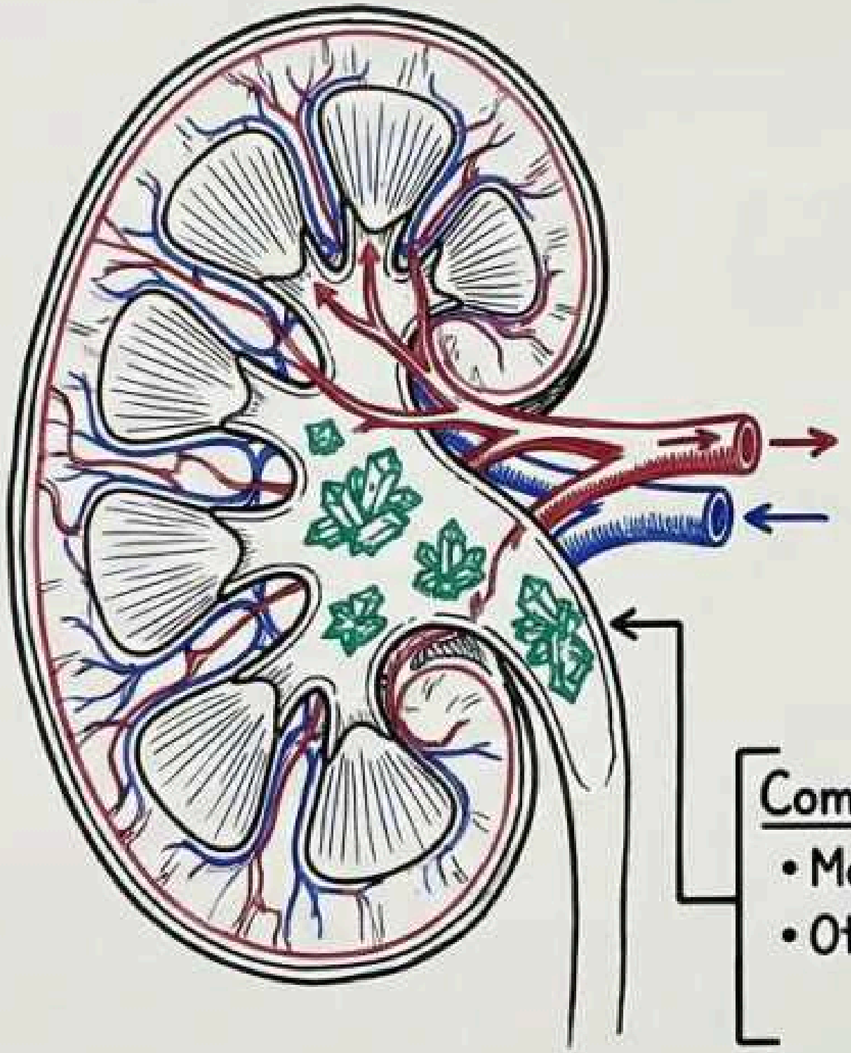
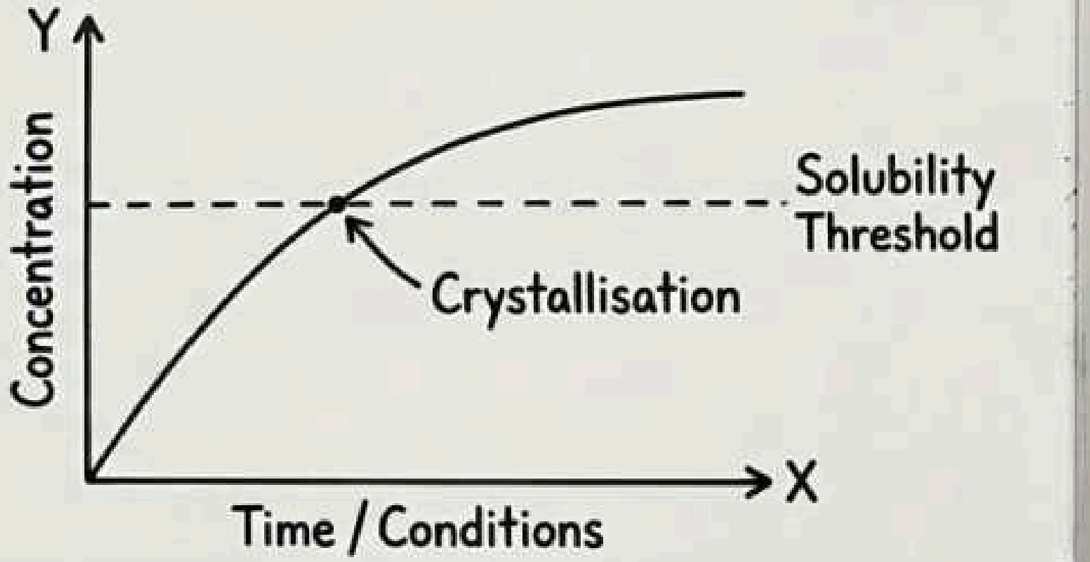
MED 523 B Lecture 6: Stones, Urinary Tract & Replacement

¶ 6.1



The Mechanism:

