

Overview of the clinical need for renal MRI

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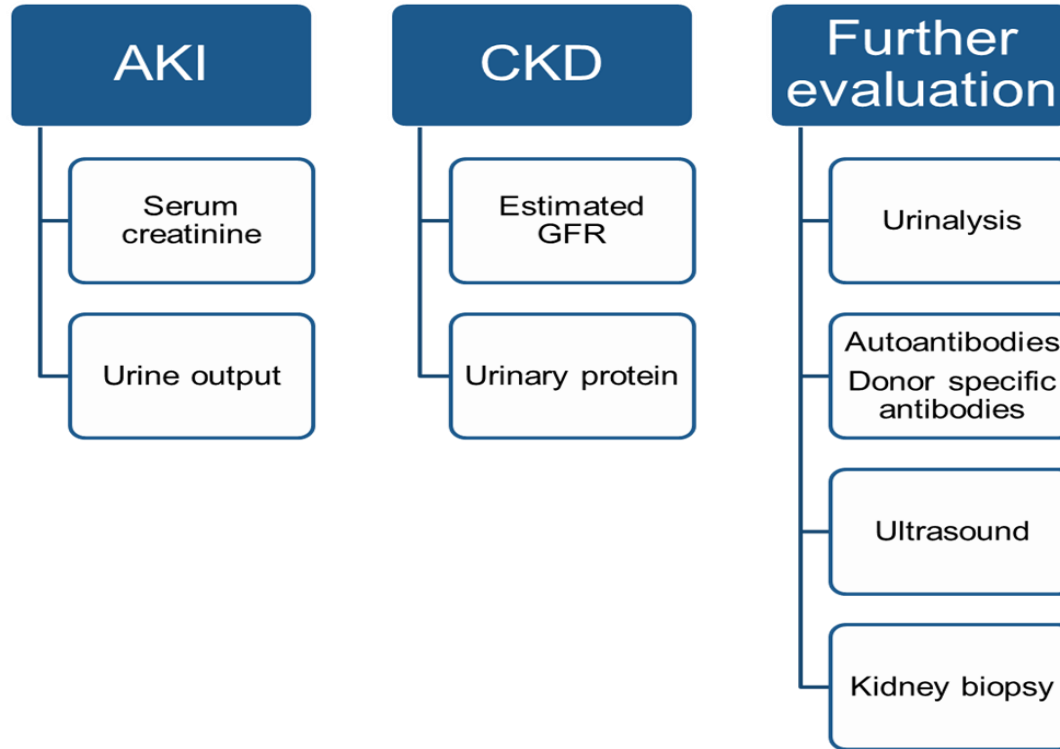
Consultant nephrologist and honorary clinical senior lecturer
Glasgow Renal and Transplant Unit



Existing methods of evaluating kidney disease

How novel methods of investigation may be helpful

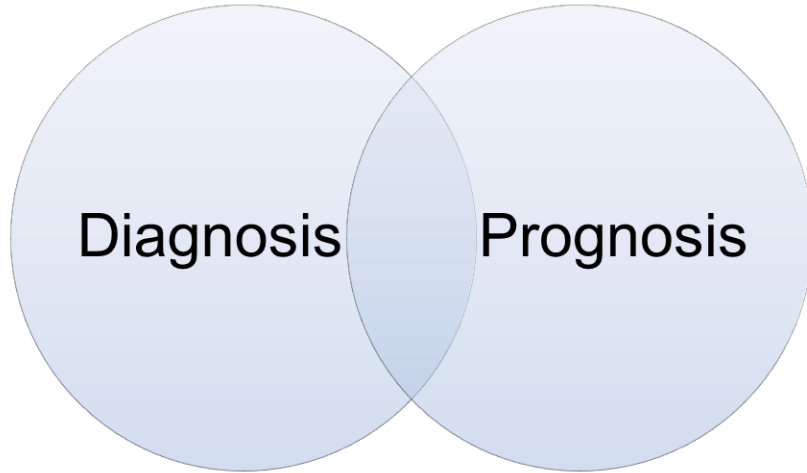
Clinical cases proving utility of renal MRI



