STEM-S

LAST MINUTE REVISION

LMR NOTES

INI-SS Sample Notes

PRESENTED BY

Stem-S

ANATOMY AND PHYSIOLOGY

Structure	Extent & Key Relations	Blood Supply	Nerve Supply	Surgical Importance / Landmarks (EXAM GOLD)
KIDNEY	**Extent:** T12–L3 (Rt lower)Hilum → L1 transpyloric plane**Anterior relations:**Rt: Liver, duodenum, colonLt: Stomach, spleen, pancreas, colon**Posterior:**Diaphragm, psoas, quadratus lumborum, 12th rib (11th also on left)	**Arterial:** Renal artery (L1–L2)→ Segmental (End arteries)**Venous:** Renal vein → IVCLt renal vein longer (between SMA & aorta → Nutcracker)	**Renal plexus** (T10–L1)Symp: vasomotorParasymp: Vagus	**● Segmental arteries = end arteries → NO collateral → partial nephrectomy plane● Posterior avascular plane (Brodel line)** → safe incision **● Left renal vein relations (SMA compression)● Suprarenal relation → adrenal preservation in nephrectomy● 12th rib relation → pleural injury risk**
URETER	**Extent:** Pelvi-ureteric junction → VUJ**3 constrictions:**1. PUJ2. Crossing iliac vessels3. VUJ**Abdominal relations:**- On psoas- Crossed by gonadal vessels**Pelvic:**♂: under vas deferens♀: under uterine artery (“water under bridge”)	**Segmental (longitudinal supply):**Upper: renalMiddle: gonadal, aortaLower: vesical/uterine**Veins:** parallel arteries	**T11–L2 (pain → loin to groin)**	**● “Water under bridge” → ureter injury in hysterectomy ● Longitudinal blood supply → avoid stripping → ischemia/stricture ● Crosses iliac vessels → landmark in surgery● Common injury sites: pelvic surgery, vascular surgery (missed in 85%) ● 3 natural narrowing → stone lodgment**
BLADDER	**Extent:** Apex → dome → base → neckEmpty: pelvic organFull: abdominal**Relations:**Anterior: pubic symphysisPosterior:♂: rectum, SV♀: uterus, vaginaSuperior: peritoneum (dome covered)	**Arterial:**Superior vesicalInferior vesical (♂)Uterine/vaginal (♀)**Venous:** vesical plexus → internal iliac	**Parasymp (S2–S4):** detrusor contraction**Symp (T11–L2):** storage**Somatic (pudendal):** sphincter	**● Dome = weakest → intraperitoneal rupture● Trigone = smooth, fixed → landmark in cystoscopy● Retropubic space (Retzius) → surgical access● Lateral pedicles → bleeding in cystectomy● Pelvic nerve injury → neurogenic bladder**

Component	Function	Clinical Link
Macula densa	Senses NaCl	Tubuloglomerular feedback
JG cells	Renin secretion	RAAS activation
Mesangial cells	Structural/support	Modulate filtration

Parameter	Value	Exam Pearl
RBF	~20–25% CO	High perfusion organ
GFR	~120 mL/min	Best kidney function marker
Filtration fraction	~20%	↑ in dehydration
Autoregulation	80–180 mmHg	Maintains GFR

Hormone	Site	Action	Important
ADH	Collecting duct	↑ water reabsorption	Acts via aquaporins
Aldosterone	DCT/CD	↑ Na, ↓ K	Acts on principal cells
PTH	DCT	↑ Ca reabsorption	↓ phosphate
ANP	Glomerulus	↑ GFR	Opposes RAAS

Electrolyte	Major Site	Key Point
Na^+	PCT + loop	Main determinant of volume
K^+	DCT/CD	Aldosterone dependent
Ca^{2+}	DCT	PTH dependent
HCO_3^-	PCT	Acid-base balance

Category	Condition	Common Clinical Presentation	Risk Factors / Clues
Neoplasm	**Bladder cancer**	Painless hematuria , irritative symptoms	Older age, male, smoking, occupational exposure
	Ureter/renal pelvis cancer	Hematuria ± flank pain	Lynch syndrome, family history (colon/endometrial Ca)
	Renal cortical tumor (RCC)	Hematuria + flank pain + mass	Family history, VHL
	Prostate cancer	Hematuria ± LUTS	Age, family history, Black race
	Urethral cancer	Bleeding, discharge, obstruction	Pain, bloody discharge
Infection / Inflammation	Cystitis	Dysuria, frequency	Female predominance
	Pyelonephritis	Fever + flank pain	DM, female
	Urethritis	Dysuria, discharge	STI exposure
	Tuberculosis	Sterile pyuria + hematuria	Endemic travel
	Schistosomiasis	Terminal hematuria	Endemic travel
	Hemorrhagic cystitis	Hematuria ± clots	Cyclophosphamide, radiation
Calculus	Nephroureterolithiasis	Colicky pain + hematuria	Stone history, family history
	Bladder stones	Hematuria, LUTS	BOO
	BPH-related bleeding	Hematuria + LUTS	Elderly male
Medical renal disease	GN (IgA, nephritis)	Hematuria + proteinuria	HTN, azotemia
	Glomerular disease	Cola urine, RBC casts	Dysmorphic RBC
Congenital / Structural	Polycystic kidney disease	Hematuria, mass	Family history
	PUJ obstruction	Flank pain, UTI	Intermittent pain (Dietl's crisis)
	Ureteric stricture	Flank pain, hydronephrosis	Surgery/radiation history
	Urethral diverticulum	Dribbling, dyspareunia	Female, recurrent UTI
	Fistula (colovesical)	Pneumaturia, fecaluria	Diverticulitis, malignancy
Other	Exercise-induced	Transient hematuria	Recent vigorous exercise
	Endometriosis	Cyclical hematuria	Menstruating female
	Hematologic disorders	Hematuria + bleeding	Coagulopathy
	Papillary necrosis	Hematuria + flank pain	Sickle cell, DM, analgesics
	AV malformation	Hematuria	Post renal surgery
	Renal vein thrombosis	Hematuria + flank pain	Hypercoagulable state
	Interstitial cystitis	Chronic pain, LUTS	No infection
	Trauma	Hematuria	Injury history
	Instrumentation	Hematuria post procedure	Recent catheter/surgery