[Solute] > Solvent Capacity → Crystallisation



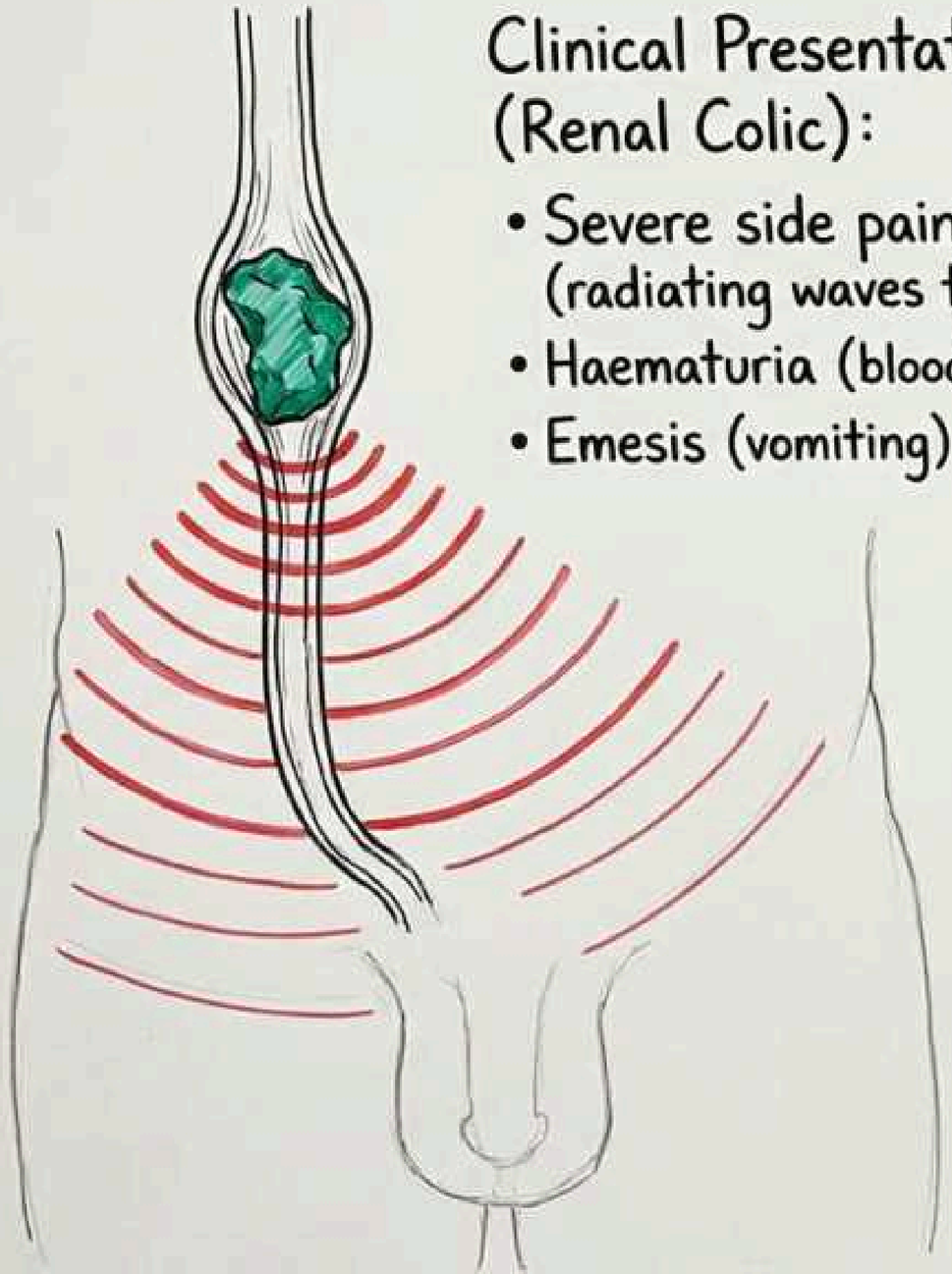
Composition Breakdown:

- Most Common: Calcium Oxalate (CaC_2O_4)
- Others: Calcium Phosphate ($Ca_3(PO_4)_2$), Uric Acid ($C_5H_4N_4O_3$)

Prevalence: ≈ 1 in 10 individuals affected (High recurrence rate).