Complications of percutaneous renal biopsy

Complication	AKI	Non-AKI
Haematuria (%)	1.9	1.0
Haematoma (%)	6.3	4.0
Death (%)	0	0.1
Transfusion (%)	10.0	5.3
Embolisation (%)	1.9	1.0

Korbet et al, Clinical Kidney Journal, 11(5) 2018



52 yo female

Presents with swelling of face and legs

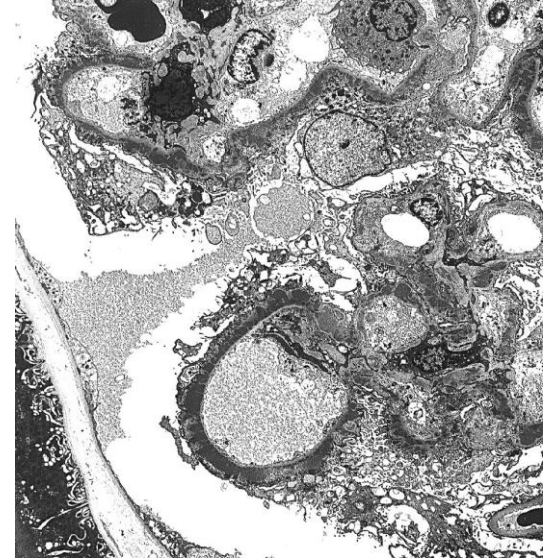
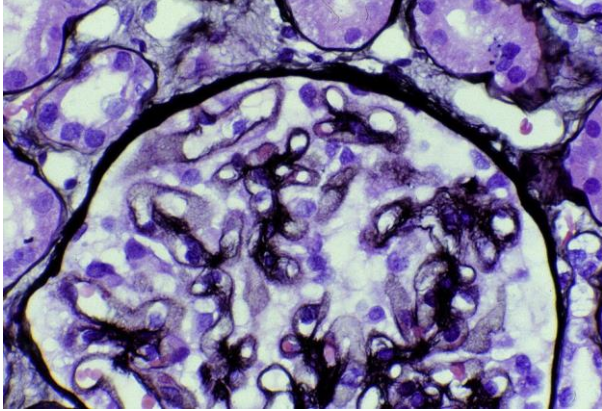
Albumin 21 g/dL

