

# CANADIAN UNDERGRADUATE UROLOGY CURRICULUM



Hematuria

# A Message from CanUUC

This educational material is intended to supplement medical student knowledge on urological health and medical practices. We are committed to promoting inclusion across all our materials. We acknowledge that some language used within this content may include terminology from source materials and research studies, which has been maintained to reflect the scientific context in which information was gathered.

Wherever possible, we aim to use language that is respectful of all individuals, recognizing gender diversity, variations in sex characteristics, and the importance of inclusive terminology.

# Objectives

1. Define microscopic and macroscopic (gross) hematuria
2. Outline the investigations required (upper and lower urinary tract) when evaluating hematuria.
3. Describe the common causes of hematuria.
4. List the common risk factors for urothelial malignancy.
5. Outline the evaluation of a renal mass.
6. List how hematuria of nephrologic origin differs from hematuria due to a urologic source

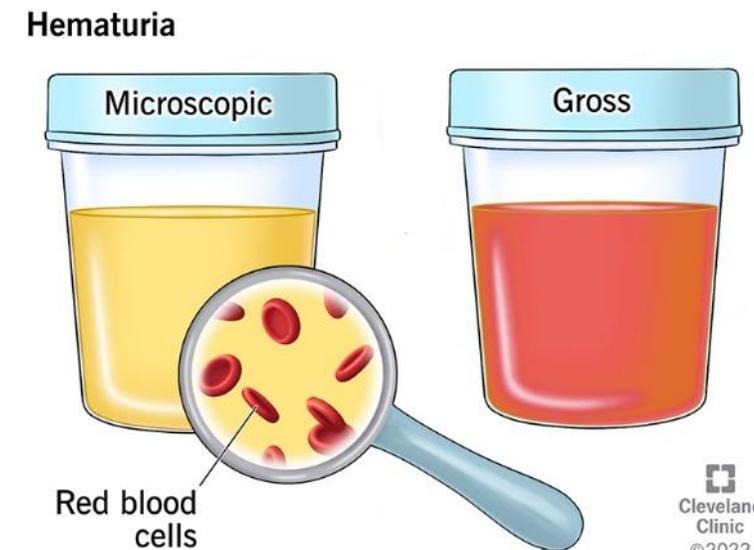
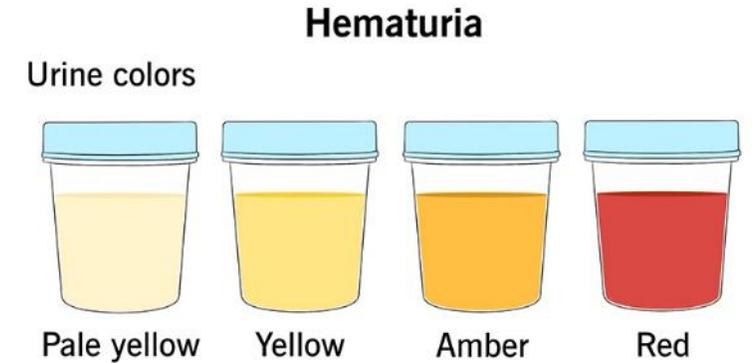
# What is hematuria?

## ➤ GROSS HEMATURIA

- Visible blood in the urine
- This is always significant!

## ➤ MICROSCOPIC HEMATURIA

- 3 or more RBC/hpf on two microscopic analyses
- Absence of recent menses, exercise, or instrumentation



# Hematuria: Why Care?

- Should be regarded as a symptom of urologic malignancy until proven otherwise
- 1-16% prevalence in the population
- Hematuria carries a 5-10 fold risk of urologic malignancy

# Cases

1. 28-year-old male with gross hematuria
2. 49-year-old female with microscopic hematuria
3. 67-year-old male with gross hematuria and clot retention

# CASE 1 – Gross Hematuria with Lower Urinary Tract Symptoms (LUTS)

# Case 1: A 28-Year-Old Male

- 2 episodes of gross hematuria
  - Self-limiting
- LUTS for 6months
  - Urinary hesitancy
  - Decrease in the force of stream; slow flow
- Non-smoker
- No pain, No trauma

# Does this patient need evaluation?

- YES!
- Gross hematuria carries a fivefold yield of representing significant underlying pathology
- Needs evaluation regardless of age or sex characteristics

# Key Points on History

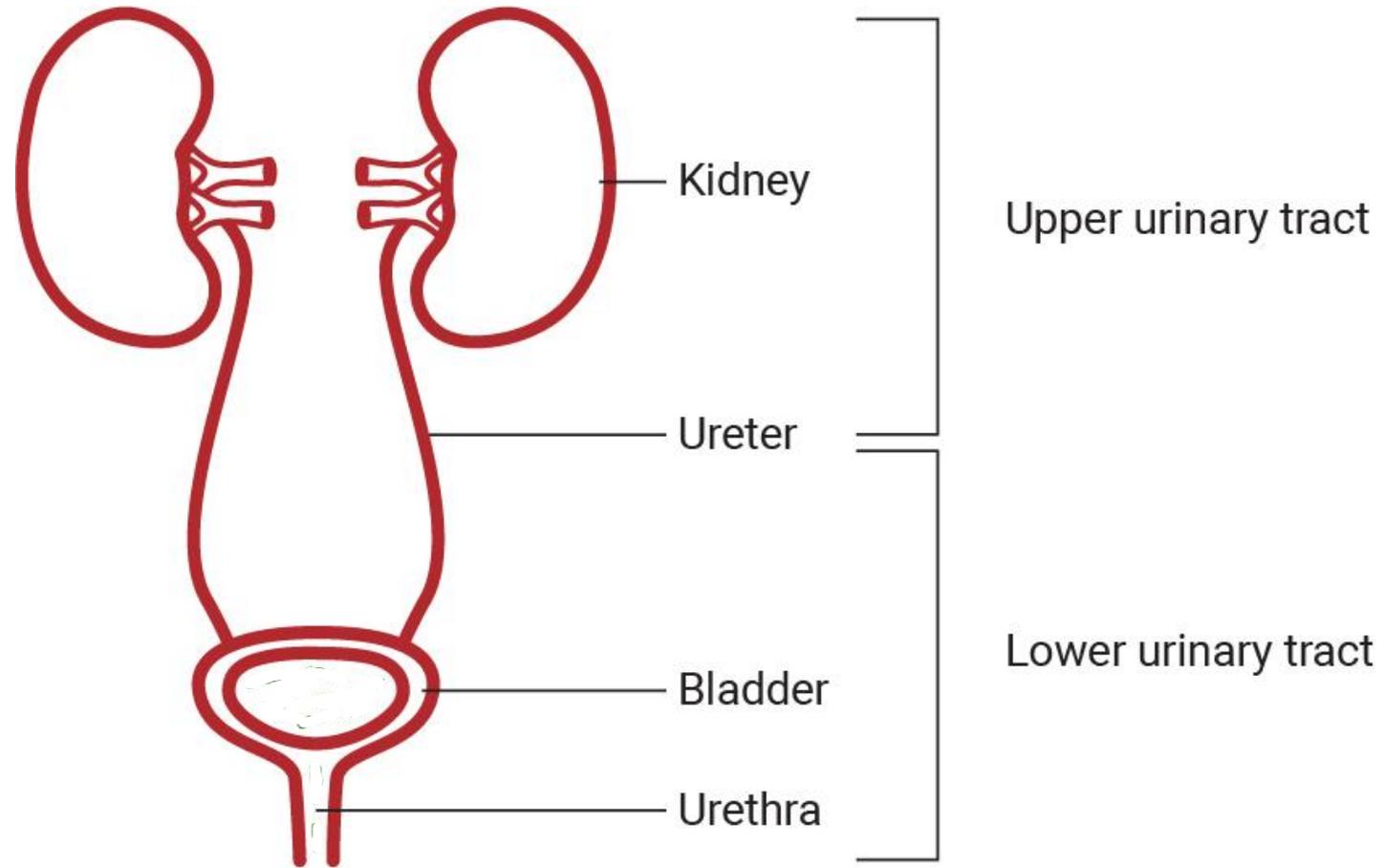
- **PAIN WITH HEMATURIA** usually from upper tracts
  - Usually represents a stone or infection
- **PAINLESS HEMATURIA** usually more worrisome
- **PRESENCE OF CLOTS**
  - Usually indicates more significant hematuria

