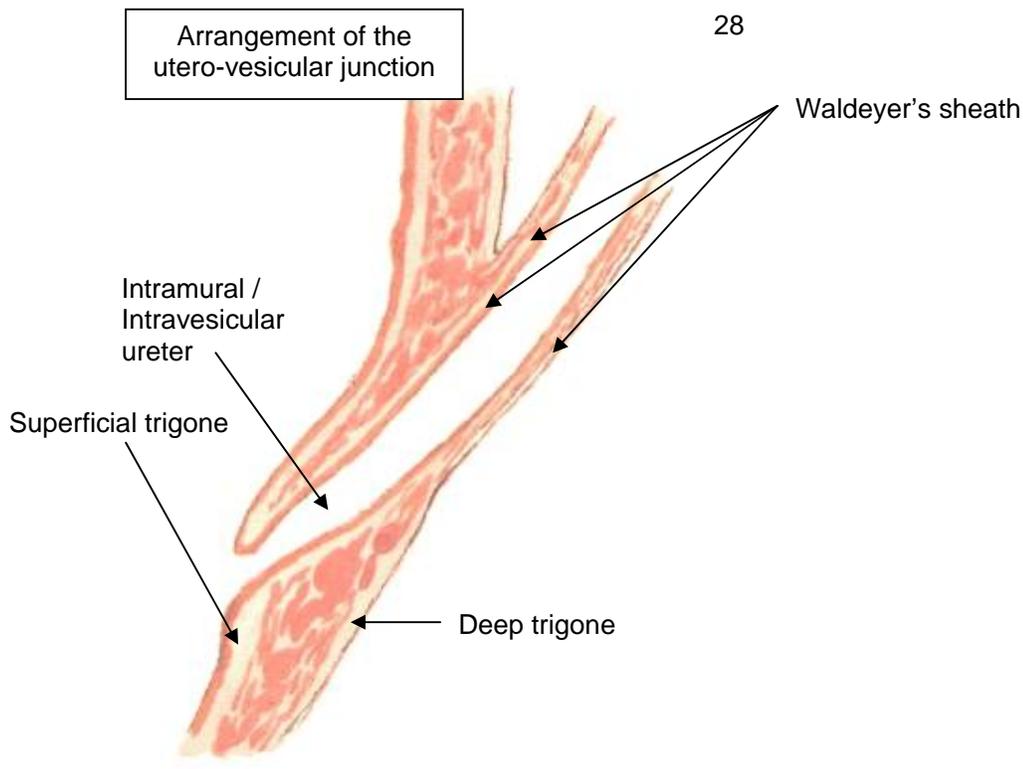


Uretero-vesicular junction
exposed on the posterior wall of
the bladder

Waldeyer's sheath

Ureter

Bladder neck



3. Compare the macroscopic structure at bladder neck in males and females.

Male:

Inner longitudinal fibres pass through internal meatus which become continuous with the inner longitudinal layer of smooth muscle in the urethra. Middle layer forms the circular preprostatic sphincter (F: continence at bladder neck). Innervation by sympathetic adrenergic fibres. Damage to these nerves (diabetes mellitus / retroperitoneal lymph node dissection for testis cancer) Leads to retrograde ejaculation. Outer longitudinal layer very thick posterior to bladder base. Insert in the midline into the apex of the trigone. And inferiorly they intermix with the smooth muscle of the prostate. Anteriorly this sheet of fibres fuses to form a loop around the neck of the bladder. (F: help of continence at bladder neck). (See diagrams at station 5 no. 1)

Female:

Inner longitudinal fibres converge to become the inner layer of the urethra. Middle circular layer thought to be absent. Outer longitudinal layer: Some fibres change direction to become oblique then fusing with the inner longitudinal layer of the urethra. Little adrenergic innervation. Sphincter F not as pronounced compared to male. According to Versi et al (1986) in 50% of women urine enters the proximal urethra during coughing.

Station 6: Prostate

1. Benign prostatic hypertrophy (BPH) is a condition common in men past the age of 45. Explain the macroscopic anatomy of the prostate with special reference to the different zones of the prostate. Add note on the anatomical basis for the signs and symptoms associated with BPH.