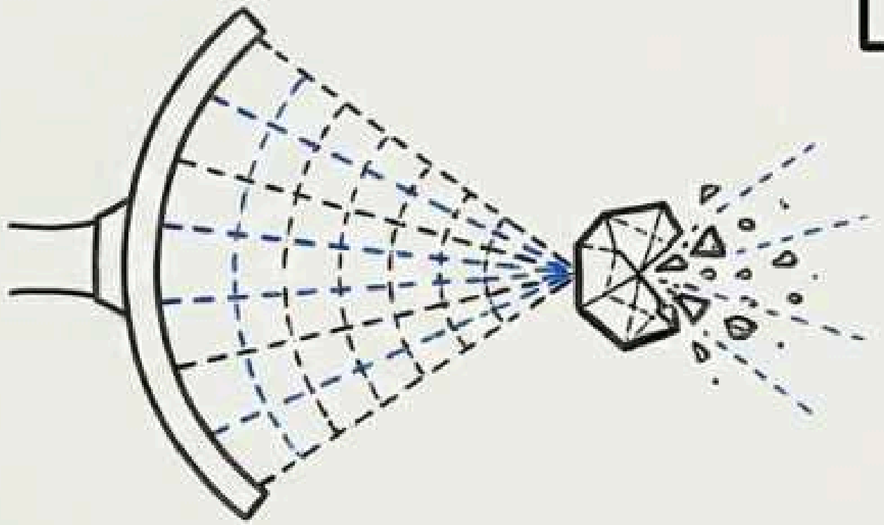
Gemini Notebook

¶ 6.2



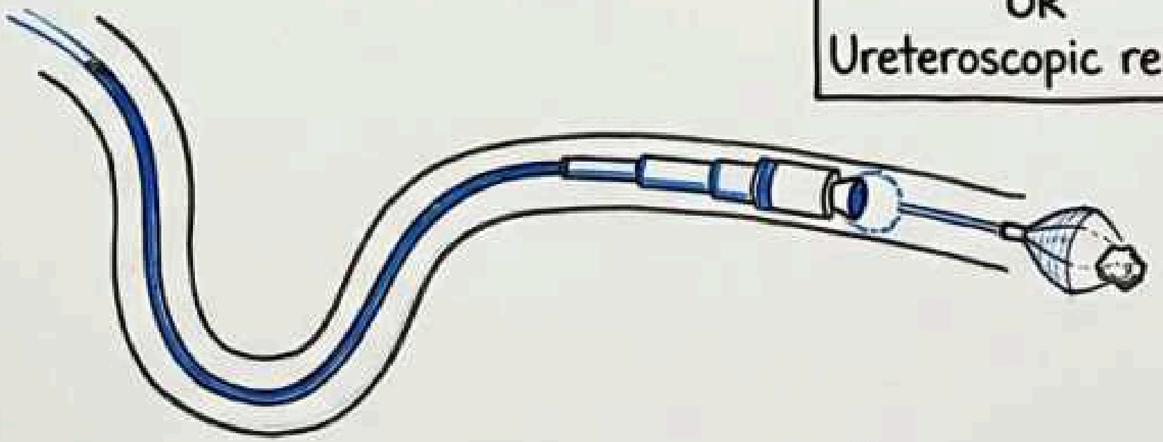
Clinical Presentation (Renal Colic):

- Severe side pain (radiating waves to groin)
- Haematuria (blood in urine)
- Emesis (vomiting)



Intervention Pathways:

- Small Stones → Pass spontaneously + Analgesia (pain relief)
- Large Stones → Shock wave fragmentation OR Ureteroscopic removal

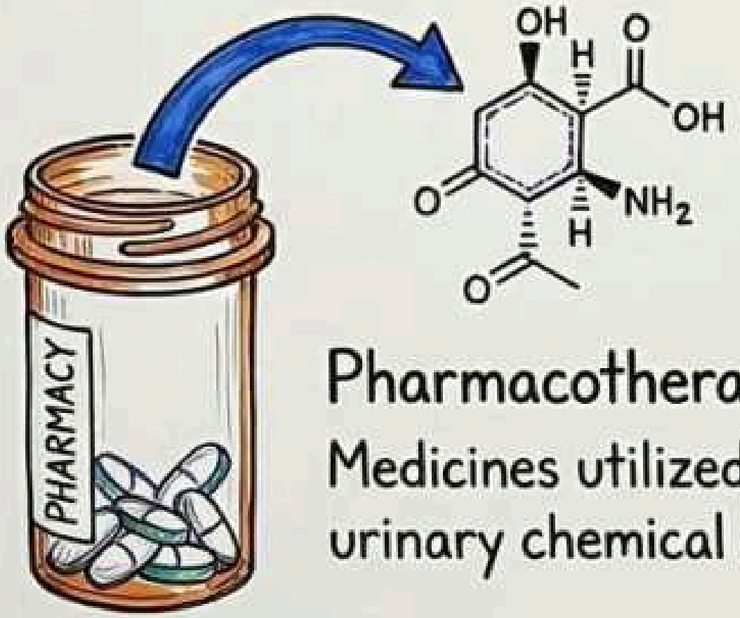


Gemini Notebook

¶ 6.3

↑ Volume (H_2O) → ↓ Concentration (Urine)

* The single most effective preventative measure.



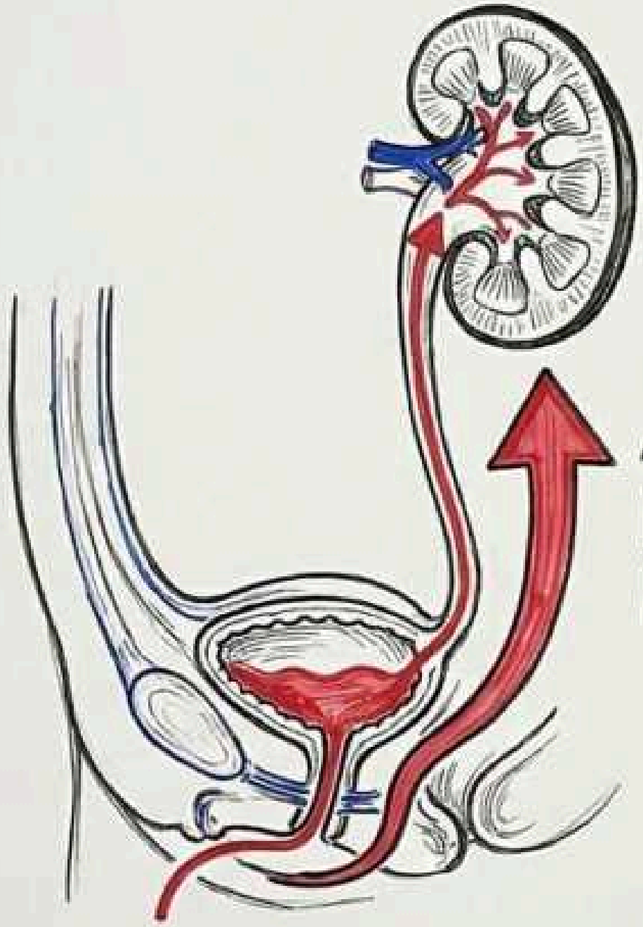
Pharmacotherapy:
Medicines utilized to alter specific urinary chemical composition.

Dietary Adjustments (Guided by stone type)

- ↓ NaCl (Salt)
- ↓ Animal Protein

Gemini Notebook

¶ 6.4



Ascending Bacterial Path

Comparative Matrix: Urinary Tract Infections

Lower UTI (Cystitis)	Location: Bladder	Symptoms: • Burning on passing urine • Frequency. • Urgency.
Upper UTI (Pyelonephritis)	Location: Kidney ↑ (Climbing bacteria)	Symptoms: • Fever • Flank/side pain. Status: Highly serious.

Pathogenesis:
Shorter female urethra = ↑ bacterial transit from skin to bladder.
(One of the most common human infections).