# What investigations are required?

- Urinalysis, urine C&S, lytes, creatinine
  - R/O infection, renal failure
- **URINE CYTOLOGY**
- **UPPER TRACT STUDY**
  - Imaging (CT Hematuria Protocol or Renal US)
- **LOWER TRACT STUDY**
  - Cystoscopy

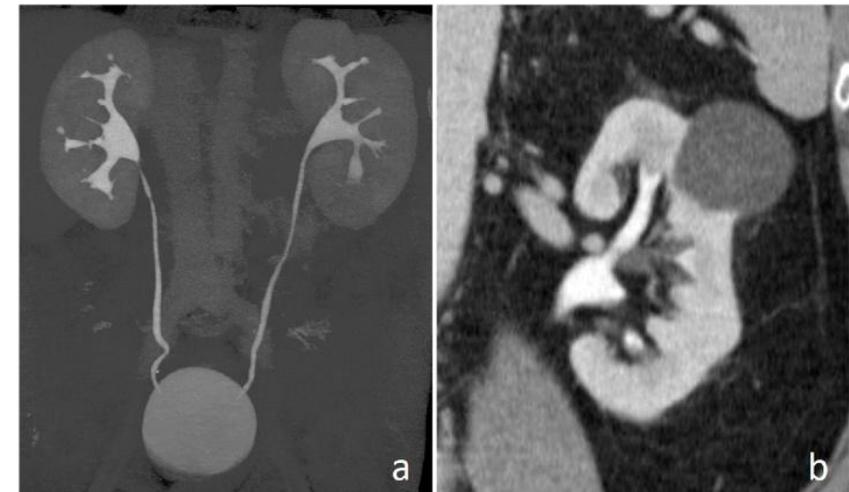
BOLDED Terms are MANDATORY investigations.

# Upper vs Lower Urinary Tract



# Upper Tract Investigations

- Ultrasound
  - Very useful first line imaging of upper tracts
  - Assess for mass, calculus, hydronephrosis
- Computerized tomography (CT)
  - For evaluation of any abnormalities on ultrasound



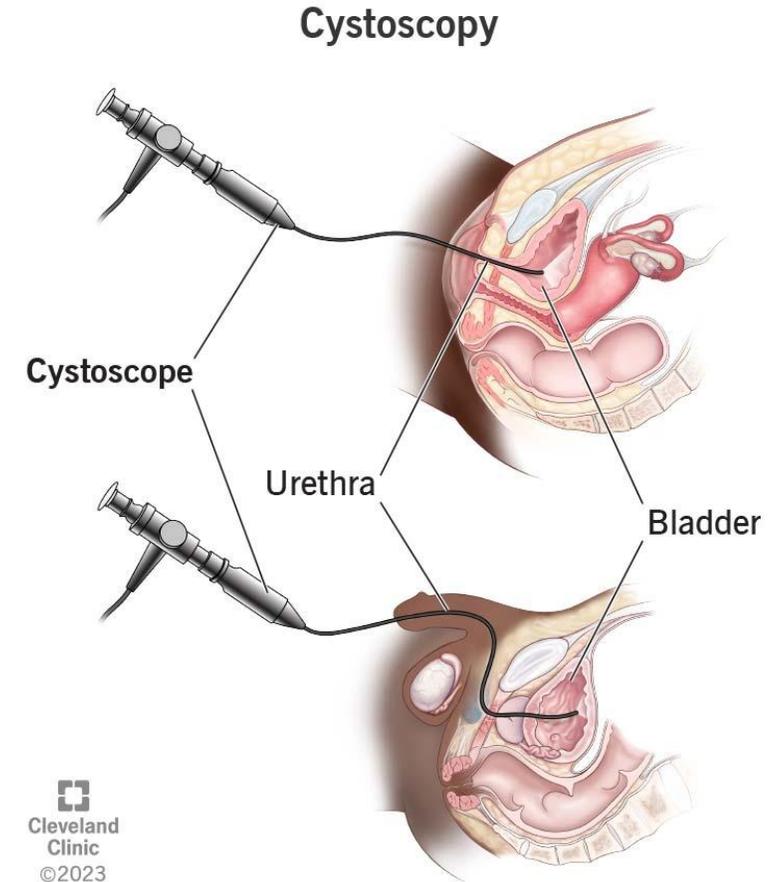
# Upper Tract Investigations - CT

- CT Hematuria Protocol (Triphasic CT Scan)
  - 1. Unenhanced Phase – assess for calculi and hydronephrosis
  - 2. Nephrographic Phase – assess for enhancing renal masses
  - 3. Excretory Phase – assess the ureters for upper tract malignancy/filling defects
- Needs IV Contrast and therefore needs to have a normal serum Cr



