Urine analysis

Peer Group meeting

10 April 2018

- Case
- Urinalysis – usefulness and interpretation
- Pits fall

Case

- 32 years old male, fit and well, Gym 3 x week
- Creatinine 75mmol/L, eGFR >90ml/min, urine ACR 3.5 mg/mol (u albumin 9mg/L) in 09/17
- Presented to ACH with L hip pain sustained from sport injury
- Haematuria 39 rbc, Urine ACR 50, raised creatinine 107 (79ml/min), CRP 1, HbA1c 24
- Examination – normal
- Referred to GLMS

Further Investigations

- Repeat urine microscopy – urine ACR, 24 hour urine protein, Auto-antibodies – negative, US normal sized kidneys, normal renal a dopplers
- Renal biopsy – IgA nephropathy with 1 fibrocellular crescent, red cell cast in tubules, scarring <2%,
- Prednisone 60 mg od for 2 months and plan to reduce and cease in 6 months
- Tolerated well to steroids apart from anxiety

Progress

						Ref. Range
Sodium	mmol/L	141		140	140	(135 - 145)
Potassium	mmol/L	4.1		4.2	4.2	(3.5 - 5.2)
Creatinine	umol/L	**113**	*	101	100	(60 - 105)
Urate	mmol/L	**0.51**	*			
eGFR mL/min/1.73m2		74		84	86	(> 90)

Date:		15/01/18		19/02/18		19/03/18		
Lab Number:		6958593		7229362		7475593		
								Ref. Range
Ur.Albumin	mg/L	**72**	*	**39**	*	**45**	*	(< 30)
Ur.Creatinine	mmol/L	6.1		2.8		3.5		
Alb/Creat ratio	mg/mmol	**11.8**	*	**13.9**	*	**12.9**	*	(< 2.5)

Urinalysis

- Informative and Non-invasive diagnostic tool
- Plays a central role in evaluating acute and chronic kidney disease
- Abnormal findings in asymptomatic patient
- First evidence of underlying kidney disease
- Can be used to monitor course of kidney disease

When to perform

- Patients with evidence of kidney disease – albuminuria, acute or chronic ↓eGFR
- Suspected kidney disease – concurrent illness or conditions associated with kidney lupus, vasculitis, newly identified hypertension
- Kidney stones – may identify etiology

Gross Assessment

- Turbidity – infection, crystals or chyuria
- Color –

-Red or brown – hematuria, hemoglobinuria, myoglobinuria, drugs, dye, beets, porphyria

-White – pyuria, chyuria, phosphate crystals

-Pink – uric acid crystal (propofol)

-Green – methylene blue, propofol, amitryptyline

- Black – hemoglobinuria, myoglobunuria

- purple – may be from bacteriuria with urinary catheter

Dipstick

- Rapid semi-quantitative assessment – heme, leucocyte esterase, nitrite, albumin, specific gravity, glucose
- Heme – not only from RBC, but also free hemoglobin, myoglobin

  - very sensitive (1 – 2 rbc/high power field), false negative unusual, urinary ascobic acid can interfere with peroxidase reaction (70% of patients with documented hematuria negative for heme)
- Leucocyte esterase – released by lysed neutrophil and macrophages, marker for presence of leucocyte (false negative with proteinuria, glycosuria, excessive diluted or concentrated urine)
- Nitrite – enzyme nitrate reductase form bacteria converts urinary nitrate to nitrite thus indicate presence of bacteria

Dipstick

- Protein – most sensitive to albumin

  Limitations – range of 30 to 300 mg/day (microalbuminuria), very dilute urine, concentrated urine, non-albumin proteinuria
- Sulfosalicylic acid detect all proteins in urine – can be used for screening

  Pos SSA + Neg dipstcik – non-albumin protein (most commonly light chains)
- Hydrogen ion concentration – Urine pH - degree of acidification of urine (4.5 – 8)
- Specific gravity – varies with osmolality