Creatinine 61 micromol/L

uPCR 350 mg/mmol

ANA/ANCA/GBM/HIV/HBV/HCV/SPEP negative

PLA2R 74



Slides courtesy of AJKD, Atlas of Renal Pathology

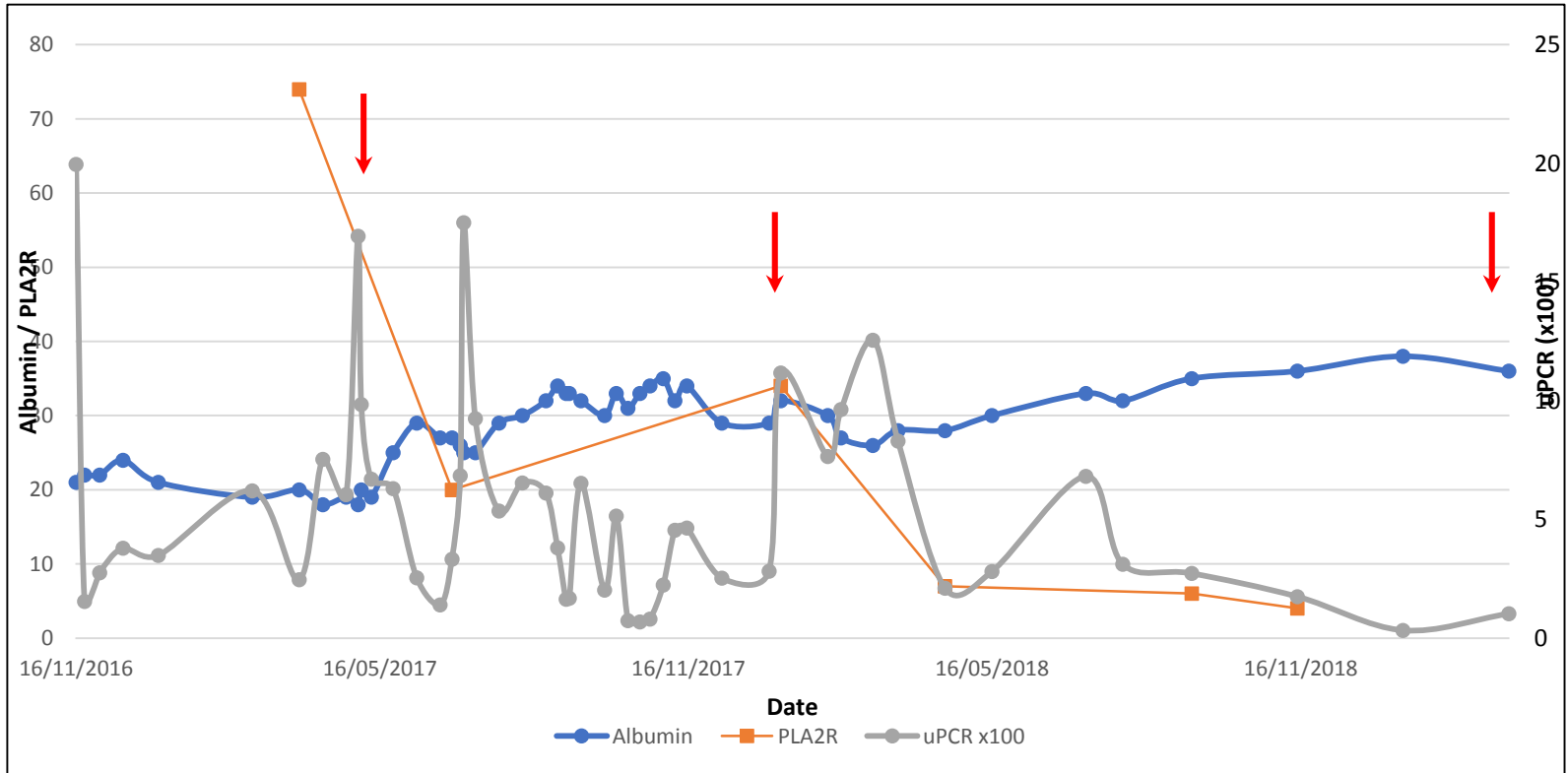
Nephrotic syndrome

Massive urinary protein losses

Progressive decline in function in 1/3

AntiPLA2R antibodies in autoimmune form

Progressive disease treated with immunosuppression



Partial remission with Cyclophos/Steroids

Remission with rituximab

Further increase in urinary protein + creatinine

Is this active disease or kidney scarring?