# Lower Tract Investigations

- Radiographic studies do not rule out lower urinary tract pathology
- Cystoscopy is the gold standard for evaluating the lower urinary tract



# Other Tests: Urine Cytology and Markers

## ➤ URINE CYTOLOGY

- Sensitivity 34%, specificity 81%
- Greatest sensitivity in high grade urothelial tumors

## ➤ BLADDER TUMOR MARKER TESTS

- More sensitive than cytology but less specific
- Possibly a role in follow-up of bladder tumors

# Urologic Causes of Hematuria

## ➤ Upper tract

- Renal cell carcinoma
- Renal calculi
- Obstruction
- Hydronephrosis
- Infection

## ➤ Lower tract

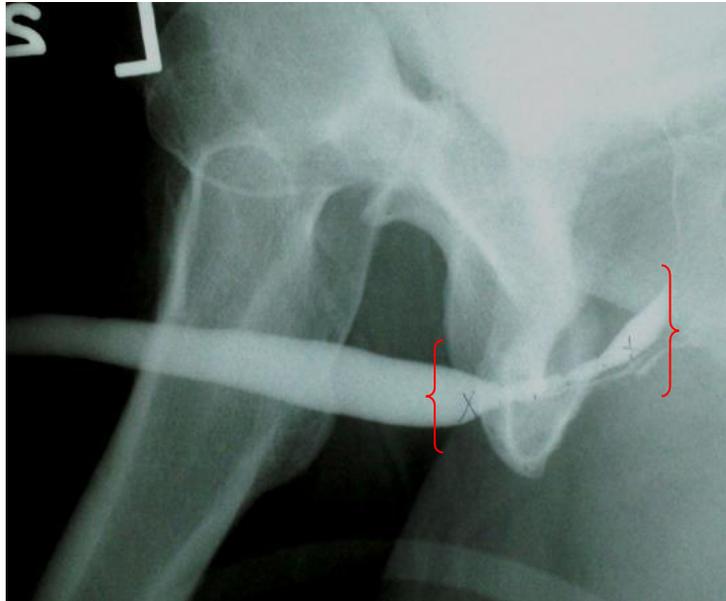
- Bladder cancer
- BPH
- UTI
- Urethral Stricture
- Trauma

# Case 1: Results

- Urinalysis, urine culture
  - 1-5 WBC, 5-10 RBC
  - No growth
  - Neg STI's
- Renal Ultrasound
  - Normal upper tracts
- Cystoscopy
  - Narrow bulbar urethral stricture
  - Stricture dilated sequentially



# Case 1: Continued

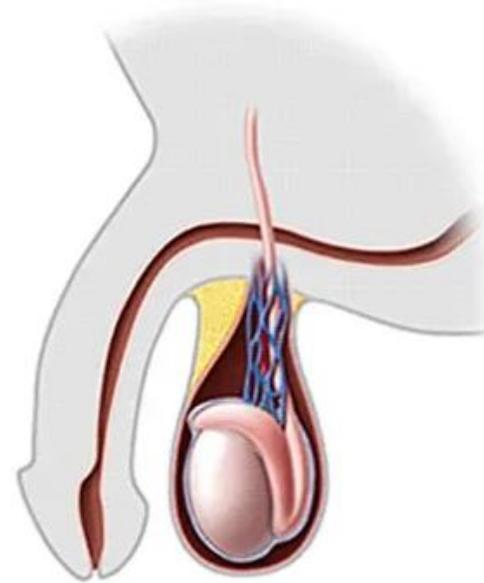


- Hematuria and LUTS improved after cystoscopy and urethral dilation
- Symptoms recurred in 6 months
- Urinary retention
- Repeat cystoscopy with urethrogram
  - 5cm bulbar urethral stricture

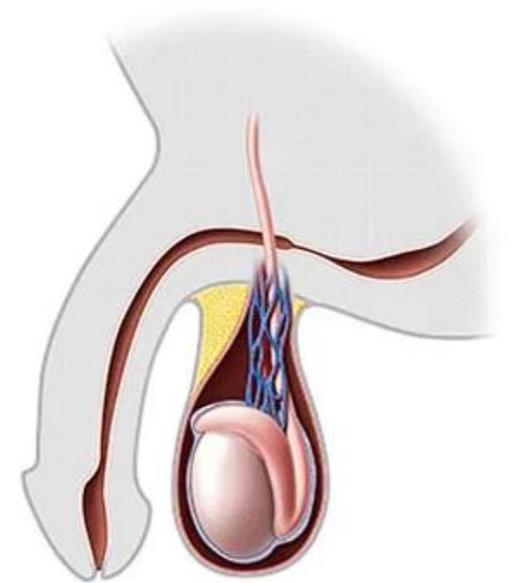
# Urethral Stricture

- Fibrosis of urethra and corpus spongiosum causing:
  - LUTS/retention
  - UTI
  - Hematuria
- Etiology
  - Trauma
  - Idiopathic
  - Infection
  - Iatrogenic

