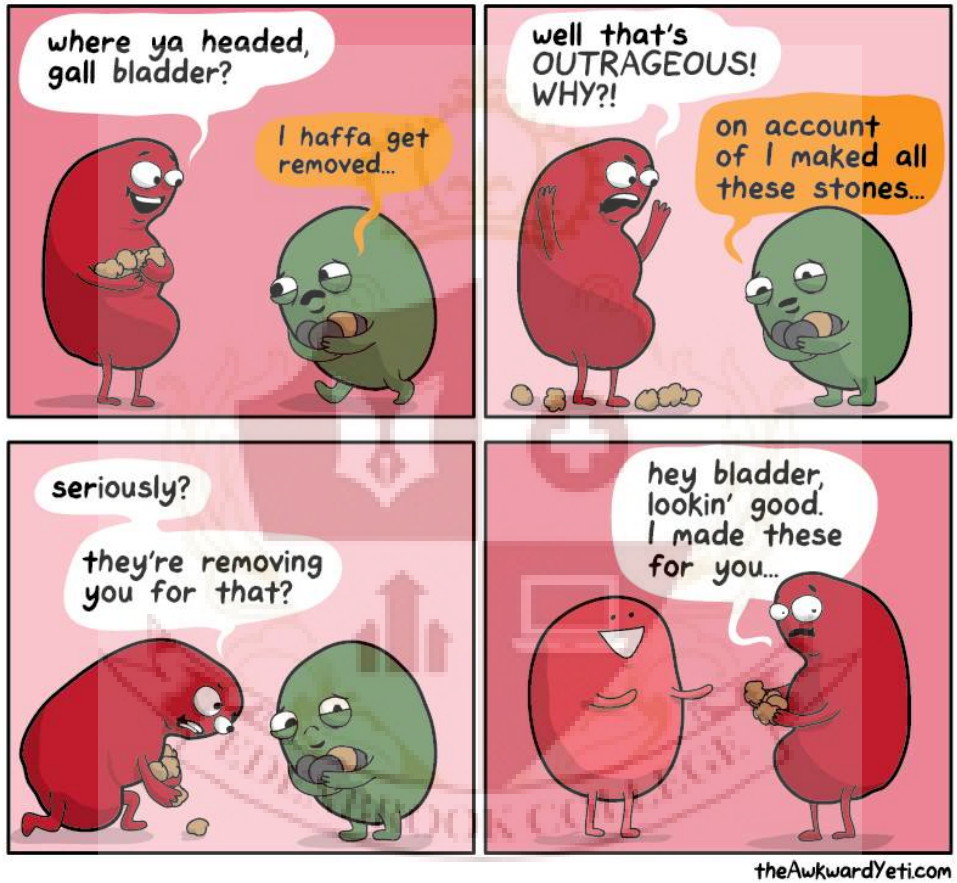

where ya headed, gall bladder?
I haffa get removed...
well that's OUTRAGEOUS! WHY?!
on account of I maked all these stones...
seriously?
they're removing you for that?
hey bladder, lookin' good. I made these for you...
theAwkwardYeti.com

Objectives

Outcome 5

- Outline the different procedures performed for visualizing the genitourinary system.