54 yo female

ESKD secondary to reflux nephropathy

Live donor transplant 1996

Deteriorating kidney function and 2nd transplant 2015

Primary function achieving creatinine 80 micromol/L

Creatinine 200 micromol/L 30/1/19

Clinically well

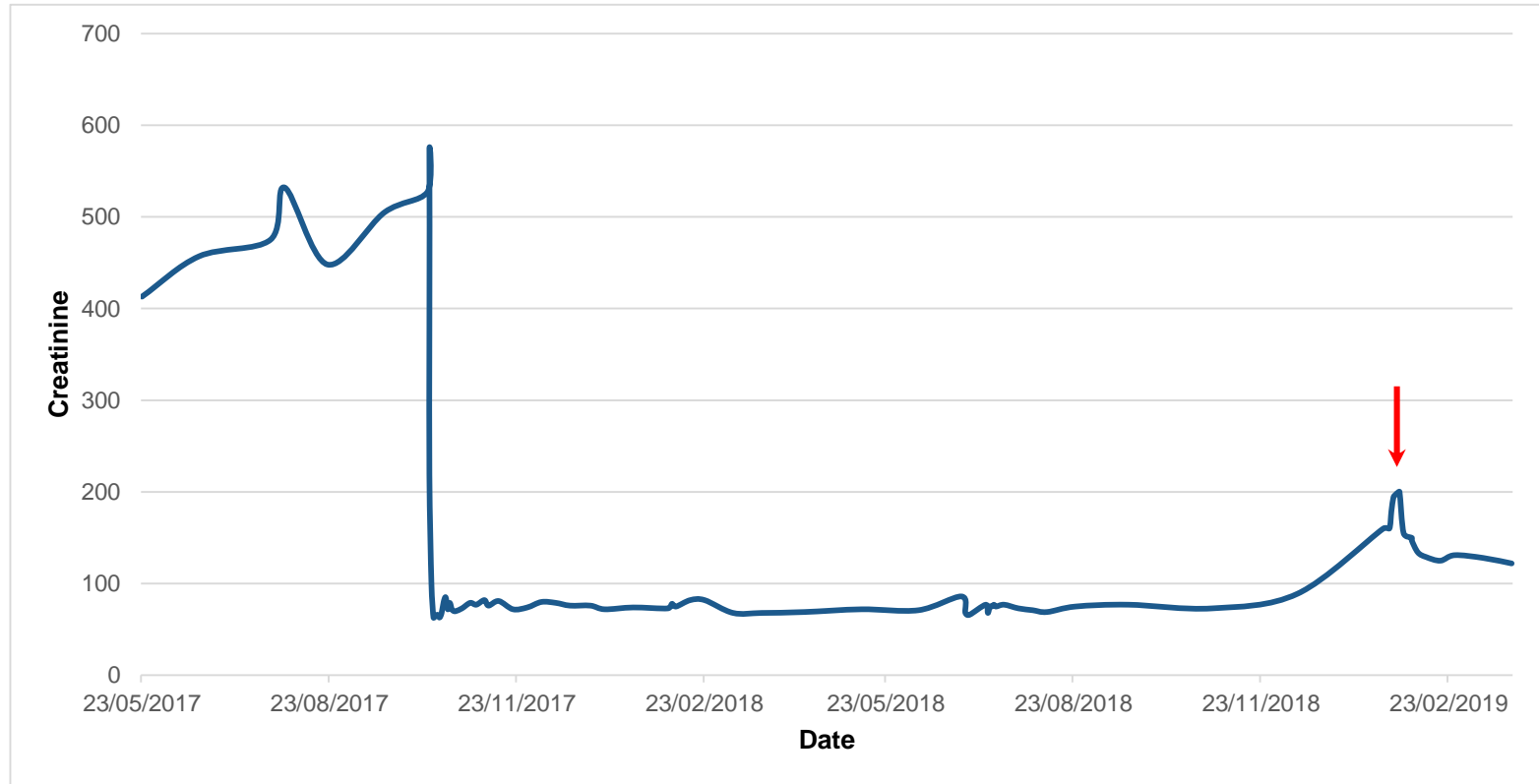
US unobstructed

CMV/BK negative

Acute cell mediated rejection occurs in 15% patients with renal transplant

Often successfully treated with IV steroids

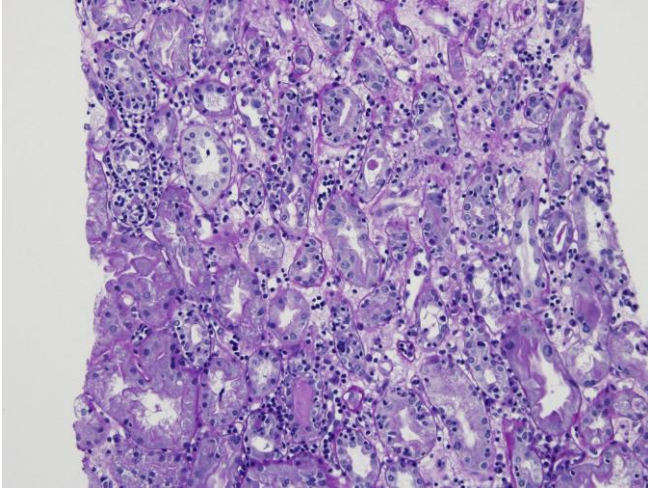
Second line therapy with biologic agent



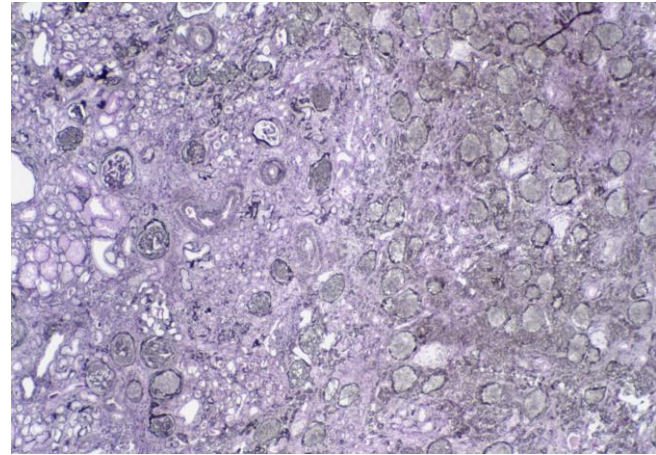
Improvement in eGFR but not to baseline

Is this active disease or kidney scarring?