Normal Groin

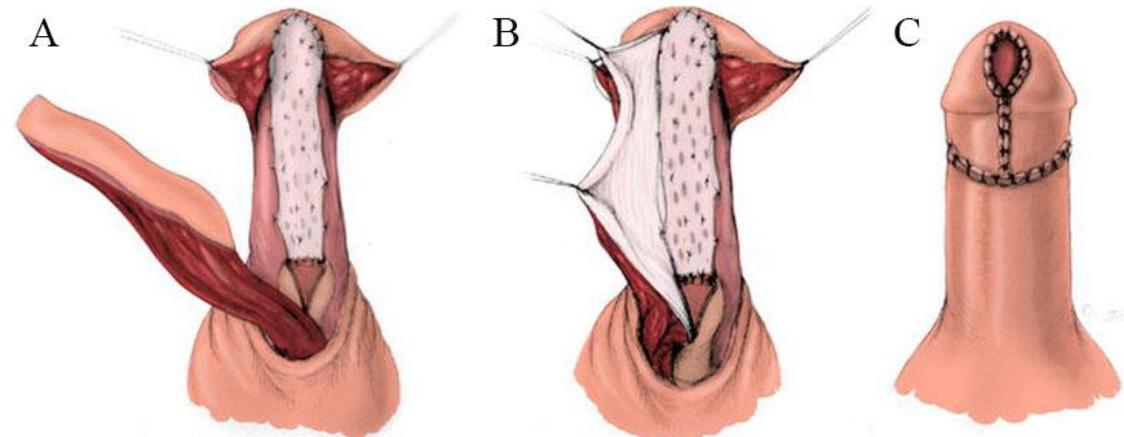
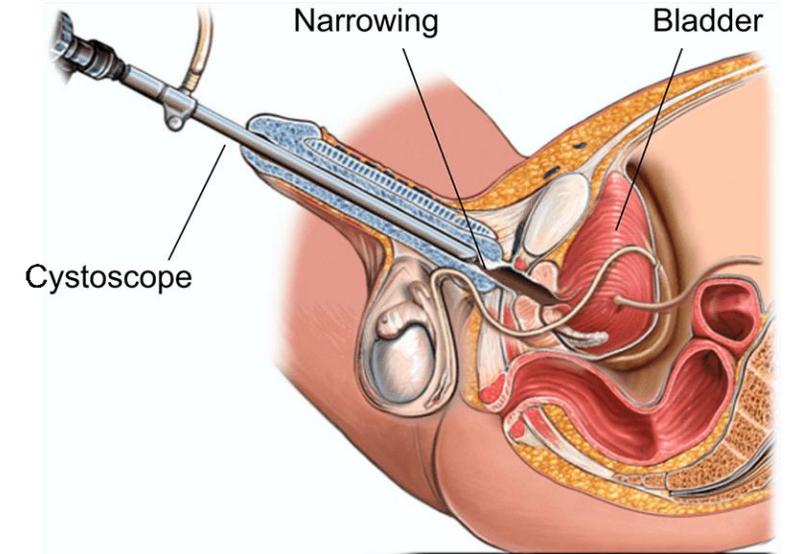


Urethral Stricture



# Urethral Stricture: Treatment

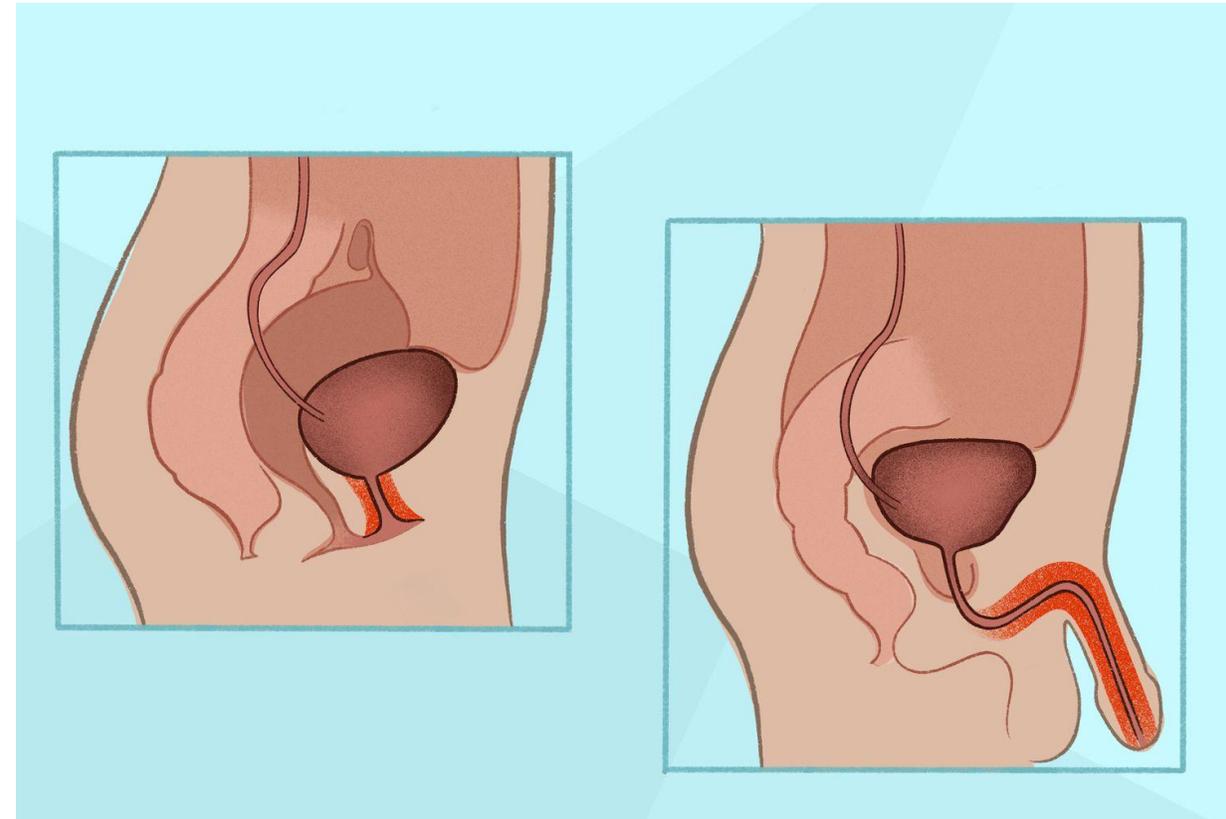
- Dilations, urethrotomy:
  - Forcibly opening strictured segment by stretching or incising
  - Not usually curative
  - Temporary relief
- Urethral reconstruction
  - >90% success
  - Tissue transfer (buccal mucosa)



# Female urethral strictures

Urethral strictures in women are less frequent compared to men due to their shorter urethral length (~5 cm in women versus ~20 cm in men)

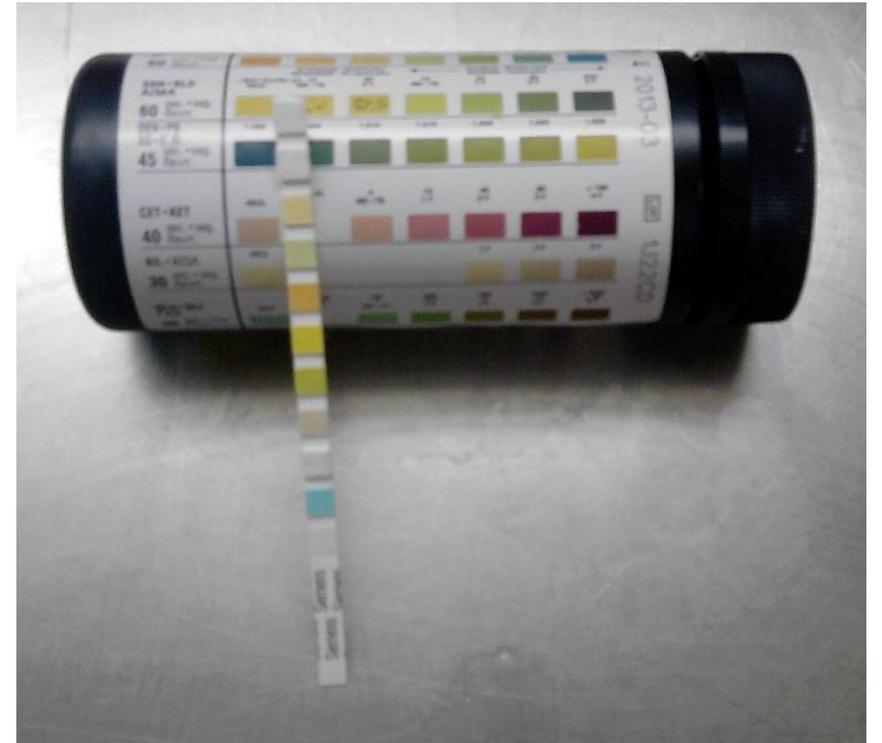
- Symptoms include
  - Weak stream
  - Recurrent urinary tract infections
  - Pain localized to the urethra
  - Urgency
  - Frequency
  - Dysuria
  - Hesitancy
  - Overflow urinary incontinence
  - Urinary retention