Surfaces:

Anterior, posterior, lateral, apex inferiorly, base superiorly. Contained within a false and true capsule. Smooth muscle bands on the posterior surface of the capsule that fuses with Denonvilliers fascia (=double layer of thickened pelvic peritoneum covering the seminal vesicles).

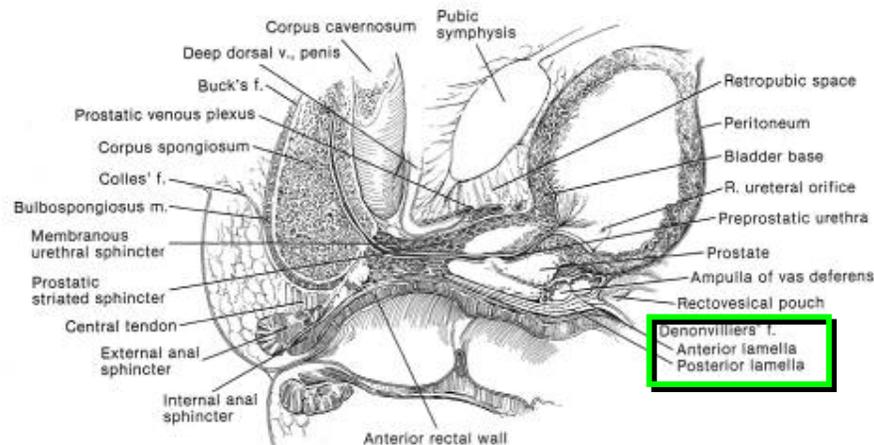


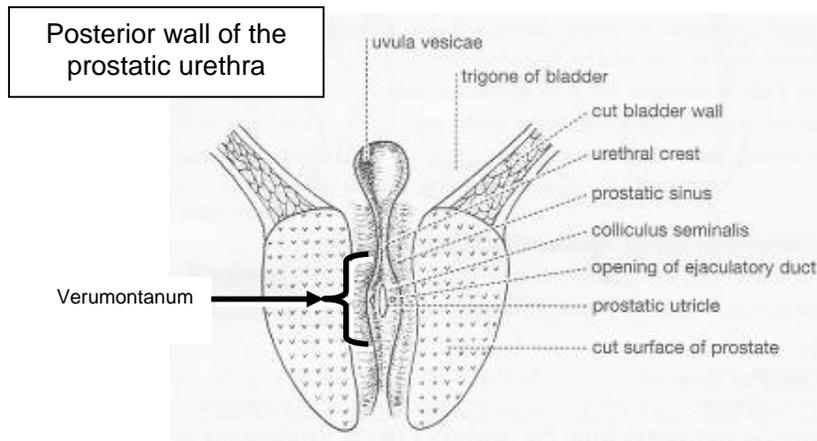
Figure 3-23. Sagittal section through the prostatic and membranous urethra, demonstrating the midline relations of the pelvic structures. (From Hinman F Jr: Atlas of Urosurgical Anatomy. Philadelphia, W.B. Saunders Company, 1993, p 356.)

Structure:

70% glandular elements, 30% fibromuscular stroma. The stroma is continuous with capsule.

Prostatic urethra:

The urethral crest lies in the posterior midline. To either side of crest is a groove, the prostatic sinuses into which all glandular elements drain. An angle occurs at this point that divides the prostatic urethra into a proximal (preprostatic) and distal (prostatic) segments. These segments differs anatomically and functionally. In the proximal segment, circular smooth muscle is thickened to form the involuntary preprostatic sphincter. Periurethral glands are located here, and contribute less than 1% of the secretory elements. However, in benign prostatic hypertrophy (BPH) these glands contribute significantly to prostatic enlargement. In the distal segment, the urethral crest widens and protrudes from posterior as the verumontanum. A slit on the apex of the verumontanum is known as the prostatic utricle. The openings of the ejaculatory duct are found laterally to the utricle orifice.