Inflammation



Fibrosis



Slides courtesy of AJKD, Atlas of Renal Pathology

74 yo female

ESKD secondary to AD polycystic kidney disease

Hospital HD for 5 years

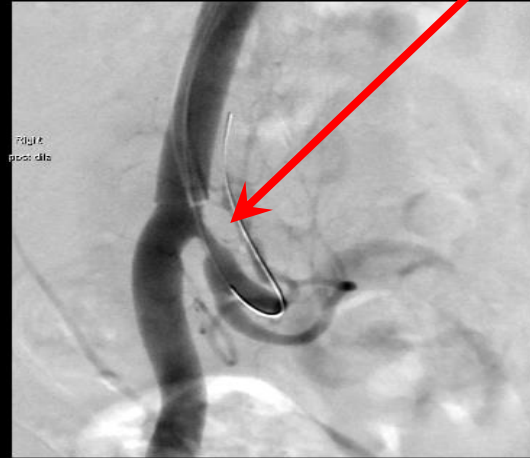
Deceased donor transplant 2015

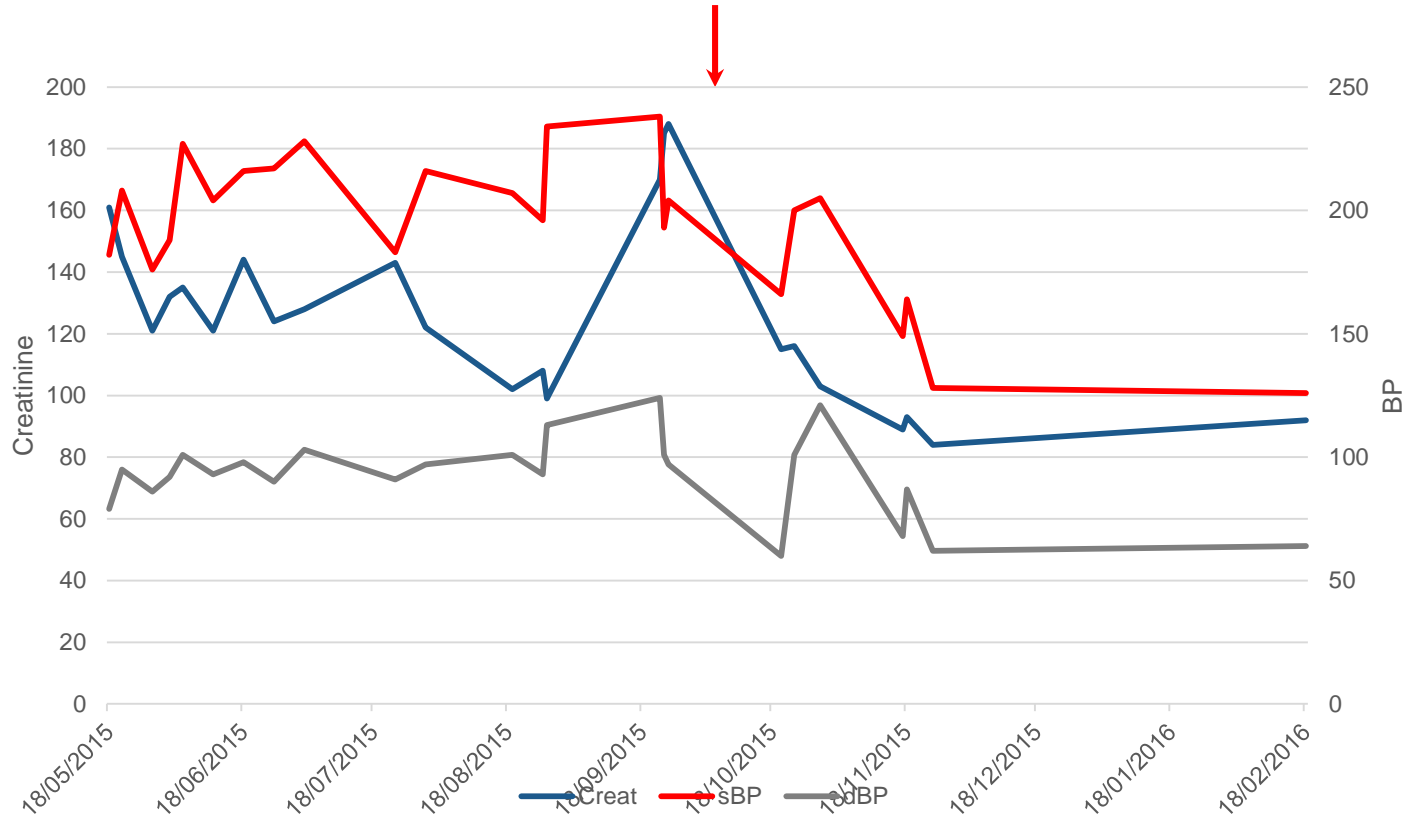
Achieved creatinine 90 micromol/L

Developed AKI, hypertension, fluid retention

Ultrasound suggested increased velocity at the origin of the renal transplant artery

< 6 - 9 @ (ALL) >





Incidence of transplant renal artery stenosis 1-25%

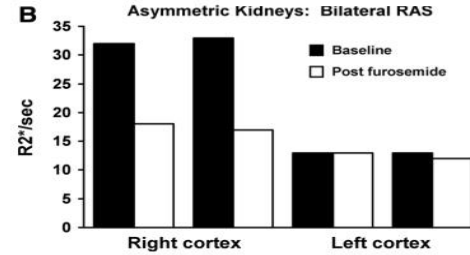
Often treated with angioplasty and stent