## CASE 2 – Microscopic Hematuria

# Case 2: A 49-Year-Old Female

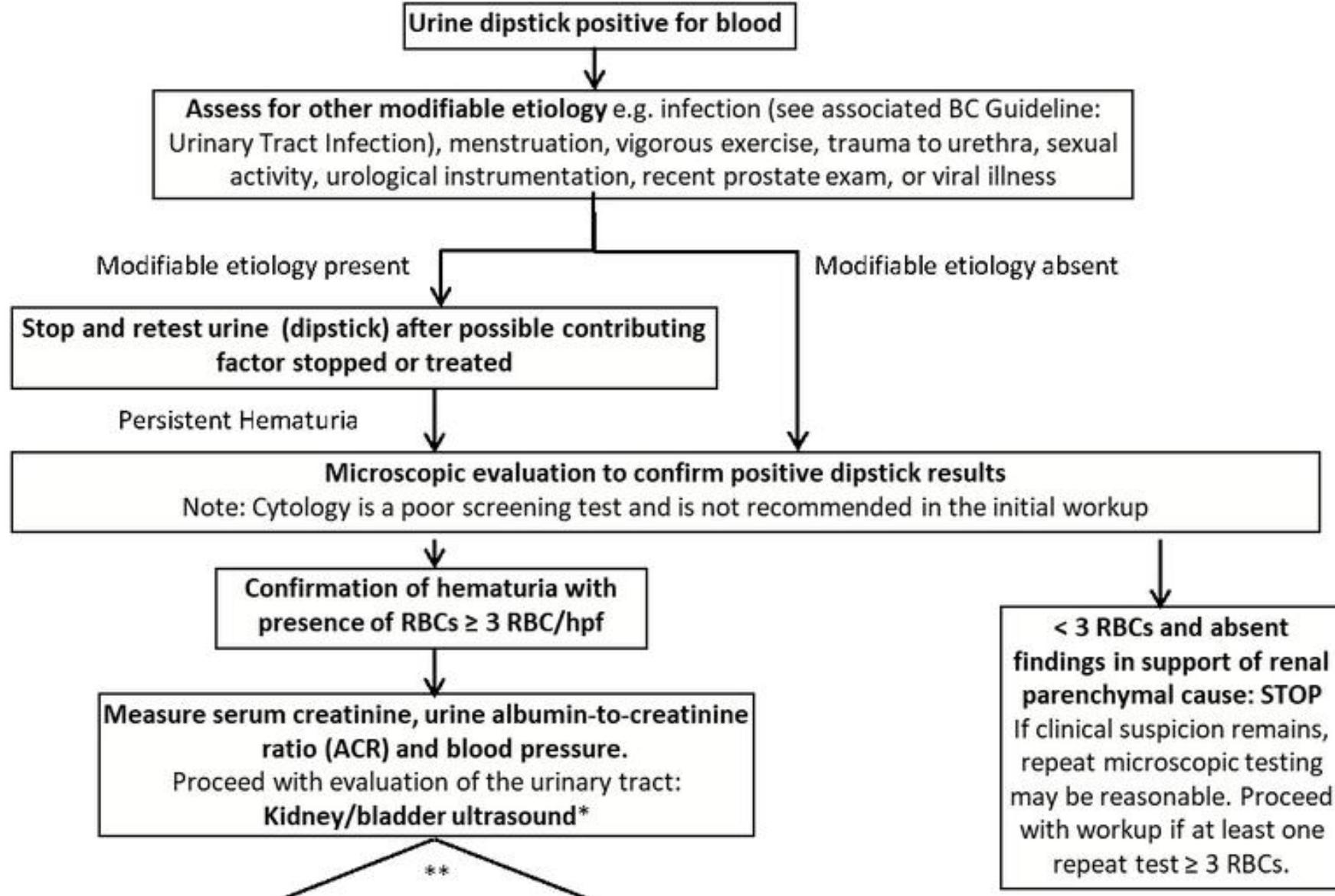
- Routine insurance urinalysis
  - Dipstick: 1+ Hgb
  - Microscopic: 5 RBC/HPF
- Negative urine C&S, N Cr (65)
- No Gross Hematuria
- Non-Smoker
- No LUTS, No pain, No calculi