Gemini Notebook

UTI Patient Presentation

Standard UTI

Short-course antibiotics

(Targeted via local resistance patterns → Link: Med 511 B)

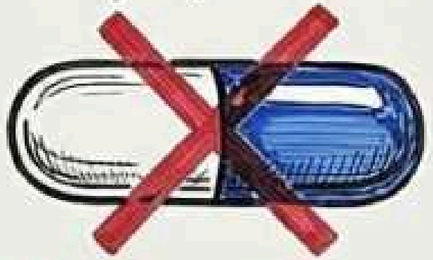
Complicated UTI

[Men, Pregnancy, Catheters, Recurrent]

Requires further clinical investigation.

Asymptomatic Bacteriuria (Older adults)

Bacteria + No Symptoms = Null Treatment

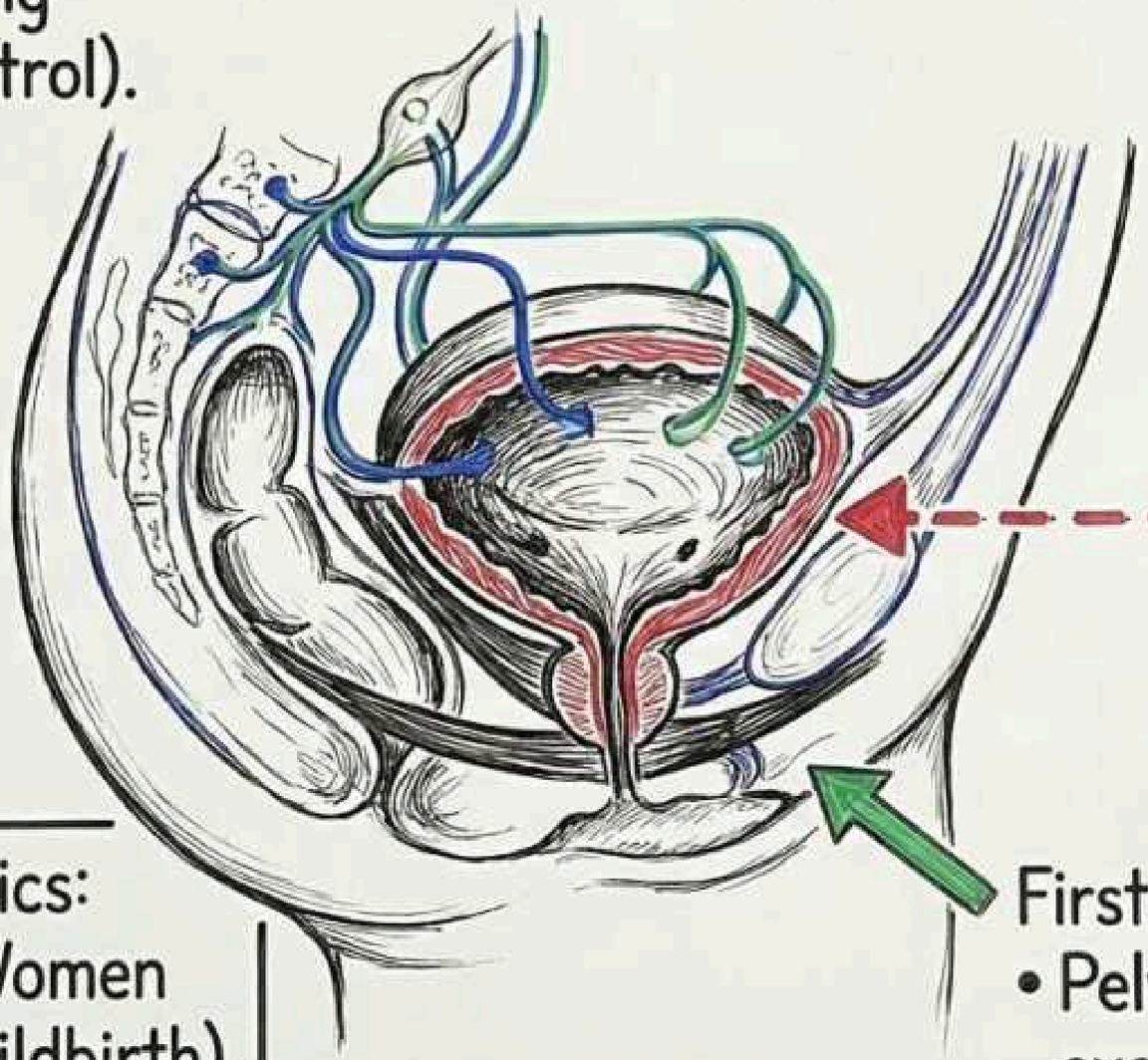


Clinical Warning: Over-treating asymptomatic patients directly drives Antibiotic Resistance.

Gemini Notebook

¶ 6.6

Core Function:
Storage and emptying
(Neuromuscular control).
Problems increase
with age.