• PHYSIOLOGICAL CHANGES

Change	Mechanism	Clinical Significance
Hydronephrosis (R>L)	Progesterone + uterine compression	Mimics obstruction
↓ Ureteric tone	Progesterone	Urinary stasis
↑ GFR	Hypervolemia	↓ serum creatinine
Glycosuria	↑ filtration	↑ UTI risk
Bladder compression	Enlarged uterus	Frequency

• UTI IN PREGNANCY

Type	Features	Management
Asymptomatic bacteriuria	Screening positive	**Treat always**
Cystitis	Dysuria, frequency	Oral antibiotics
Pyelonephritis	Fever, flank pain	**Hospitalization + IV antibiotics**

Safe drugs: Penicillin, cephalosporin
Avoid: Fluoroquinolones, tetracycline

• STONES IN PREGNANCY

Feature	Key Point
Incidence	Similar to non-pregnant
Presentation	Flank pain, hematuria
Imaging	**USG first-line**, MRI if needed
Management	Conservative → stent/nephrostomy if needed
Definitive	Postpartum

- ESWL contraindicated in pregnancy.

• URINE SAMPLE COLLECTION

Aspect	Method	Key Points / Traps
Type	Midstream clean catch	Most common
	Catheter sample	If unable to void
	Suprapubic aspirate	Gold standard (sterile)
Timing	Early morning sample	Most concentrated → best for protein, casts
Transport	Within 1 hour	Delay → false results
Storage	Refrigerate if delay	Prevent bacterial overgrowth
Preparation	Clean genitalia	Avoid contamination

• PHYSICAL EXAMINATION

Parameter	Normal	Significance
Color	Pale yellow	Red → hematuria; dark → bilirubin
Appearance	Clear	Turbid → infection
Odor	Mild	Fruity → ketones
Volume	1–2 L/day	Polyuria/oliguria
Specific gravity	1.005–1.030	Hydration + concentrating ability

• CHEMICAL ANALYSIS (DIPSTICK)

Parameter	Normal	Meaning if abnormal	Key Pearl
pH	4.5–8	Acidic → acidosis; alkaline → UTI	Urease bacteria → alkaline
Protein	Negative	Renal disease	Persistent → GN
Glucose	Negative	Diabetes	Exceeds renal threshold
Ketones	Negative	DKA, starvation	Fruity odor
Blood	Negative	RBC / Hb / myoglobin	Needs microscopy
Bilirubin	Negative	Liver disease	Conjugated only
Urobilinogen	Trace	Hemolysis, liver disease	↑ in hemolysis
Nitrite	Negative	Gram - bacteria	E. coli
Leukocyte esterase	Negative	WBCs → infection	UTI marker

Scan	Tracer	Indications	Key Interpretation	Advantages / Pearls
DTPA scan	Tc-99m DTPA	GFR measurement	Time-activity curve	**Direct GFR measurement**
MAG3 scan	Tc-99m MAG3	Obstruction, drainage	Washout curve (T½)	**Best for obstruction**
DMSA scan	Tc-99m DMSA	Renal scars	Cortical defects	**Gold standard for scars**
EC scan	Tc-99m EC	Obstruction	Similar to MAG3	Alternative tracer
Lasix renogram	MAG3/DTPA + furosemide	Obstruction vs dilatation	T½ >20 min = obstruction	Functional differentiation
Captopril renogram	DTPA/MAG3 + ACEi	Renovascular HTN	↓ function post drug	Renal artery stenosis
Transplant scan	DTPA/MAG3	Graft function	Perfusion + excretion	Rejection vs ATN
Bone scan	Tc-99m MDP	Bone metastasis	Hot spots	**Prostate Ca metastasis**