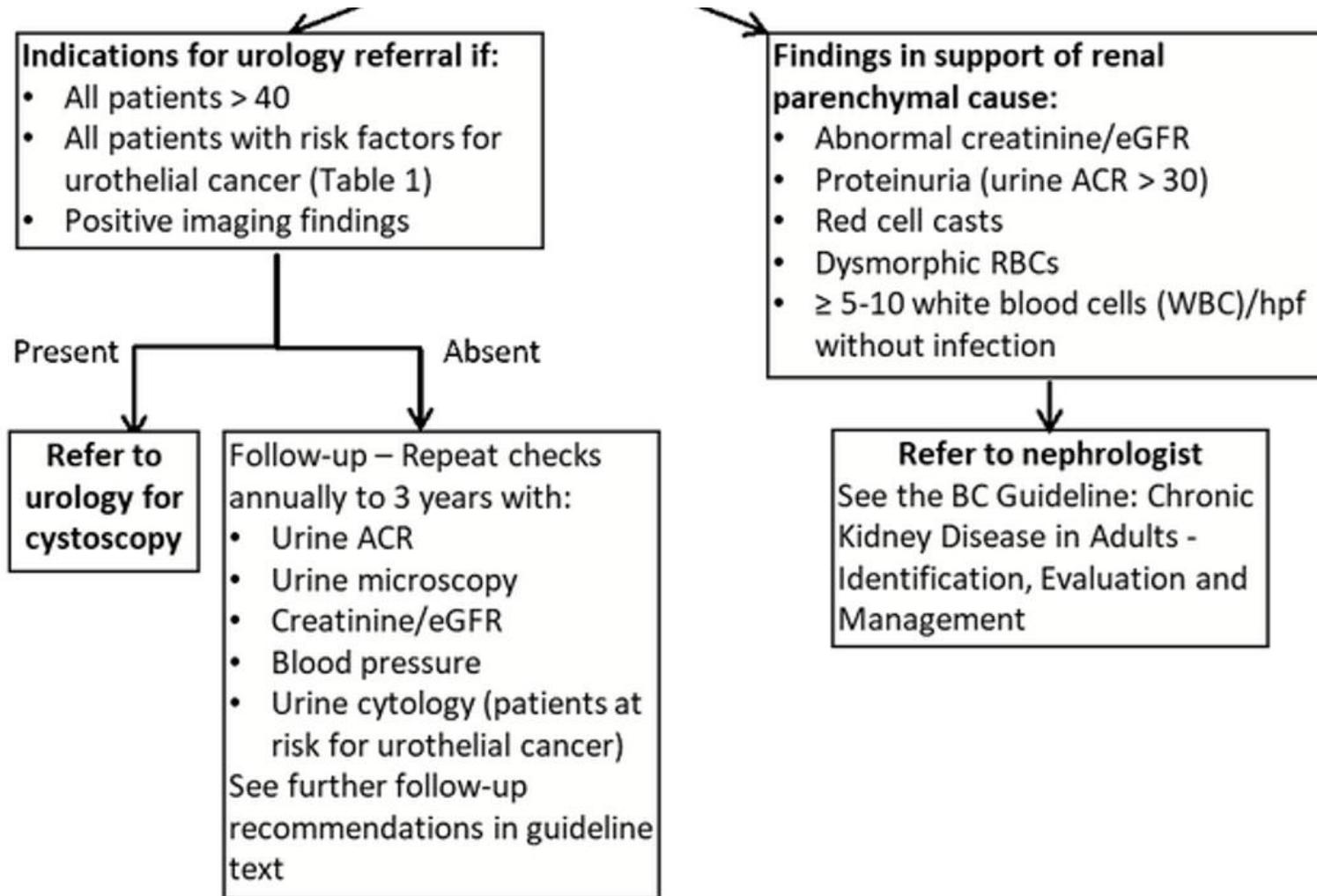
# Does this patient need investigation?

- Yes!
- Age >40 with microscopic hematuria regardless of sex characteristics

# Workup of Microscopic Hematuria



# Workup of Microscopic Hematuria



\* Please note that imaging does not completely assess the lower urinary tract

\*\*Patient may require referral to either or both urology or nephrology

# Microscopic Hematuria: Who to Investigate?

- Patients over the age of 40 need full urologic evaluation
  - Yield 11%
- Complete investigation NOT needed for microscopic hematuria in a nonsmoker less than 40 years of age
- Upper tract imaging reasonable in all patients
- Cystoscopy can be deferred in patients under 40 without risk factors for lower tract pathology

# When do people under 40 with microscopic hematuria require full cystoscopy?

People with risk factors for lower tract malignancy:

- People who smoke
- Occupational exposure to dyes
- Radiation therapy to pelvis
- Cyclophosphamide exposure
- Analgesic use with phenacetin

# Does a positive dip always indicate hematuria?

- No
- Causes of a false positive dipstick:
  - Dehydration
  - Myoglobinuria
  - Presence of menstrual blood
  - Oxidizing agents (Vitamin C, etc.)

# Hematuria: Is Urine Dipstick Accurate?

- Sensitivity 0.91
- Specificity 0.99
- False positive 16% therefore confirm with microscopic exam of urine sediment
- Good for screening

# When to suspect a nephrologic (glomerular) source?

- RBC casts
  - Proteinuria
  - Dysmorphic red blood cells
  - Elevated creatinine
- 
- \*If these are present there may be no need to investigate for urologic source\*



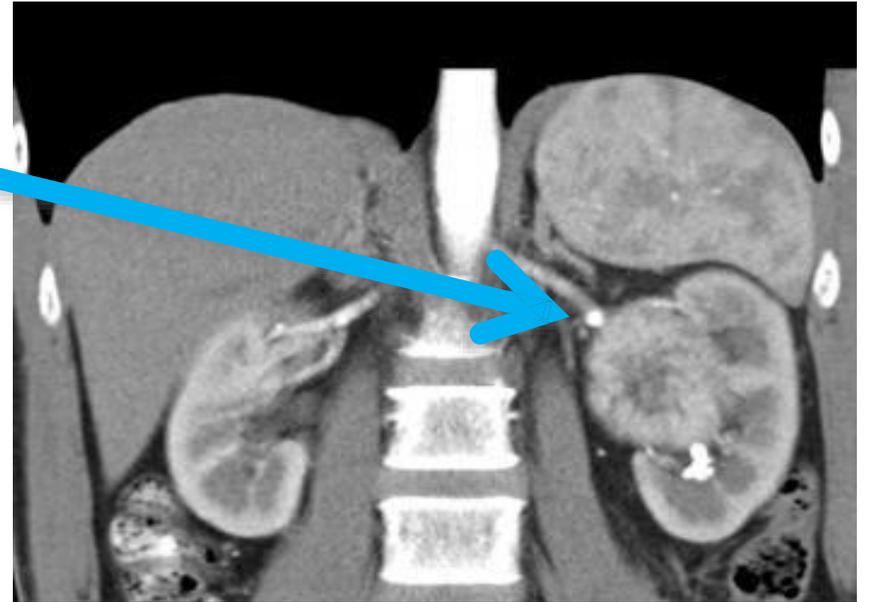
# Case 2: Investigations

- Upper tract
  - 4cm left renal mass on ultrasound
  - No calculi or hydronephrosis
- Lower tract
  - Normal cystoscopy
  - Normal cytology



# Further Evaluation: CT Abdomen

- 4cm central left renal mass
- Differential Diagnosis:
  - RENAL CELL CARCINOMA
  - Oncocytoma
  - Angiomyolipoma
  - Lymphoma
  - Mets from another primary malignancy
- A solid renal mass is considered carcinoma unless proven otherwise!