Other

- Osmolality – plasma osmolality (275 – 290momol/kg), kidney's ability to excrete urine with markedly different from that of the plasma. Mediated by ADH (promote water reabsorption in collecting tubules)
- Glucose – glycosuria occurs when plasma glucose exceed 10 mmol/L
- Glycosuria with normal plasma glucose may indicate defect in proximal tubule reabsorption, often coexist with uricosuria, phosphaturia, aminoaciduria, renal tubular acidosis (Fanconi)
- May result from MM, heavy metal, medications (tenofovir, lamivudine, cisplatin, aminoglucoside etc)

Urine sediment

(Microscopic examination of urine sediment)

- Should be performed by trained lab staff
- Crystals – uric acid, Ca P or oxalate, Cysteine, Mg ammonium phosphate (infection)
- Microorganisms – bacteria often seen guided by clinical symptoms, fungi
- Cells – RBC, WBC, Epithelial cells
- Epithelial cell - squamous E cells derived from distal urethra and external genitalia – contamination from genital secretions

WBC

- Neutrophils and Eosinophils – cells types of interest
- Neutrophils – asso with bacteriuria, sterile pyuria – interstitial nephritis, TB, Nephrolithiasis
- Eosinophiluria – classically with acute interstitial nephritis (34% with biopsy proven AIN) – not establish or exclude AIN

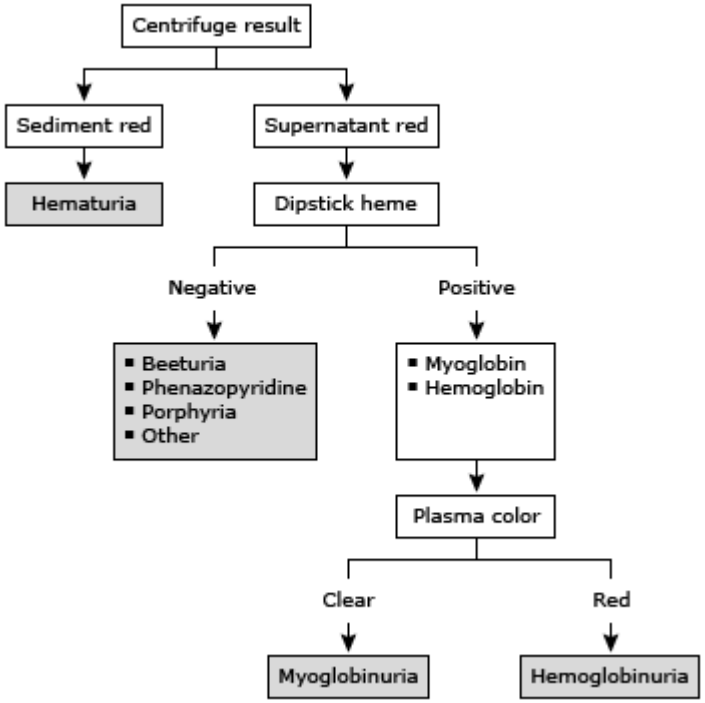
RBC

- Can be benign or serious underlying disease
- Microscopic defined as 2 or more rbc per high power field in spun urine sediment
- Transient hematuria – exercise, sexual intercourse, menstruation (malignancy after >50)
- Persistent hematuria should always be evaluated – most common stones, malignancy, glomerular diseases
- Distinguishing between glomerular and non-glomerular cause is first step (Isomorphic vs Dysmorphic)
- No uniform criteria defining dysmorphic rbc and proportion
- Concomitant presence of rbc casts and/or proteinuria suggestive of glomerular origin