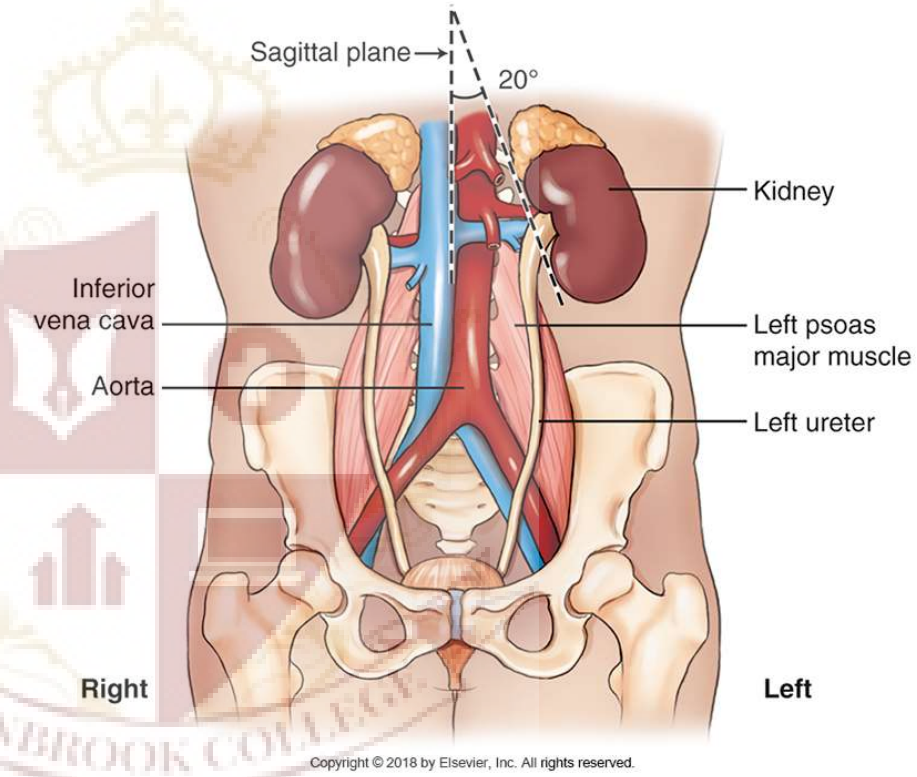
Outcome 6

- Distinguish the elements required for producing radiographic images of the genitourinary system

**Please refer to your course outline for more detail*

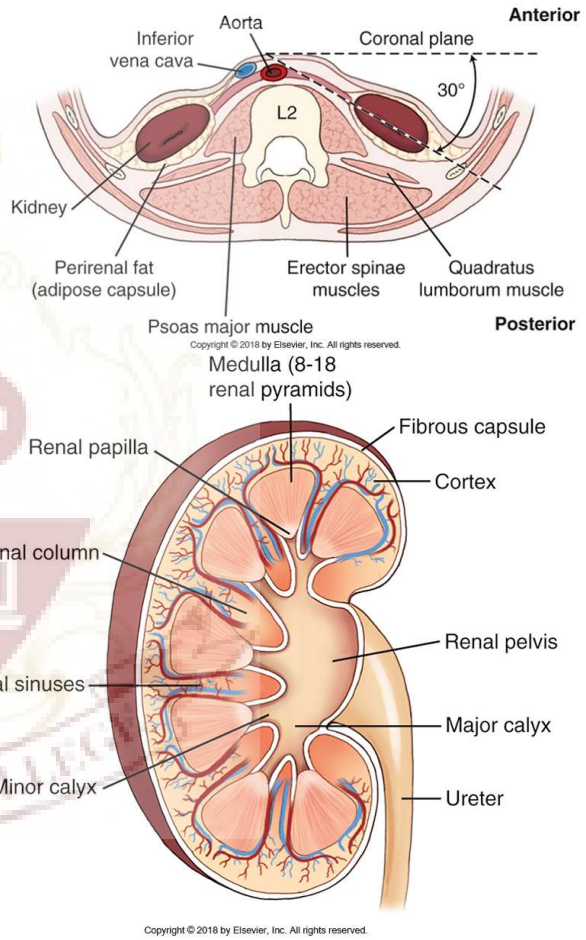
Urinary Anatomy

- Kidneys
- Ureters
- Bladder
- Urethra



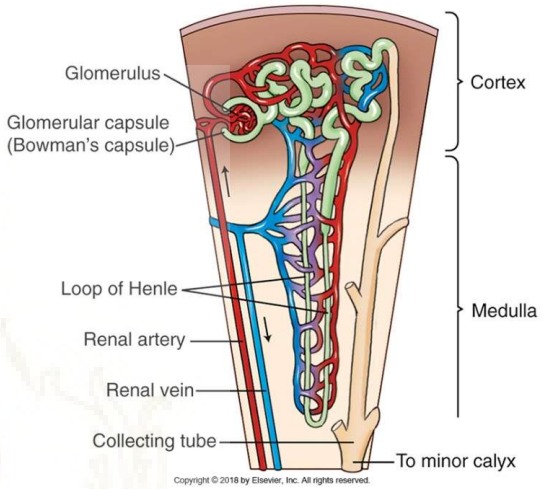
Kidneys

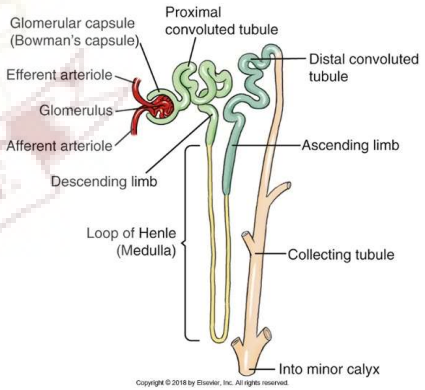
- Lie on an oblique plane
- Outer fibrous capsule
- Cortex
  - Blood vessels
- Medulla
  - Renal pyramids
- Nephrons
- Minor and major calyces
- Renal pelvis
- Renal Parenchyma
  - Functional parts of the kidneys