# Renal Cell Carcinoma

- 3% of all adult malignancies
- 90% of malignant renal tumours
- Males: Females = 2:1
- Risk factors:
  - Smoking (mild)
  - Hypertension
  - Obesity
  - Occupational exposures (ie: chlorinated solvents, benzene)
  - Familial RCC syndromes (ie: Von Hippel-Lindau (VHL) syndrome, Birt-Hogg Dubé, etc)
  - Idiopathic

# Renal Cell Carcinoma: Presentation

- Age 40-60
- ~60% are incidentally discovered (ultrasound, CT etc)
- Hematuria – very common symptom
- 15% have “classic triad” of flank pain, abdominal mass, & hematuria
  - This triad is rare now – late findings
- Paraneoplastic syndromes
  - Hypercalcemia, Cushing’s, etc.

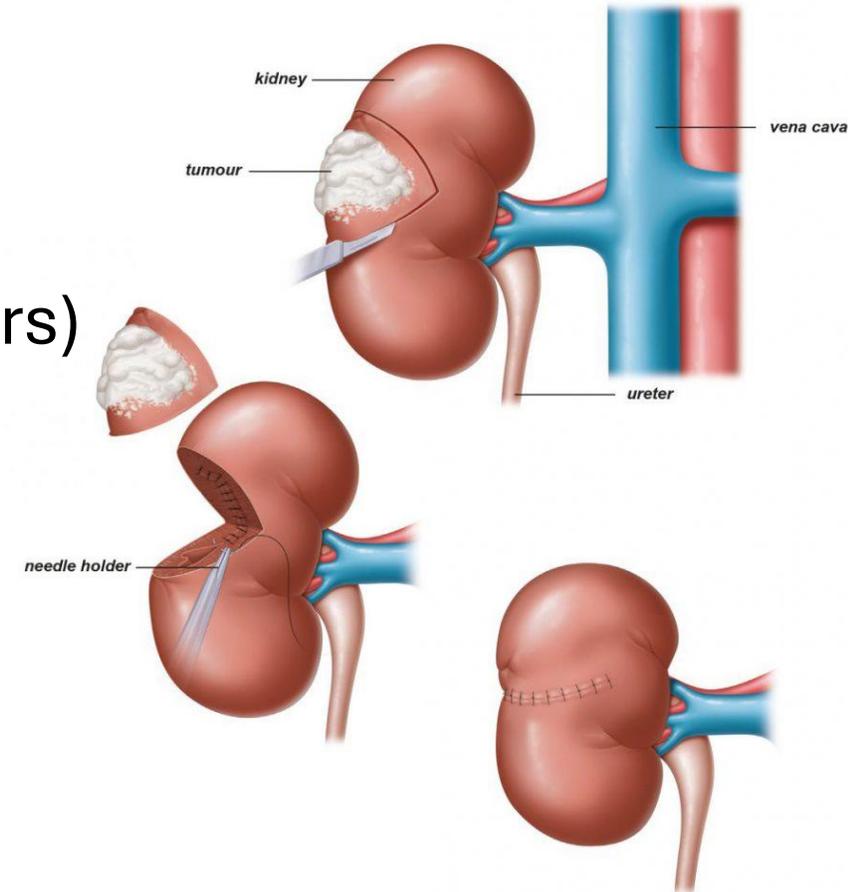
# Renal Cell Carcinoma: Diagnosis

- Based on radiographic studies
  - Incidental ultrasound
  - Contrast enhanced CT is the method of choice
  - Biopsy only if it will change management



# Renal Cell Carcinoma: Treatment

- Localized disease:
  - Nephrectomy is the only cure
  - Radical vs. Partial (small or bilateral tumours)
  - Chemotherapy ineffective
- Metastases:
  - Palliative radiotherapy (bony lesions)
  - Tyrosine kinase inhibitors (TKIs)
  - Immunotherapy



# CASE 3 – Gross Hematuria and Clot Retention

# Case 3: A 67-Year-Old Male

- Gross hematuria for 2 weeks
- Passing clots per urethra for 2 days
- Unable to void for 8 hours
- Has smoked regularly for 30 years
- Urinalysis: 4+ Hgb, >50 RBC/HPF



# Does this patient need investigation?

- Yes! Definitely
- Gross hematuria
- History of smoking



# Treatment Plan

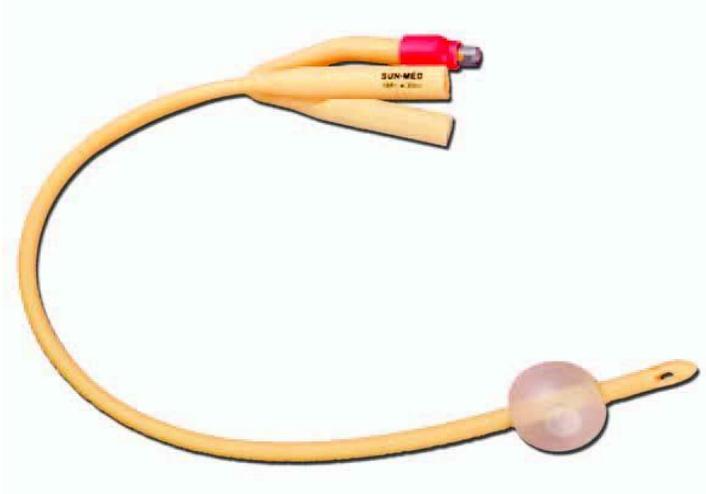
- Needs catheter (large lumen or 3 way for continuous bladder irrigation (CBI))
- Upper tract imaging
  - Renal ultrasound
- Lower tract study
  - Cystoscopy
- Urine Cytology



# Clot Retention

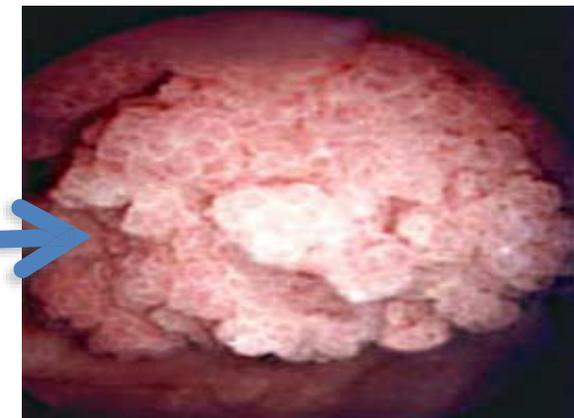


- Bladder hemorrhage and large clots
- Place large bore 3-way catheter
  - 3 lumens – balloon, inflow and outflow
- Manually irrigate clots
- Continuous bladder irrigation (CBI) – Flushes out blood before clots can form