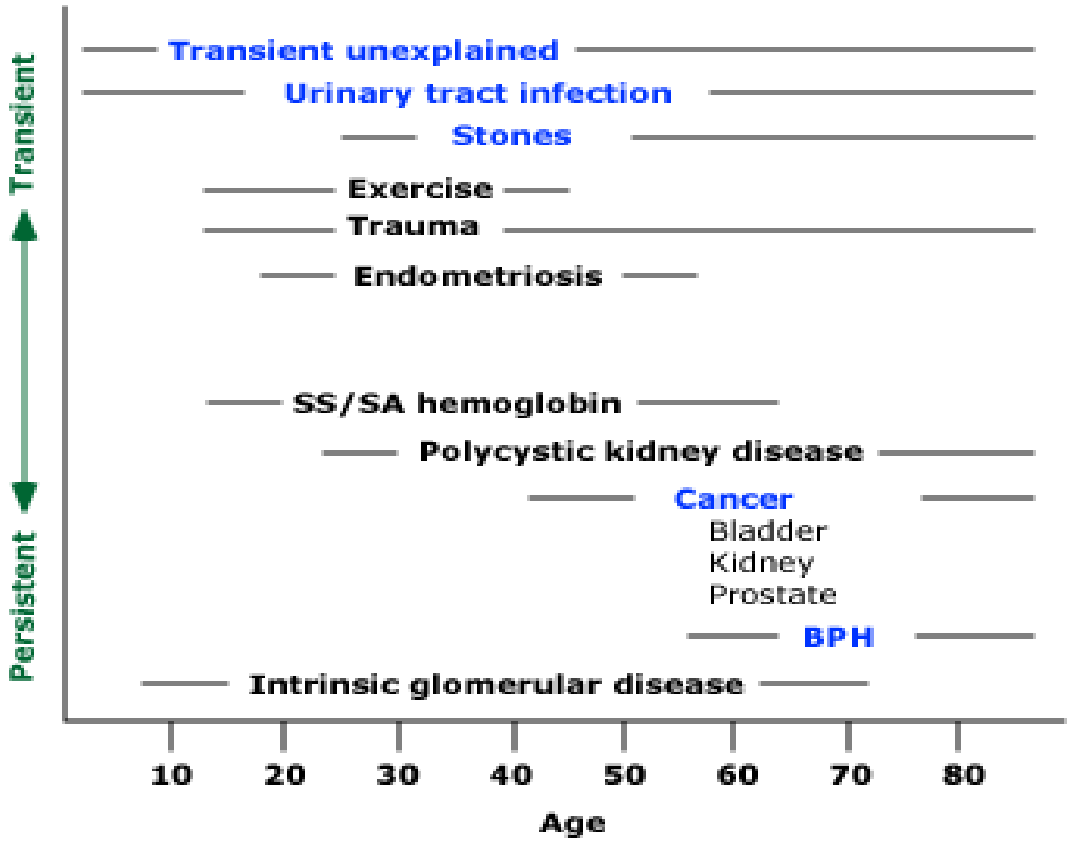
Casts

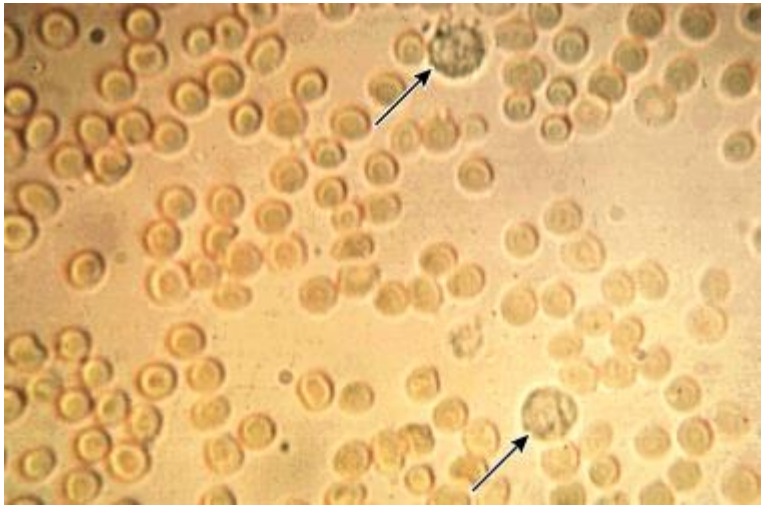
- Cylindrical structures formed in tubular lumen
- RBC casts – suggestive of glomerular hematuria nd GN
- WBC casts – interstitial or glomerular inflammation
- Granular casts & renal tubular epithelial casts – may indicate ATN
- Hyaline casts – generally non specific