Kidney Function

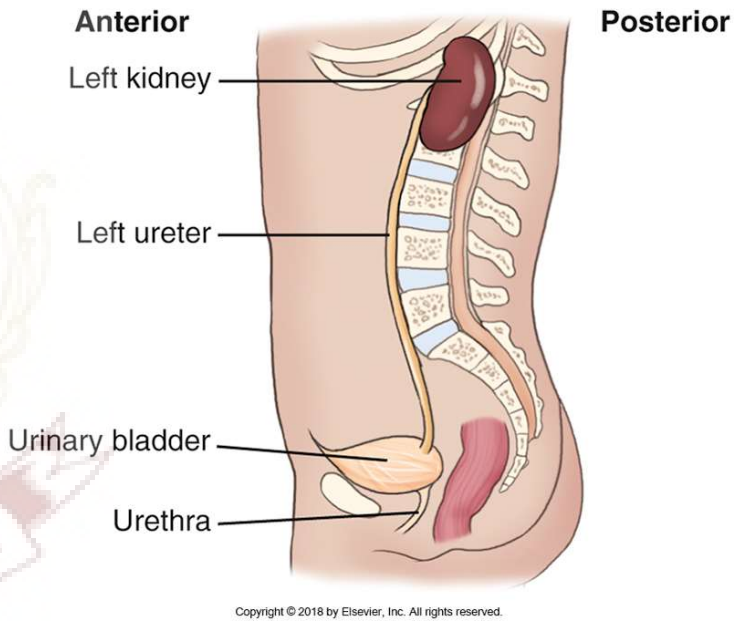
- Nephrons receive blood from afferent arterioles
- Waste is filtered out
- Blood leaves the kidney via efferent arterioles
- Waste is drained
  - Minor calyx → Major calyx → Renal pelvis → Ureter





Ureters

- Exit the kidneys on the medial side
- Move anteriorly and inferiorly towards the bladder
  - Curve with the lumbar spine



Copyright © 2018 by Elsevier, Inc. All rights reserved.

Ureters cont.

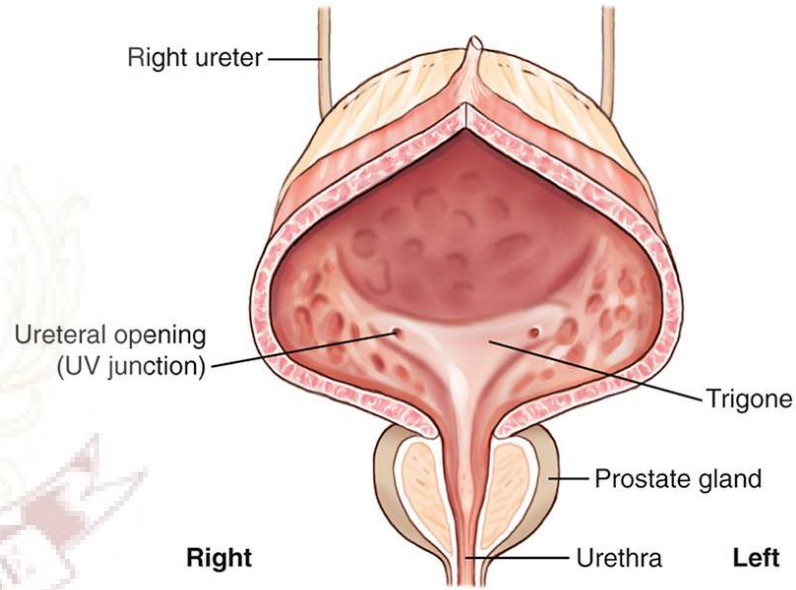
- Range in internal diameter from 1cm down to 1mm

- 3 points of constriction
  - Ureteropelvic junction
    - Renal pelvis turns into ureter
  - Pelvic brim (iliac blood vessels cross ureters)
  - Ureterovesical junction
    - Where ureters join bladder

- Inferior aspect connects to the posterior surface of the bladder

Bladder

- Collects urine until urination
- Muscular walls stretch as it fills
- Capacity of 350-500ml
- Urination is voluntary unless capacity is exceeded



Copyright © 2018 by Elsevier, Inc. All rights reserved.