# Case 3 - Investigations

- Renal ultrasound
  - Normal kidneys
  - Possible bladder lesion
- Urine Cytology
  - “Atypical cells”
- Cystoscopy
  - Papillary bladder tumour



# Bladder Cancer: Urothelial Cell Carcinoma (UCC)

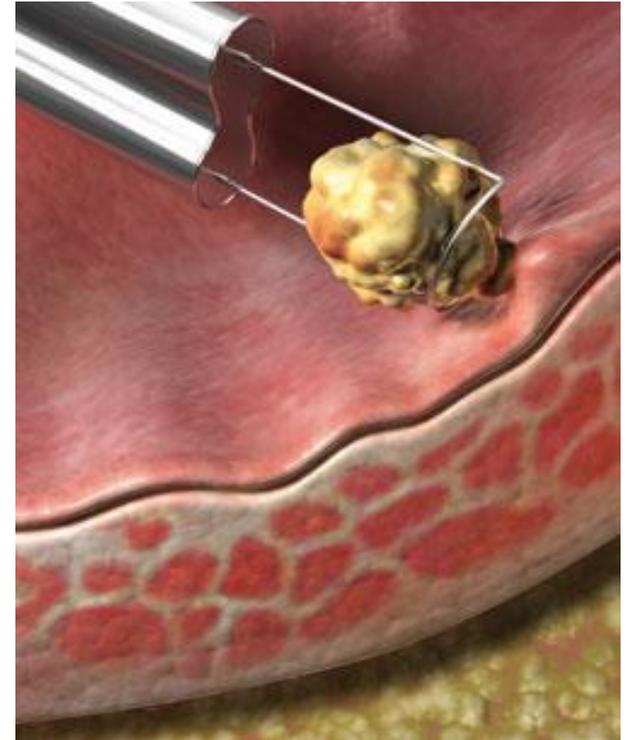
- Most common cause of gross hematuria over age 40
- Linked to smoking (3x more likely)
- Most common bladder tumour (>85% tumours)
- Radiologic investigations have a high false negative rate
- Cystoscopic (“visual”) diagnosis

# Urothelial Cell Carcinoma Risk Factors

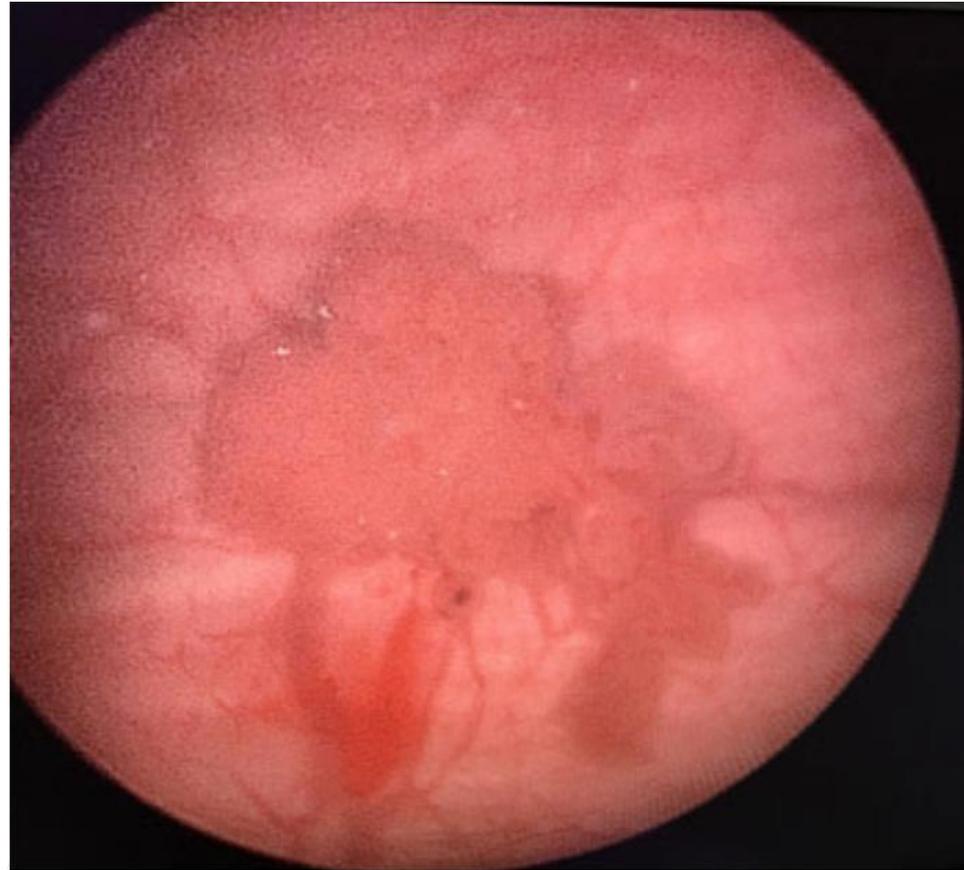
- Smoking (increases with number of pack years)
- Increasing age (incidence rises from age 50-54)
- Exposure to environmental carcinogens
  - arsenic and chemicals used to manufacture dyes, rubber, leather, textiles, ink and paint
- Previous pelvic radiation
- Chronic bladder inflammation
- Personal or family history of cancer

# UCC: Treatment

- Transurethral Resection of Bladder Tumour
  - Stages the cancer
  - Treatment for early stage cancers
- Prone to recurrence
  - Cystoscopic surveillance
- Non-muscle invasive bladder cancer
  - for high grade tumours, consider intravesical chemotherapy or immunotherapy (ie. BCG)
- Muscle invasive bladder cancer
  - Radical cystectomy and urinary diversion
  - Trimodal therapy (maximal TURBT and chemoradiation)



# Transurethral Resection of Bladder Tumor (TURBT)



**Bladder Tumor Before TURBT Surgery**

# When To Re-evaluate Hematuria

- The likelihood of tumors developing within 2 to 5 years after a negative evaluation is in the 0 to 3% range
- When no specific cause for persistent microscopic hematuria is found, the patient should be followed annually with
  - urine microscopy
  - creatinine/eGFR
  - blood pressure
  - urine cytology (if patient has risk factors for urothelial cancer)
- Re-evaluate if:
  - Gross hematuria
  - Positive or atypical urine cytology
  - New onset of irritative voiding symptoms without infection