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 juction
    - 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 extravasion 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	BPH	Denonvilliers fascia
chronic prostatitis	excretory urography	extravasation
falx inguinalis	fascia transversalis	IVP
obstructive uropathy	periuretral glands	preprostatic sphincter
prepuce	prostatic utricle	prostatic sinuses
trigone	referred pain	urachus
ureteral reflux	uretero-vesicular junction	verumontanum
Waldeyer's sheath		

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.

Netter Atlas: Plate 319

Wet specimen from departmental collection, see also WG de Haas museum

Or

McMinn: p245 & 261

c) Where is a kidney biopsy usually taken?

Moore 5th ed: p317

McMinn: p260

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:

McMinn: p256 & 257

Netter Atlas: Plate 324

2. Detail of renal arteries:

Campbell's Urology: p 86 Or Moore 5th ed: p 311

Netter Atlas: Plate 322

3. Renal transplants:

Moore 5th ed: p 311 Diagram & text

Snell: p273 Diagram & text

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.

McMinn: p259

Weir: p131

Snell p258 – 260 Diagrams & text

Moore 5th ed: p343

Station 3: Ureters

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

1. Abdominal ureter:	**2. Pelvic ureter**	**3. Intramural ureter:**
• Originates from renal pelvis • Descends medially to transverse process of L2 • From L2 – descends vertically → L2 – L5 anterior to psoas major muscle	• Retroperitoneal distally • Descends into true pelvis • Crosses ilio - sacral joint & bifurcation of common iliac artery	• Extends medially through wall of bladder NB: Uretero-vesicular junction: See station 5

Wet specimen from departmental collection, see also WG de Haas museum Or McMinn: p254, 261 & 262

Campbell's Urology: p86

Snell: p273 &274

Moore 5th ed: p319 & 320

McMinn: p255 & 256

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

Netter CIBA vol 6 section VI: p215

Snell: p272 & 273

Station 4: Bladder

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

Snell: p376 & 377	Netter CIB vol 6 section III: p97

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. 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.

Snell: p319	Netter CIBA vol 2 section III: p35	Moore 5th ed: p441& 442

Station 5: Internal structure of the bladder and bladder neck

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

   <u>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 intravesiclar 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.</u>

Netter atlas: Plate: 367	Campbell’s Urology: p108

Wet specimens from departmental collection, see also WG de Haas museum Or McMinn: p268

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.

Campbell's Urology: p109	Netter CIBA vol 6 section I: p23

Wet specimens from departmental collection, see also WG de Haas museum.

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 longitidinal 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.

Netter Atlas: Plate 353	Moore 5th ed: p443

Station 6: Prostate

1. Benign prostatic hypertrophy (BPH) is a condition common in men past the age of 45. Explain the macroscapic 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).

Campbell's Urology: p106

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 from the involuntary preprostatic sphincter. Periurethral glands are located here, and contribute less than 1% of the secretory elements. However, in begnine prostatic hypertrophy (BPH) these glands contribute significantly to prostatic enlargement. In the distal segment, the urethral crest widens and protrudes from posterior as the veromontanum. 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.

Kieser: p258 or Netter Atlas: Plate 353

Moore 5th ed: p403

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 periuretral glands centrally.

Campbell's urology: p112

Moore 5th ed: p409

Netter CIBA vol 2 section IV: p51 – 53; 55 – 57

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

Moore 5th ed: p409

McMinn: p268

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

Netter CIBA vol 2 section IV: p51 & section II: p21

Kieser: p259

Wet specimen from departmental collection, see also WG de Haas museum

Or

McMinn: p270 & 271