Urethra

- Moves urine from the bladder outside the body
- Much shorter and wider in the female

Urinary Pathology

- The most common urinary system pathology we see in the fluoro department are:
  - Cystitis
  - Pyelonephritis
  - Vesicoureteral reflux
  - Renal calculi/Urolithiasis

Cystitis/Pyelonephritis

- Urinary Tract Infection (UTI)

- Cystitis is an infection in the bladder
  - Usually enters via the urethra
  - More common in females
    - Shorter, wider urethra is easier entry point for bacteria

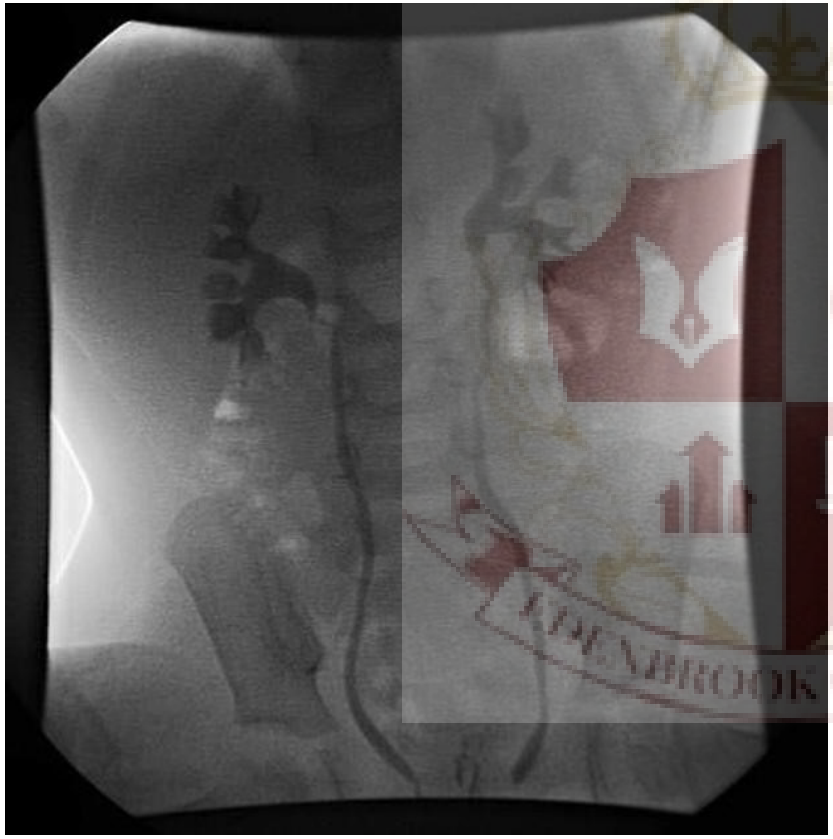
- Pyelonephritis is an infection in the kidneys
  - Usually cystitis that travels up ureters

Vesicoureteral Reflux

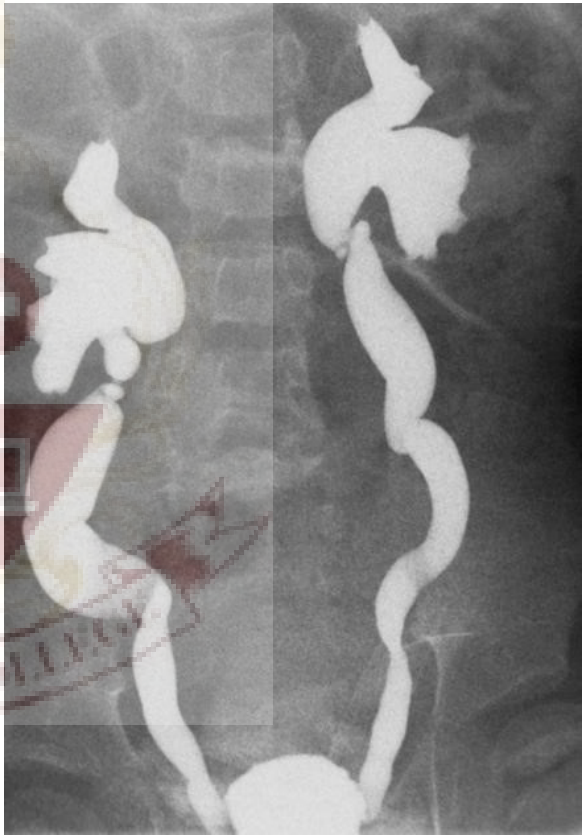
- Retrograde passage of urine up the ureters towards kidneys
- Much more common in children
- Usually prevented by one way valve at VU junction
- Graded from G1 (reflux into non-dilated ureter) to GV (Gross dilation of ureter, pelvis, and calyx; with ureteral tortuosity)
- Can cause repeated UTIs

Vesicoureteral Reflux cont.