Zones:

Glandular elements of the prostate are divided in several zones. At the angle within the prostate, around the preprostatic urethra: the transition zone: BPH. Central zone around the ejaculatory duct. Peripheral zone 70% of prostatic glandular tissue. Ducts from this zone drain to prostatic sinuses in the distal segment of the prostatic urethra. This zone affected in chronic prostatitis.

Anatomically and clinically the prostate has two lateral lobes and one medial lobe. This medial lobe can be palpated through the rectum. These lobes do not correspond to histology of a normal prostate, but relates to the pathological enlargement of the transition zone laterally and the periurethral glands centrally.

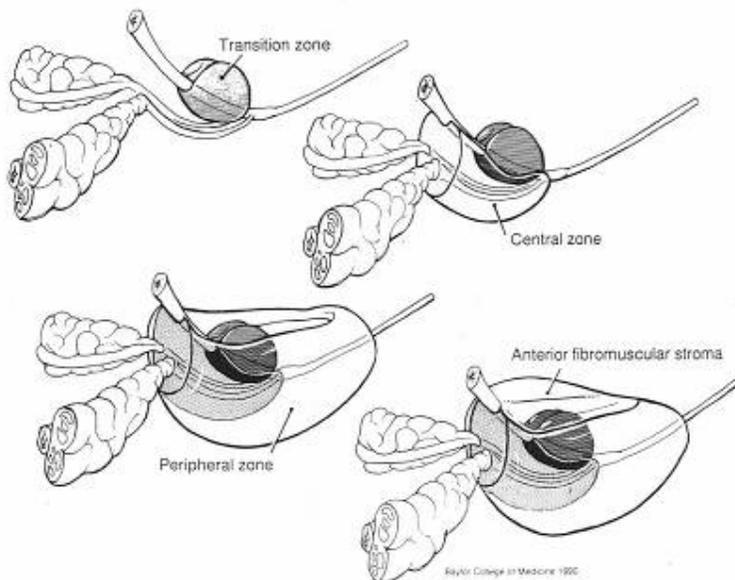
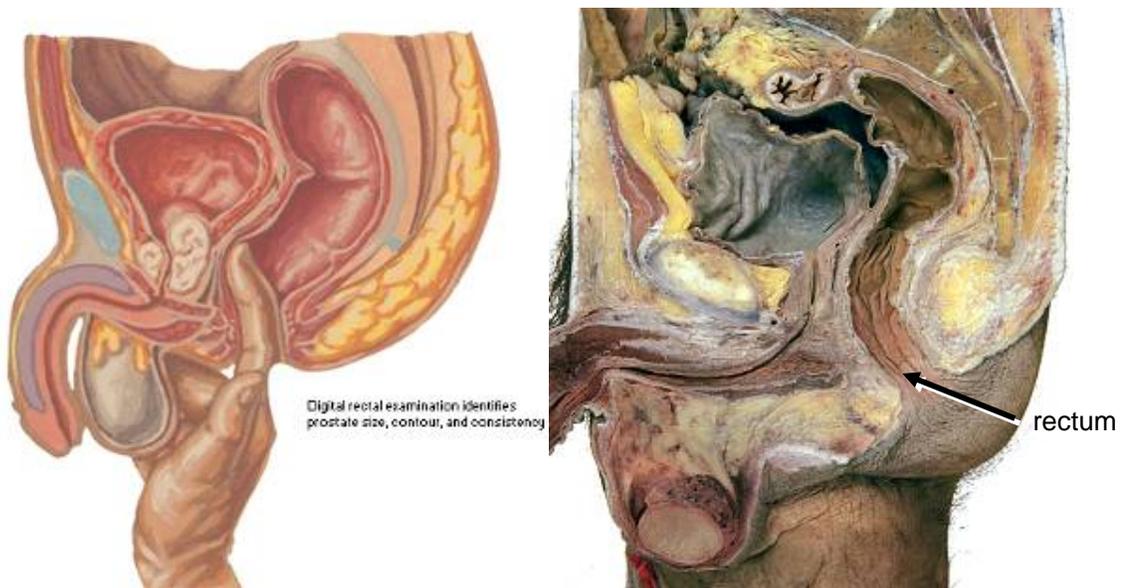