Cancer	PET Type	Use	Key Pearl / Trap
Prostate cancer	**PSMA PET-CT**	Staging, recurrence	**Most sensitive modality**
	FDG PET	Limited role	Low uptake in prostate
Bladder cancer	FDG PET	Metastasis staging	Urinary excretion limits local use
Renal cell carcinoma	FDG PET	Metastasis	Not primary diagnostic
Testicular cancer	FDG PET	Residual mass (seminoma)	Useful post chemo
Penile cancer	FDG PET	Nodal staging	Detects occult nodes
Adrenal tumors	FDG PET	Malignancy vs benign	High uptake = malignant

• DONOR INVESTIGATION CHECKLIST

System	Tests
Renal	Serum creatinine, GFR, split renal scan
Imaging	CT angiography (vessels, anatomy)
Infection	HIV, HBsAg, HCV, CMV
Cardiac	ECG ± Echo
General	CBC, LFT, glucose
Urine	Urinalysis (proteinuria)

• RECIPIENT INVESTIGATION CHECKLIST

Category	Tests
Immunology	ABO, HLA typing, crossmatch
Renal	RFT, electrolytes
Infection	HIV, HBV, HCV, TB
Cardiac	ECG, Echo, stress test
Imaging	USG, CT if needed
Malignancy	Age-appropriate screening
Others	CBC, LFT, coagulation

• IMMUNOLOGIC MATCHING

Test	Importance
ABO compatibility	Mandatory
HLA matching	Improves graft survival
Crossmatch	Must be negative
PRA (panel reactive antibody)	Sensitization level

IMMUNOSUPPRESSION

A. INDUCTION THERAPY (Peri-transplant)

Drug	Mechanism	Use
Basiliximab	IL-2 receptor blocker	Low-risk patients
ATG (Anti-thymocyte globulin)	T-cell depletion	High-risk / sensitized
Alemtuzumab	Anti-CD52	Profound depletion

B. MAINTENANCE THERAPY (STANDARD TRIPLE REGIMEN)

Drug Class	Drugs	Mechanism	Key Side Effects	Exam Pearl
CNI	Tacrolimus / Cyclosporine	↓ IL-2	Nephrotoxicity, HTN	Backbone drug
Antimetabolite	MMF / Azathioprine	↓ lymphocyte proliferation	BM suppression	MMF preferred
Steroids	Prednisolone	Anti-inflammatory	DM, osteoporosis	Early taper possible

C. ALTERNATIVES / ADD-ONS

Drug	Use	Key Point
mTOR inhibitors (Sirolimus, Everolimus)	CNI-sparing	Delayed wound healing
Belatacept	CNI-free regimen	Less nephrotoxicity

D. REJECTION TREATMENT

Type	Treatment
Acute cellular	Steroids ± ATG
Antibody-mediated	Plasmapheresis + IVIG ± Rituximab

- **WHEN TO TREAT**

Indication	Reason
Pregnancy	Prevent pyelonephritis, preterm labor
Before urologic procedures (mucosal breach)	Prevent sepsis
Early renal transplant (first 3 months)	Risk of graft infection

- **WHEN NOT TO TREAT – Elderly, Diabetics, Catheterized patients, Spinal cord injury, Non-pregnant women, Children (most cases)**

Parameter	APN	CPN	Emphysematous PN	XGP	Pyonephrosis	Renal Abscess
Onset	Acute	Chronic	Acute severe	Chronic	Acute	Subacute
Clinical presentation	Fever, flank pain, dysuria	Recurrent UTI, HTN, CKD	Toxic, septic shock	Mass, fever, weight loss	Fever + obstruction pain	Persistent fever, flank pain
Cause	Ascending infection (E. coli)	VUR / obstruction	Gas-forming organisms (E. coli, Klebsiella)	Chronic infection + stones	Obstruction + infection	Untreated APN / hematogenous (Staph)
Risk factors	Female, VUR	VUR (children)	**Diabetes**	Staghorn calculus	Stone/obstruction	DM, immunocompromised
Urine findings	Pyuria + bacteriuria	± pyuria	Pyuria ± bacteriuria	Often sterile	Pyuria + pus	May be sterile
Blood findings	Leukocytosis	Mild	Severe sepsis	Chronic inflammation	Sepsis	Leukocytosis
Special features	Responds to antibiotics	Small scarred kidney	**Gas in kidney (CT)**	**“Bear paw sign”**	**Pus under pressure**	**No response to antibiotics**
Imaging	CT if severe	USG/CT (scarring)	CT = gas	CT = enlarged kidney	USG = hydronephrosis + debris	CT = fluid cavity
Radiology pearl	Wedge-shaped lesion	Cortical scarring	Air shadows	Bear paw appearance	Dilated system with echoes	Rim-enhancing lesion
Complication	Sepsis	CKD	High mortality	Non-functioning kidney	Urosepsis	Rupture → perinephric abscess
Initial management	IV antibiotics	Treat cause	ICU + IV antibiotics	Antibiotics	Emergency drainage	IV antibiotics
Definitive management	Antibiotics	Correct reflux/obstruction	**Drainage ± nephrectomy**	**Nephrectomy**	**Urgent drainage (PCN)**	**Drainage (>3 cm)**