Grade 3



Grade 5



Renal Calculi/Urolithiasis

- Kidney stones
- Many different materials
  - 80% have enough calcium to show up on plain X-ray
- 99% can be seen on CT with no contrast
- Can be asymptomatic while still in renal pelvis
  - Become excruciating when they pass into the ureter
- Can become lodged in any one of the 3 narrow points of the ureter
  - Ureteropelvic junction
  - Pelvic brim
  - Ureterovesical junction (this is the most common site)

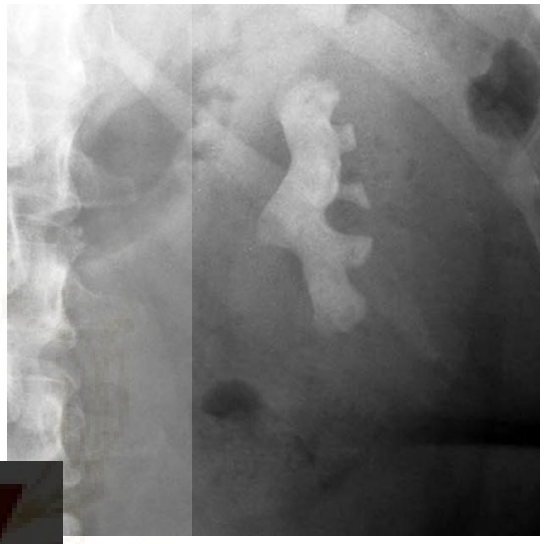
Renal Calculus cont.



Stone in kidney

Stone in ureter





Staghorn calculus in renal pelvis*

*Staghorn calculi are stones that fill the entire renal pelvis, and take on the shape of the calyces

Contrast

- Non-ionic, iodinated, water soluble
  - Omnipaque, Isuvue, Visipaque, Cystoconray (very old)

- Often diluted to avoid missing very small or radiolucent stones

Contraindications

- Similar to other procedures that use water soluble contrast
- Previous contrast reactions
  - May pre-medicate with antihistamines if the exam is crucial
- Impaired renal function
  - Test creatinine and blood urea nitrogen levels before administering
- Some contraindications only exist when you're administering the contrast intravenously

Intravenous Contraindications

- Diabetes
  - Causes impaired renal function
  - Kidneys can't handle extra fluid load from a bolus contrast injection
- Congestive heart failure
  - Same as above
- Anuria (absence of urine)
  - Kidneys are not producing any urine at all
  - Body cannot process contrast at all
  - Adding contrast to blood stream may overload circulatory system

Procedures - IVU

- Intravenous Urogram
  - Used to be called Intravenous pyelogram
  - Pyelogram only refers to renal pelvis, not the entire urinary tract
- Can be done in X-ray or fluoroscopy
- Largely usurped by contrast CT
  - Still a possibility in smaller facilities or old-fashioned physicians
- Functional test
  - Shows true real time function of the urinary tract

Intravenous Urography

- Blood filters through the kidneys
  - Intravenous contrast filters with it
- Allows us to visualize the function of the kidneys, ureters, and bladder
- Will see any blockages or slowing in transit time

IVU Patient Preparation

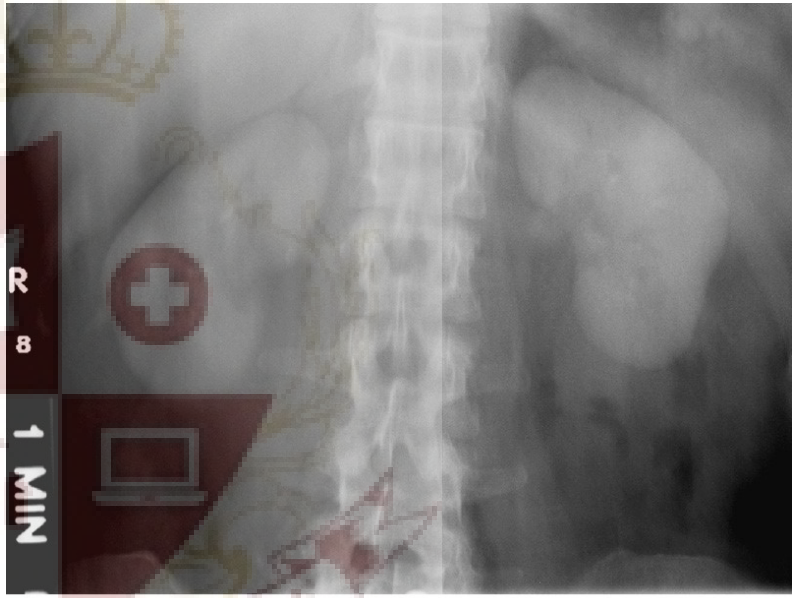
- Similar to a BE
  - Don't want fecal matter obscuring tiny details
- Light evening meal the night before
  - NPO 8 hours before procedure
  - Mild dehydration helps concentrate contrast in the kidneys
- Possibly an enema the morning before the procedure
- Void the bladder before procedure
  - Urine dilutes the contrast in the bladder
  - Avoid overfilling bladder and possible rupture
  - Urinate over a screen if concerned of passing stones