Figure 3-28. Zonal anatomy of the prostate as described by J. E. McNeal (*Am J Surg Pathol* 1988; 12:619-633). The transition zone surrounds the urethra proximal to the ejaculatory ducts. The central zone surrounds the ejaculatory ducts and projects under the bladder base. The peripheral zone constitutes the bulk of the apical, posterior, and lateral aspects of the prostate. The anterior fibromuscular stroma extends from the bladder neck to the striated urethral sphincter.

Benign prostatic hypertrophy, or more properly, prostatic nodular hyperplasia, is an extremely common disorder of older men. [see the Clinical Correlation C145 "Benign Prostatic Hypertrophy."] Because the urethra traverses the prostate, diseases of the prostate often cause urethral obstruction and hence voiding problems. The developing masses are referred to as "median," "lateral," and "anterior" lobe enlargements, according to their location, but these designations are misnomers, since the prostate, with the exception of the posterior lobe, is anatomically not a lobate organ. These terms merely designate general sites relative to the urethra and should not be interpreted as implying the involvement of a special separable portion of the prostate. The tumors usually enlarge in a symmetrical manner and can adopt a number of gross configurations, the most frequent types being the so-called bilobular (two lateral lobes) and trilobular (two lateral plus median lobe) enlargements. Median enlargement may occur alone without lateral lobe enlargement [see the Clinical Correlation C145 "Benign Prostatic Hypertrophy"] but this is less common. During such obstructions, the more a person strains, the more the prostatic enlargement functions like a valve in blocking the flow. Consequently, the chronic distention of the bladder and increased pressures developed to void may cause the bladder first to thicken (compensatory, or work, hypertrophy), and then to become distended, atonic and flaccid (decompensated) in association with the prostatic disease.