Native RAS often only treated medically

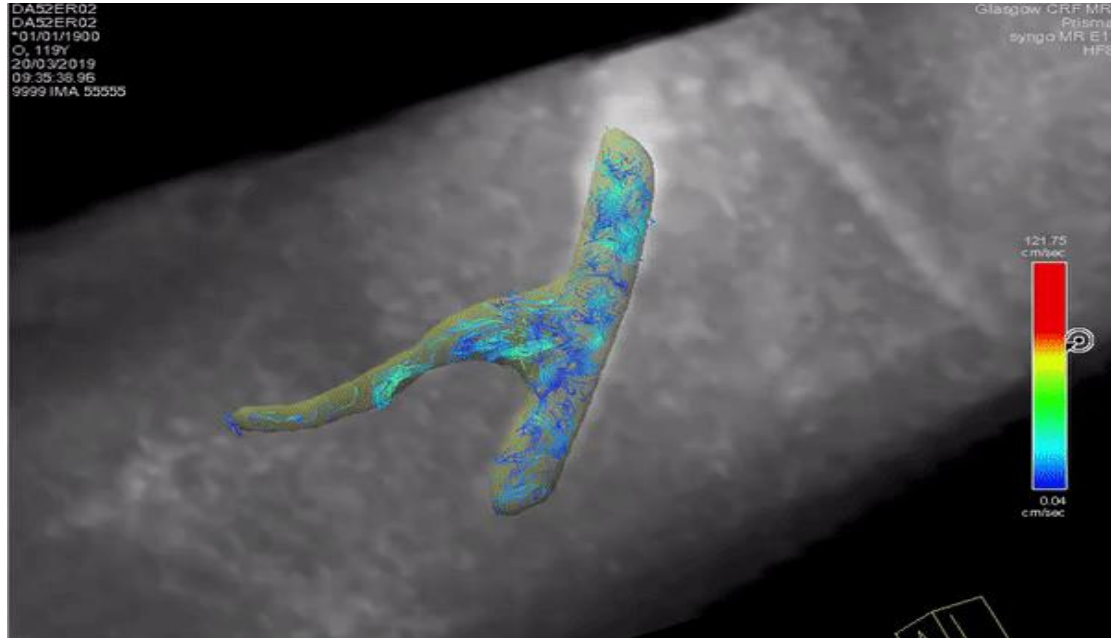
Revascularisation successful in 80%

Imaging often a challenge

- Doppler user dependent**
- Gadolinium contraindicated eGFR < 30ml/min**



The use of magnetic resonance to evaluate tissue oxygenation in renal artery stenosis. Textor et al, JASN 2008