IVU Procedure

- Place patient on procedure table
- Take a preliminary image with no contrast
- Initiate IV line and radiologist injects contrast slowly
  - Contrast injection takes 30 seconds – 1 minute
  - All timers start when injection is started
- Images start 1 minute from contrast injection
  - 1 minute, 5 minute, 10 or 15 minute, 20 minute
  - Time markers are ESSENTIAL

IVU Images – 1 Minute

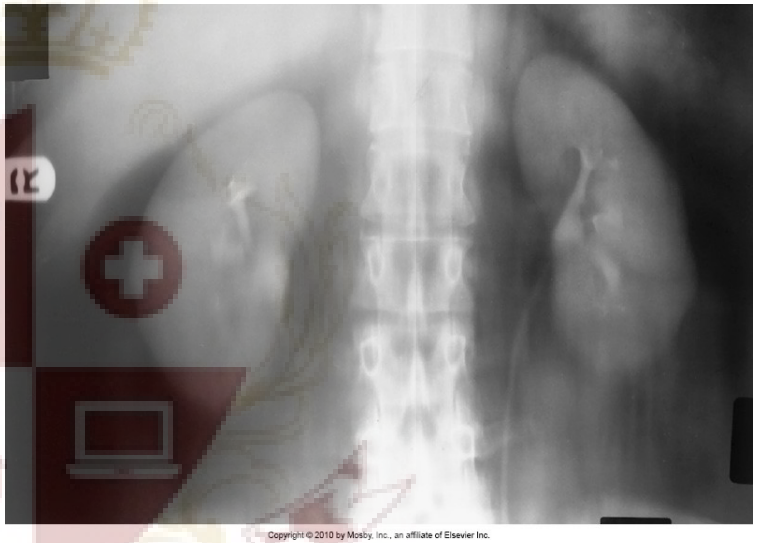
- "Blush" stage
- Nephrons are full of contrast
- Patient supine
- Collimate to kidneys



Copyright © 2010 by Mosby, Inc., an affiliate of Elsevier Inc.

IVU Images – 5 Minutes

- Patient supine
- Include all KUB anatomy on one image
- Contrast is beginning to collect in renal pelvis and travel down ureters to bladder
- Add time marker to image

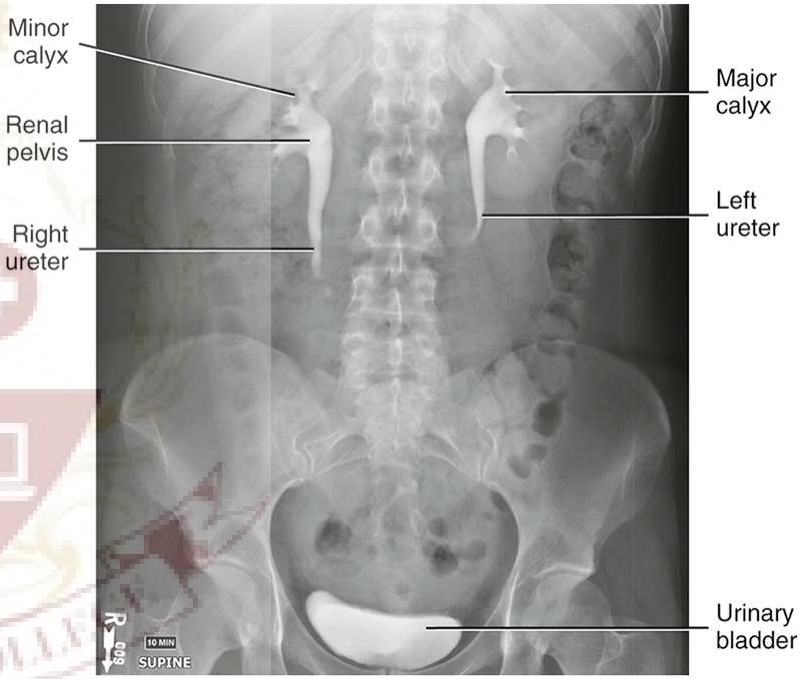


*This image is a tomographic image, not general radiography

*Demonstrates contrast in renal pelvis

IVU Images – 10 or 15 Minutes

- Same as 5 minute image
- Contrast mostly out of nephrons and into renal pelvis
- Bladder filling with contrast