2. Briefly describe the anatomy involved in the digital rectal examination of the prostate gland.

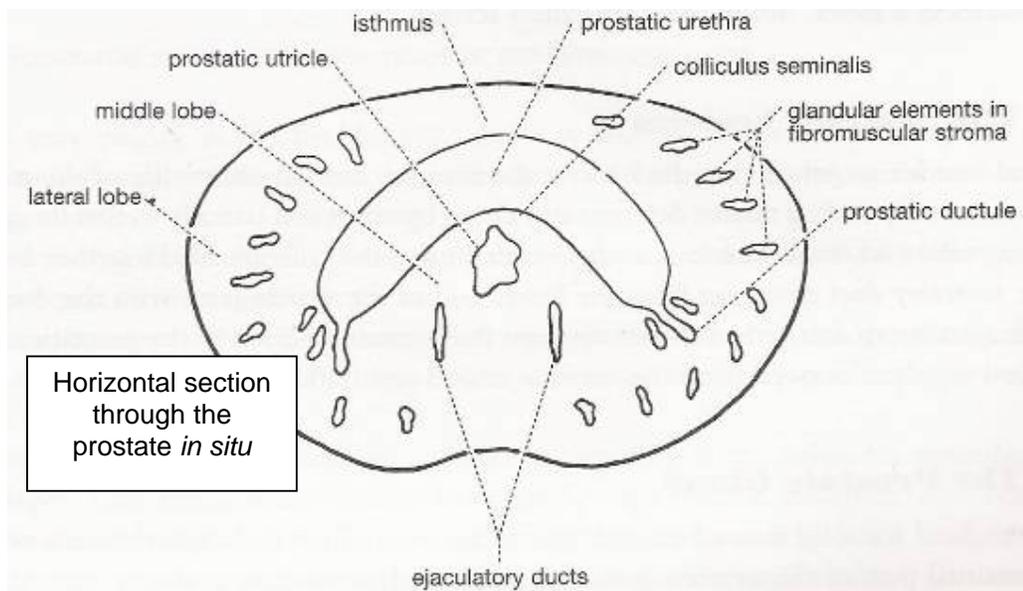
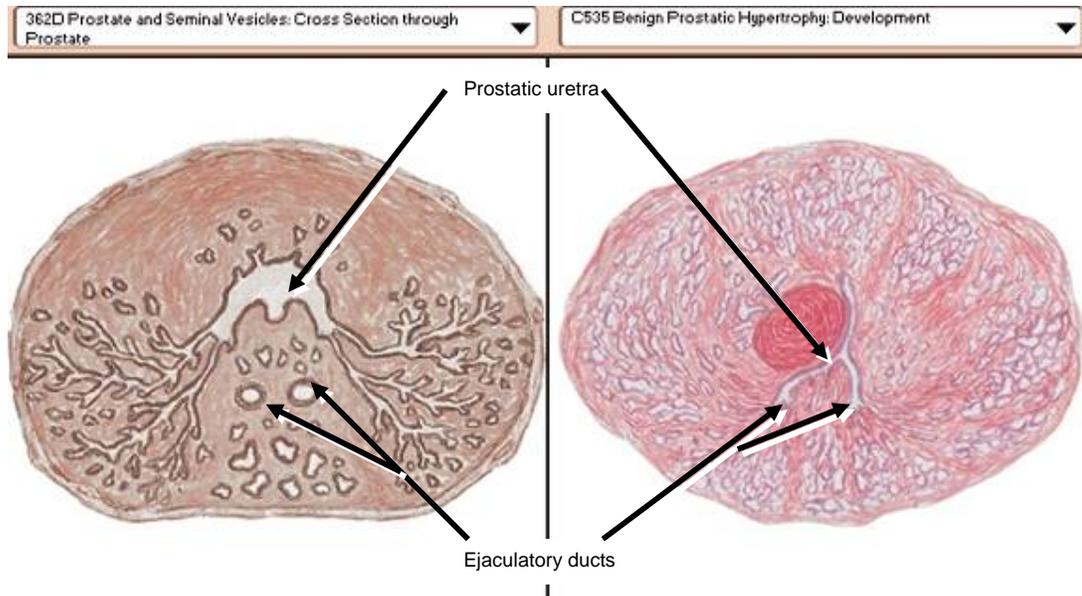
Digital Rectal Examination of Male



The digital rectal examination is an important part of the physical examination and is usually performed at the conclusion of the abdominal portion of the exam. The patient either stands with hips flexed and the upper body supported on the examination table or lies in a left lateral (Sim's) position. The buttocks are spread, and the anus and perianal region are inspected for abnormalities (e.g., hemorrhoids, skin tags, fissures, rash, or cysts).

The gloved and lubricated examining finger is inserted, and the tone, evenness, and strength of contraction of the sphincter muscles (anal ring) are tested. The pectinate line and anal valves cannot be palpated unless a pathologic process is present. The lateral and posterior anal walls are palpated in sequence, sweeping the finger over the smooth rectal mucosa checking for nodules, masses, polyps, or other irregularities and for tenderness; in so doing, the ischial spines, coccyx, and lower sacrum can be felt. The examining finger can reach to a depth of 6 cm to 10 cm. Bidigital palpation - placing the thumb against the perianal skin and drawing the examining finger toward it - is especially sensitive for the detection of perianal abscesses (see Plates 372A and 372B).

3. How does the prostate affected by BPH differ from the normal prostate?



Benign prostatic hypertrophy, or more properly, prostatic nodular hyperplasia, is an extremely common disorder of older men. [See the Clinical Correlation C146 "Benign Prostatic Hypertrophy and Urinary Tract" and Plate 362A for more information.] These fibromuscular nodules (fibromyomas) usually arise in a well-defined area from the periductal tissue of the "inner group" (short urethral and submucosal) of glands that empty into the prostatic urethra proximal to the orifices of the ejaculatory ducts. These early lesions can often be seen adjacent to the urethra in this area. These small nodules are not palpable per rectum. However, depending on placement, a small, developing nodule can be as or more obstructive of the urethra than a much larger, fully developed tumor.