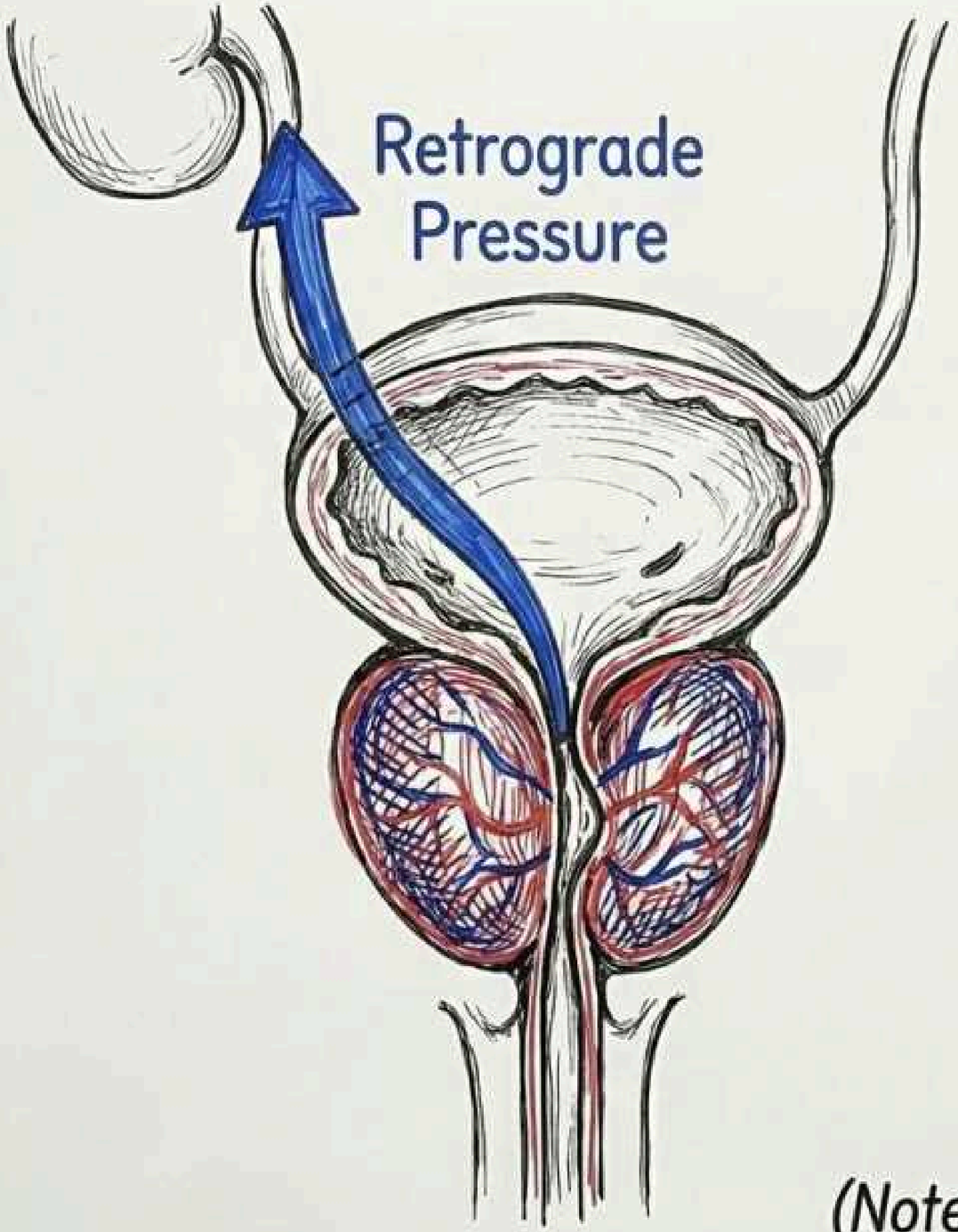
Pathology:
Incontinence
(Involuntary urinary
leakage).

Primary Demographics:
Older populations, Women
(specifically post-childbirth).

First-Line Interventions:
- Pelvic floor rehabilitation / exercises
- Bladder training programs

Gemini Notebook

¶ 6.7



Anatomy: Prostate surrounds urethra, inferior to bladder.

↓

Pathology: Benign Prostatic Hyperplasia (BPH) = Age-related gland enlargement.

↓

Hemodynamics: Urethral compression → Flow obstruction → Post-renal kidney injury.

↓

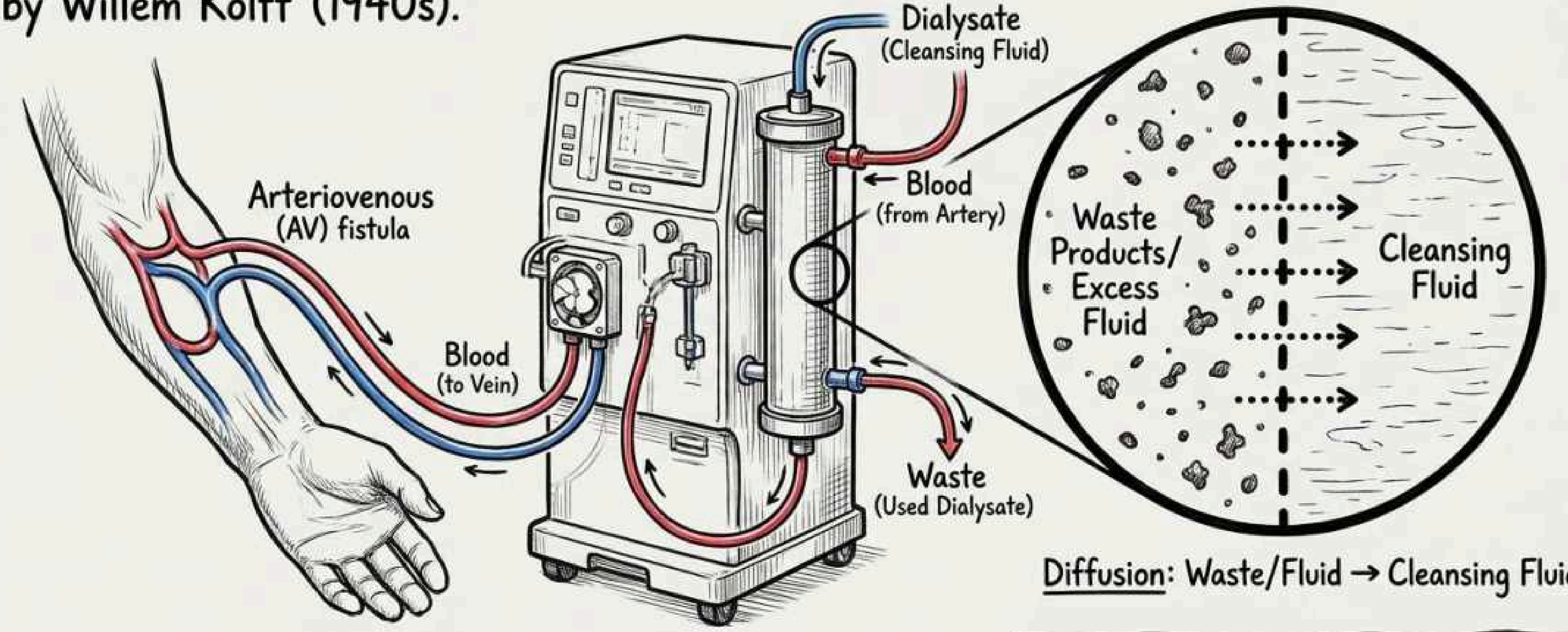
Resolution: Medical or procedural relief of obstruction.