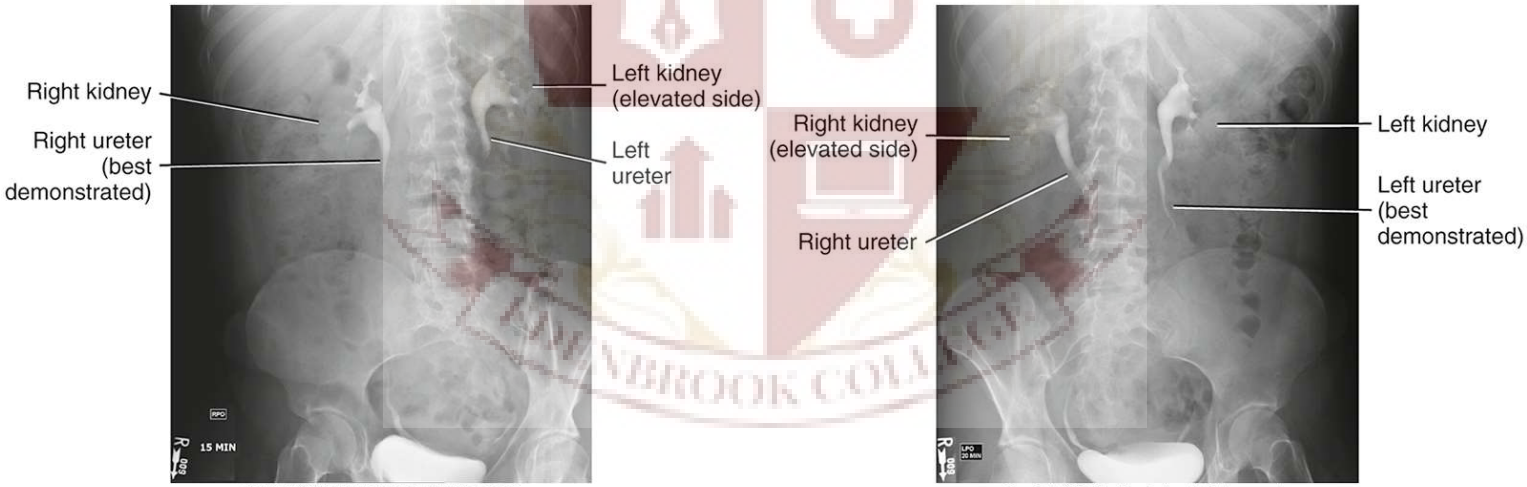


Copyright © 2018 by Elsevier, Inc. All rights reserved.

IVU Images – 20 Minutes

- AP, LPO, RPO

- Demonstrates *upside kidney and downside ureter*



IVU Images – Post Void

- Done upright or prone
- Prone moves stones off ureterovesicular junction
- Include all KUB anatomy
- May demonstrate reflux of urine or fluid outside bladder or urethra in the case of trauma



Copyright © 2018 by Elsevier, Inc. All rights reserved.

* Image shows a prolapsed bladder

Retrograde Exams

- Voiding cystourethrography
- Urography
  - Visualizes kidneys/ureters
- Cystography
  - Visualizes bladder
- Contrast is administered against normal urine flow

Voiding Cystourethrogram

- Done in a fluoroscopy suite
- Functional exam of bladder and urethra
- Much more common in children

VCUG Patient Prep

- No prep required
- Very thorough (age appropriate) explanation of procedure
- Bladder should be voided if possible before catheter inserted

VCUG Exam

- Catheter inserted into urethral opening
- Done using aseptic technique
  - High chance of causing a UTI if not done aseptically
- Done by a radiologist or technologist with advanced training
- Infant feeding tube or foley catheter used depending on size of patient

VCUG Catheters



https://www.myamericannurse.com/verifying-ng-feeding-tube-placement-pediatric-patients/

Infant feeding tube size reference



Foley catheter

EDENBROOK COLLEGE

VCUG Exam cont.

- Contrast bottle attached to catheter by IV tubing
- Bladder filled using the force of gravity only
  - NEVER forcefully injected
  - Avoiding trauma to urethra and bladder
- Periodic fluoro until bladder is at max capacity
  - 350-500mls depending on patient
  - Ask patient if they feel like they have to urinate
  - Record how much contrast is administered
- Remove catheter and encourage urination
  - Have a proper vessel to catch urine depending on age and patient size

VCUG Exam cont.