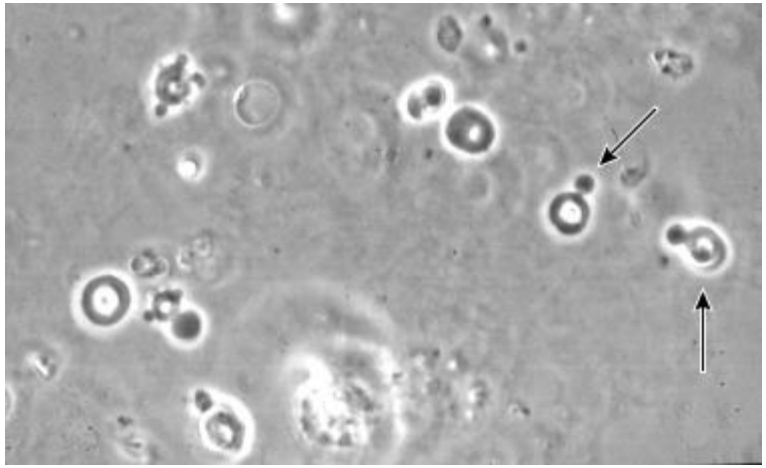
Approach to the patient with red or brown urine

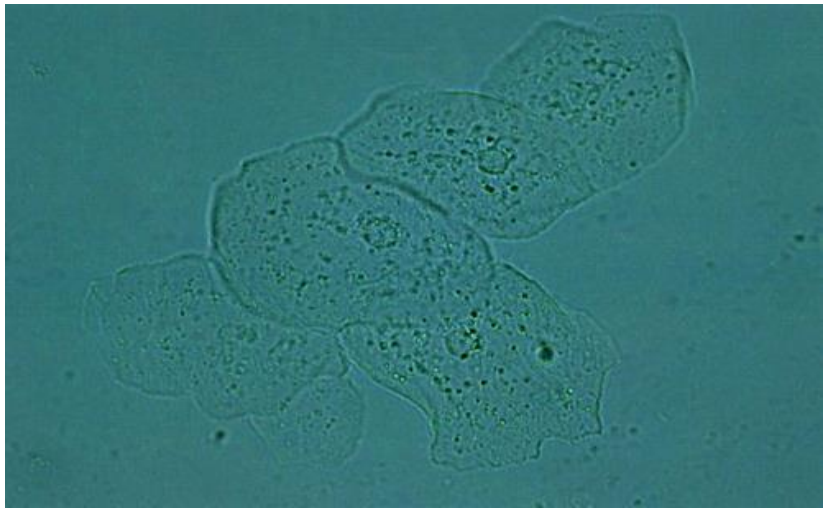


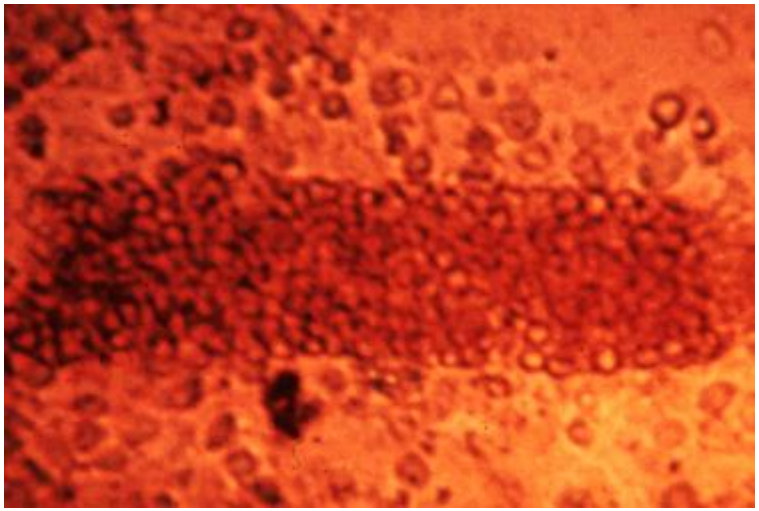
Major causes of hematuria by age and duration