(Note: Prostate cancer covered in later clinical courses)

Gemini Notebook

¶ 6.8

Historical Context: Developed into practical treatment by Willem Kolff (1940s).



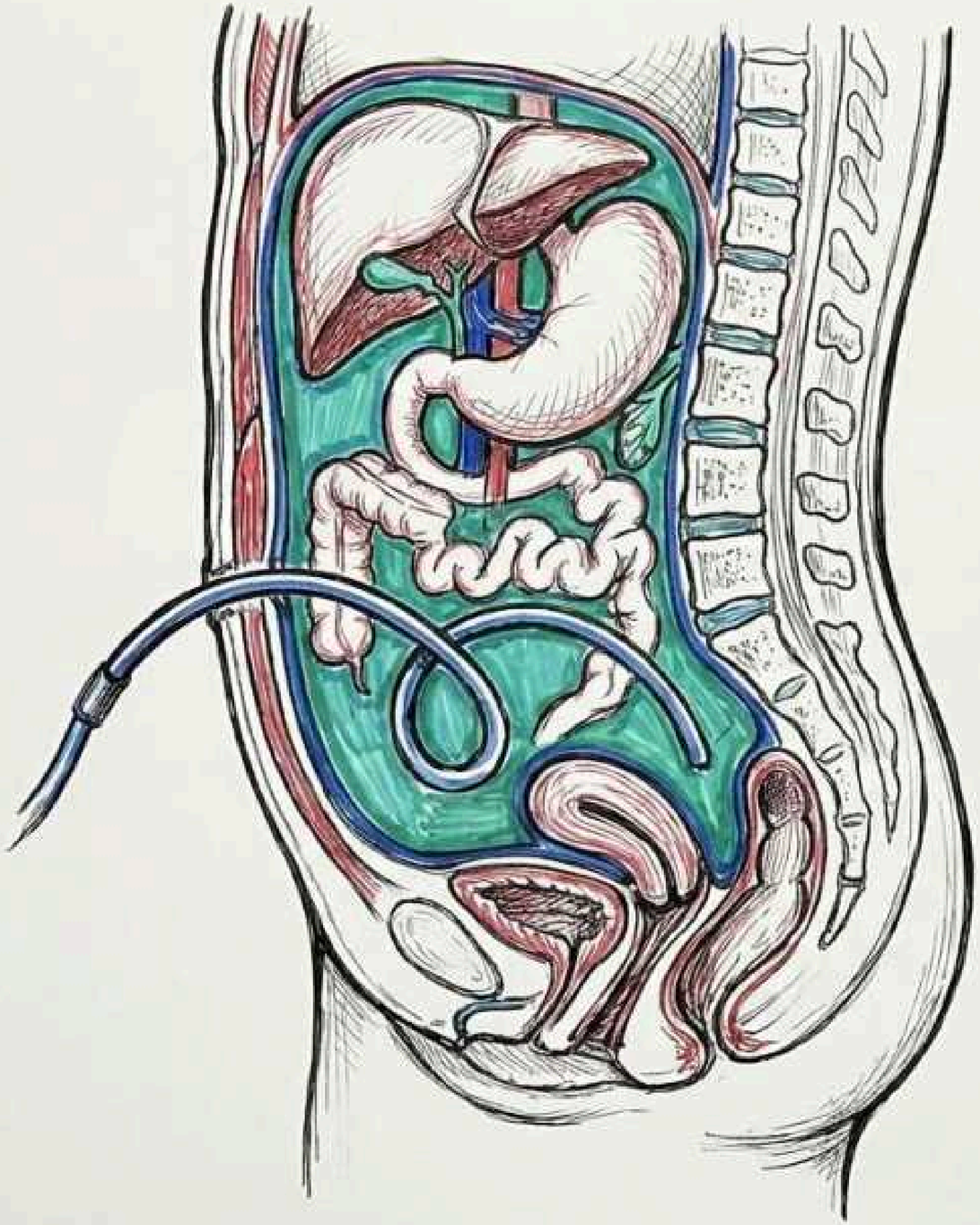
Diffusion: Waste/Fluid → Cleansing Fluid

Mechanism: Extracorporeal blood pump → semi-permeable membrane filter outside the body.