- Fluoro during voiding
  - Pediatric patients will require a lot of encouragement
- Watch urine flow through urethra
- Look for vesicoureteral reflux (flow of urine back up ureters)
  - Bladder contraction forces urine back up ureters if the valves are not competent
- Female patients void in AP or slight oblique
- Male patients void in 30º RPO
  - Allows visualization of entire urethra

VCUG Images



Prelim/scout image



Bladder filling image

* Can see the round retention balloon on the catheter

VCUG Images cont.



Voiding image



Post void image

* Can see the tiny amount of contrast remaining in the urethra

VCUG Post Procedure

- Pt will be allowed to go to the washroom to clean up

- Give them wipes or washcloths
  - Contrast is very sticky
  - Tell patient that any remaining contrast will come off in the shower

- Warn patient that urination may burn and be accompanied by a small amount of blood for the rest of the day
  - Drinking lots of fluids will help ease this
  - Contact regular physician if this worsens or does not go away quickly

VCUG Tech's Role

- Ensure fluoro suite is set up and stocked
- Prepare contrast and administration tools aseptically
- Explain procedure to patient and/or guardian
- Assist radiologist in administering contrast and managing urination
- Provide supportive care and enhance patient comfort
- Provide post care and instructions
- Document fluoro time + images, contrast administered,and contrast voided (if site protocol) for patient chart

Retrograde Urography pg. 606 Bontrager

- Done in a dedicated urography suite with a urologist, anesthetist, and nursing staff
- Can visualize stones, strictures, or other abnormalities
- Can remove stones or place stents at the same time
- Contrast fluoroscopy combined with cystoscopy
  - Similar to the endoscopy done for ERCP, but in the bladder
- Our role is largely technical, much like ERCP

RU – Patient Preparation

- NPO for several hours (information is variable by source)
- Bowel prep to prevent artifact on images
  - Similar to IVU
- Void bladder before procedure

RU - Exam

- Patient lays on a dedicated fluoro bed
  - Fixed unit or C-arm, depending on site
- Patient is heavily sedated
- Cystoscope is introduced into the urethral opening and into the bladder
- Catheter is run along the length of the cystoscope and into the ureters to the renal pelvis
  - Fluro images are taken to ensure the correct position

RU – Exam cont.

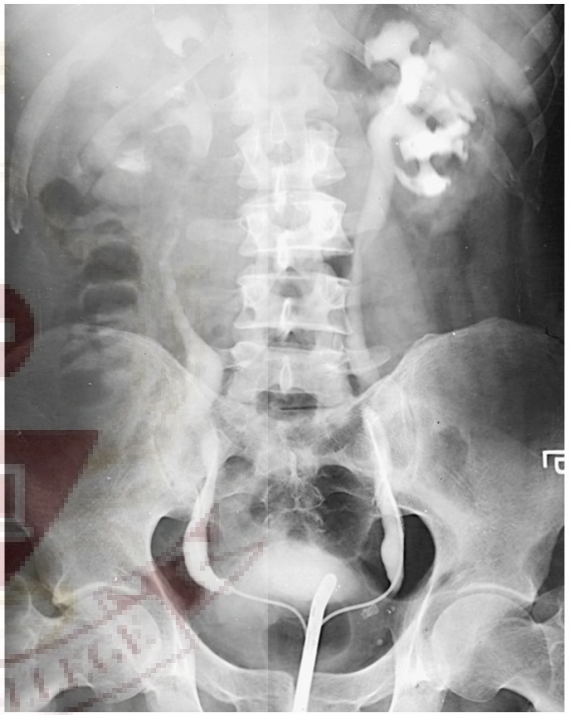
- 3-5 ml of contrast is injected into the renal pelvis
- Fluoro exposures done with both catheter and contrast in place
- Catheters are removed and exposures made as contrast drains into ureters

RU Images



radtechonduty.com/2014/10/retrograde-urography-ap-projection.html

Before contrast



From Long BW, Rollins JH, Smith BJ: *Merrill's atlas of radiographic positioning & procedures*, ed 13, St Louis, 2016, Elsevier.

After contrast

RU Images cont.

Catheter removed from the left ureter, but remaining in the right



Copyright © 2018 by Elsevier, Inc. All rights reserved.

RU – Post Procedure

- Patient recovers in recovery room and leaves with a driver

- Can expect some mild pain on urination for a day or so
  - Drink plenty of fluids to ease this

RU – Tech's Role

- Entirely technical
- Set up fluoro
- Help with exposures
- Record fluoro time and images in patient's chart

I'm thinking about you guys!

Please ask me questions about this material if you have any. Visit the discussion boards or email me.