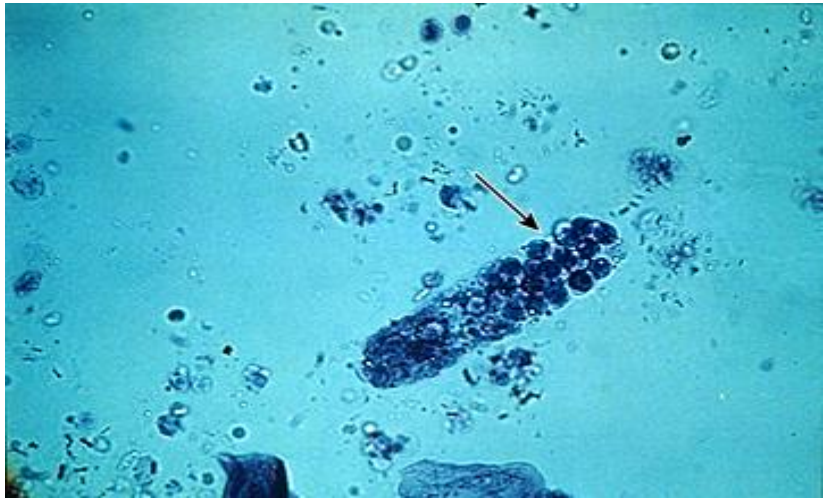


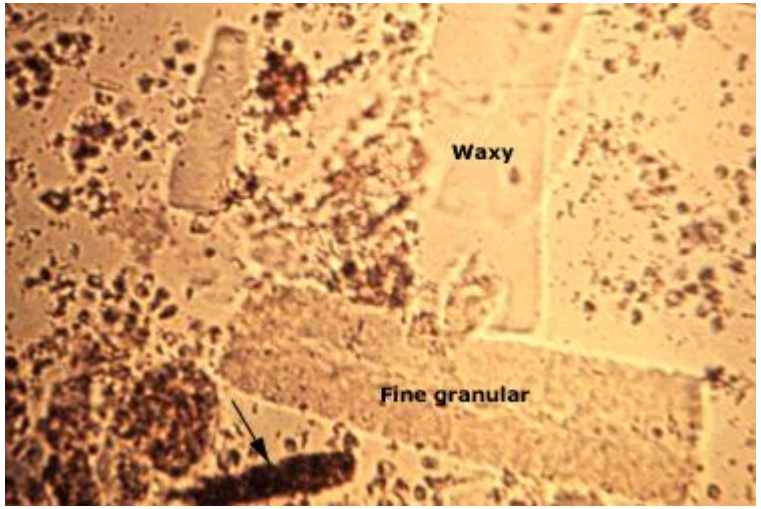


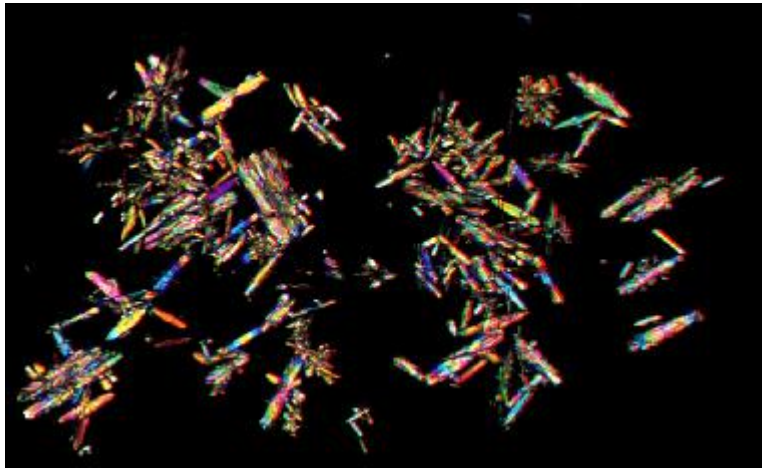


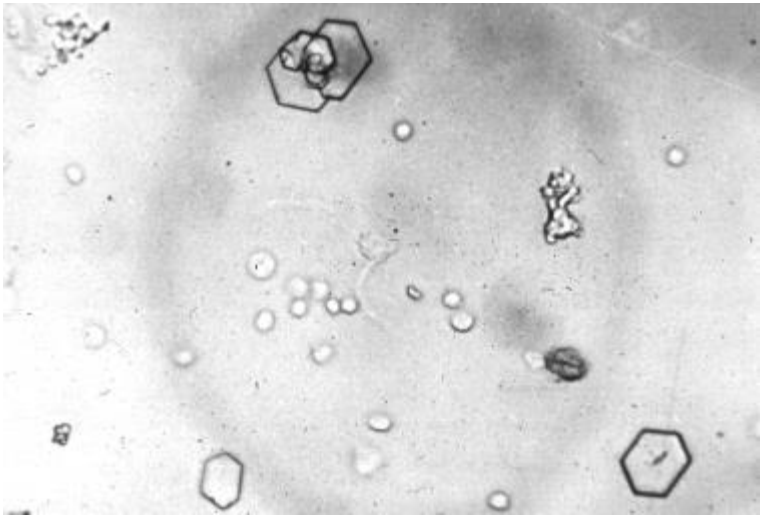


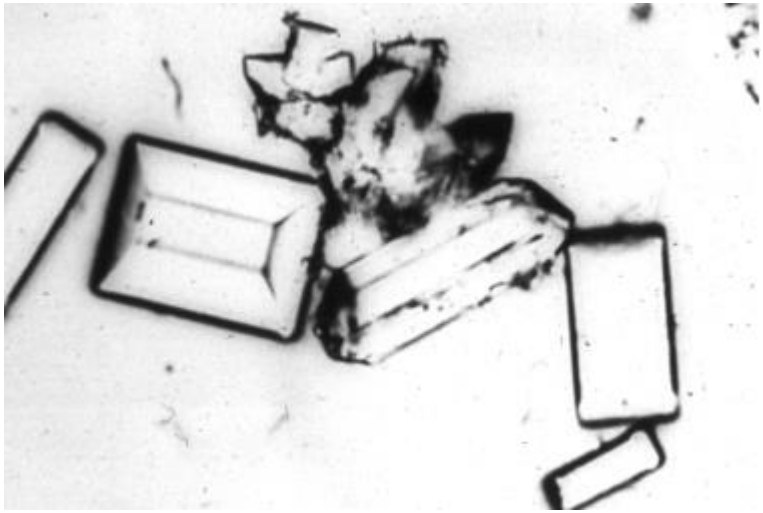





Waxy
Fine granular







Take home message

- Hematuria (persistent) needs further investigations (proteinuria, decreased eGFR)
- Proteinuria >3G nephrotic range - biopsy
- Non-nephrotic range – active sediment or ↓eGFR – consider biopsy
- Limitation of UACR/UPCR - Influence of the urine creatinine/Variability of protein excretion