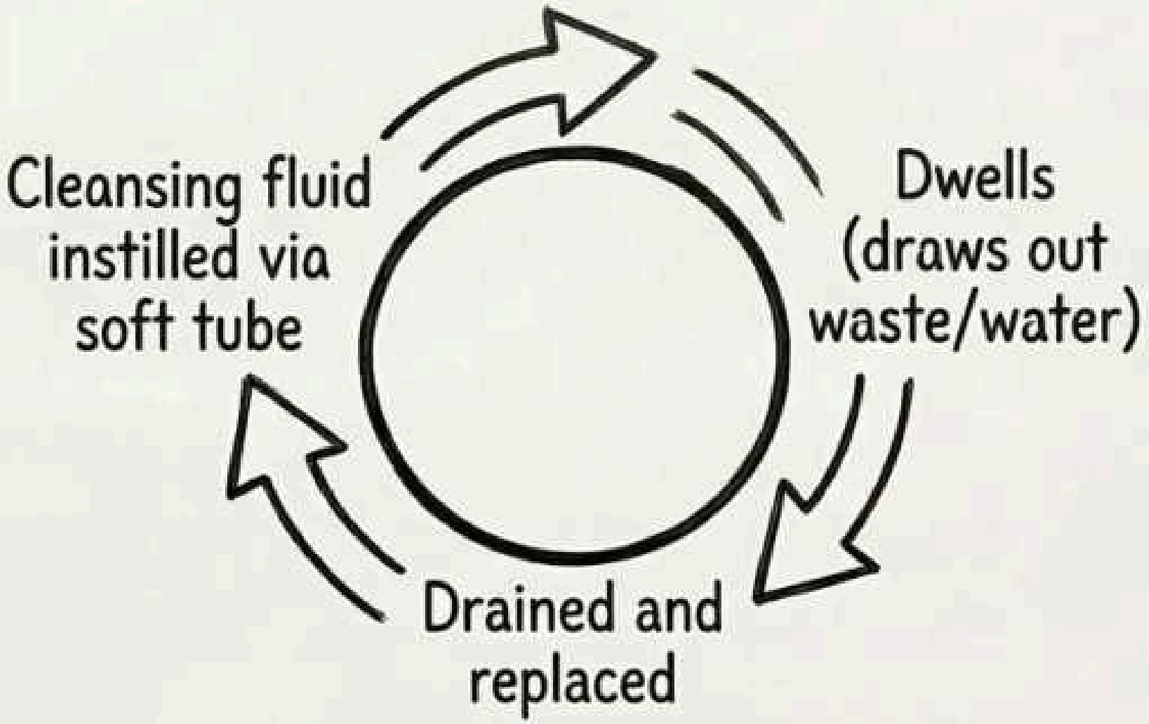
Regimen: ≈ 4 hours / 3x per week via AV fistula.

Gemini Notebook

¶ 6.9



Mechanism: Utilizes patient's endogenous peritoneum as the filtration membrane.



Advantage: Home-based therapy, often automated overnight by machine.

Clinical Outcome: Maximizes patient independence.

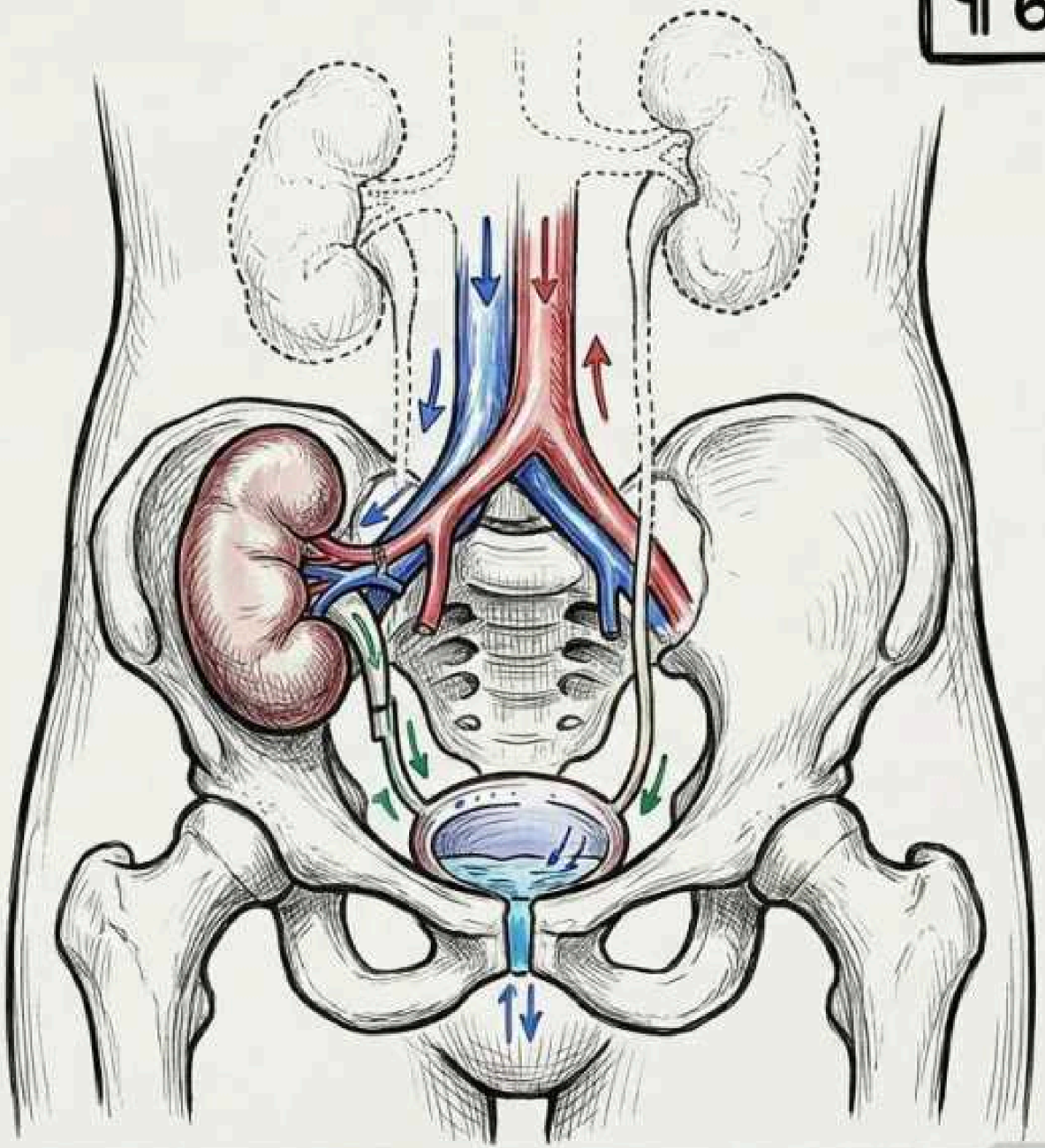
Gemini Notebook

¶ 6.10

Milestone: 1954, Boston (Joseph Murray) – First successful transplant between identical twins → Nobel Prize.

The Gold Standard: Optimal treatment for fit patients with renal failure.

Efficacy: Superior longevity and better quality of life compared to all dialysis modalities.

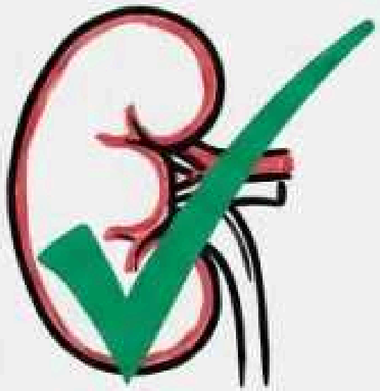


¶ 6.11

Logistics

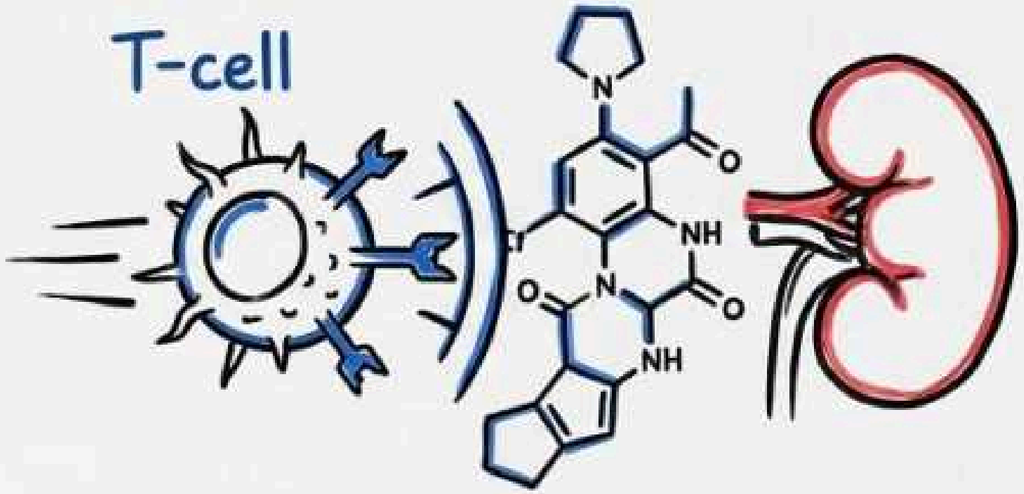
Organ Sourcing

- Deceased Donor
- Living Donor (Relative/Friend)



Humans live healthily with just <u>one</u> kidney.

Immunology



<u>Immunology</u>: Continuous immunosuppressive therapy required as long as kidney functions to halt rejection (Link: Med 504 B).

The Constraint: Demand ≫ Supply

(Many patients wait years on lists).

Gemini Notebook

The Grand Unifying Flowchart.

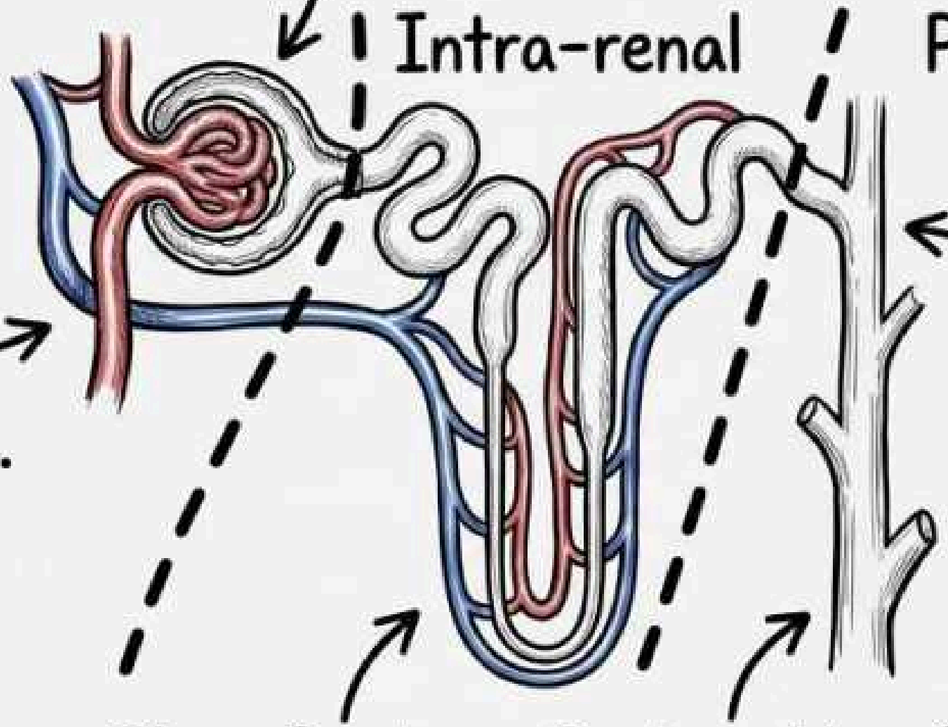
¶ 6.12

Core Physiology: Filtration → Reabsorption → Secretion.

Pre-renal

Intra-renal

Post-renal



Crucial Dichotomies:
Volume ≠ Concentration.

Electrolytes/pH:
Respect renal control of Potassium (K^+) ✓ and Acid (H^+). ✓

Acute Injury Classification: Sort sudden failure into Before (Pre-renal), Within (Intra-renal), or After (Post-renal).

Chronic Disease Maxim:
Common, Silent, and Preventable.

Questions/Feedback: garyanderson@mail.grokbot.com
X: @garyanderson

Gemini Notebook