4D flow images courtesy of Dr Pauline Barrientos

65yo gentleman

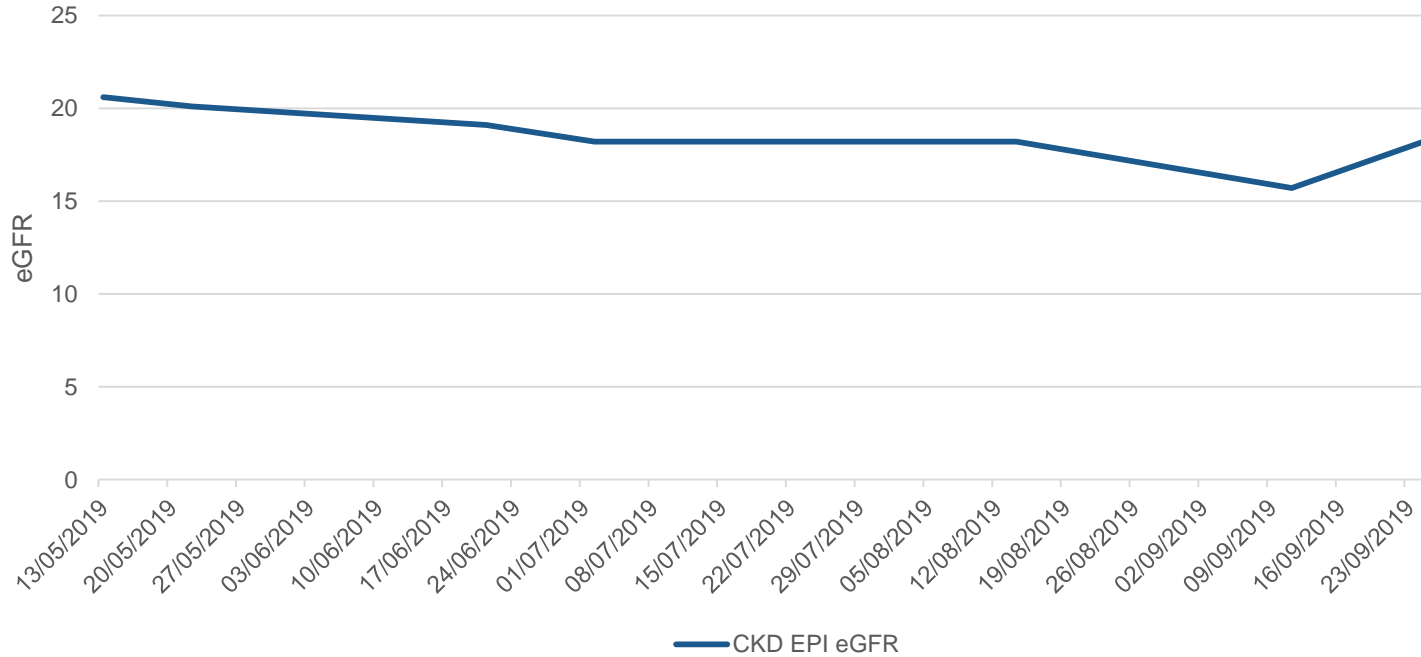
HTN 20 years

MI 2005

eGFR 20

uPCR 213

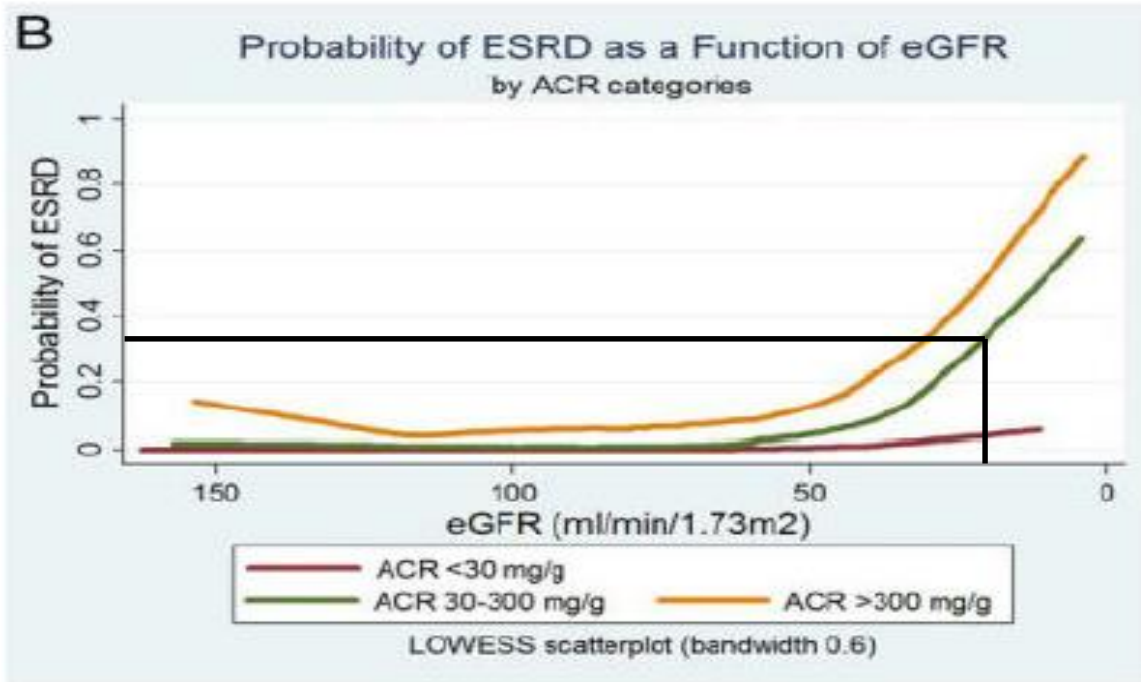
US: R 10.4cm L 9.9cm



**Prognosis of CKD by GFR
and albuminuria categories:
KDIGO 2012**

				Persistent albuminuria categories Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30–300 mg/g 3–30 mg/mmol	>300 mg/g >30 mg/mmol
GFR categories (ml/min per 1.73 m ²) Description and range	G1	Normal or high	≥90			
	G2	Mildly decreased	60–89			
	G3a	Mildly to moderately decreased	45–59			
	G3b	Moderately to severely decreased	30–44			
	G4	Severely decreased	15–29			
	G5	Kidney failure	<15			

Green: low risk (if no other markers of kidney disease, no CKD); yellow: moderately increased risk; orange: high risk; red, very high risk.



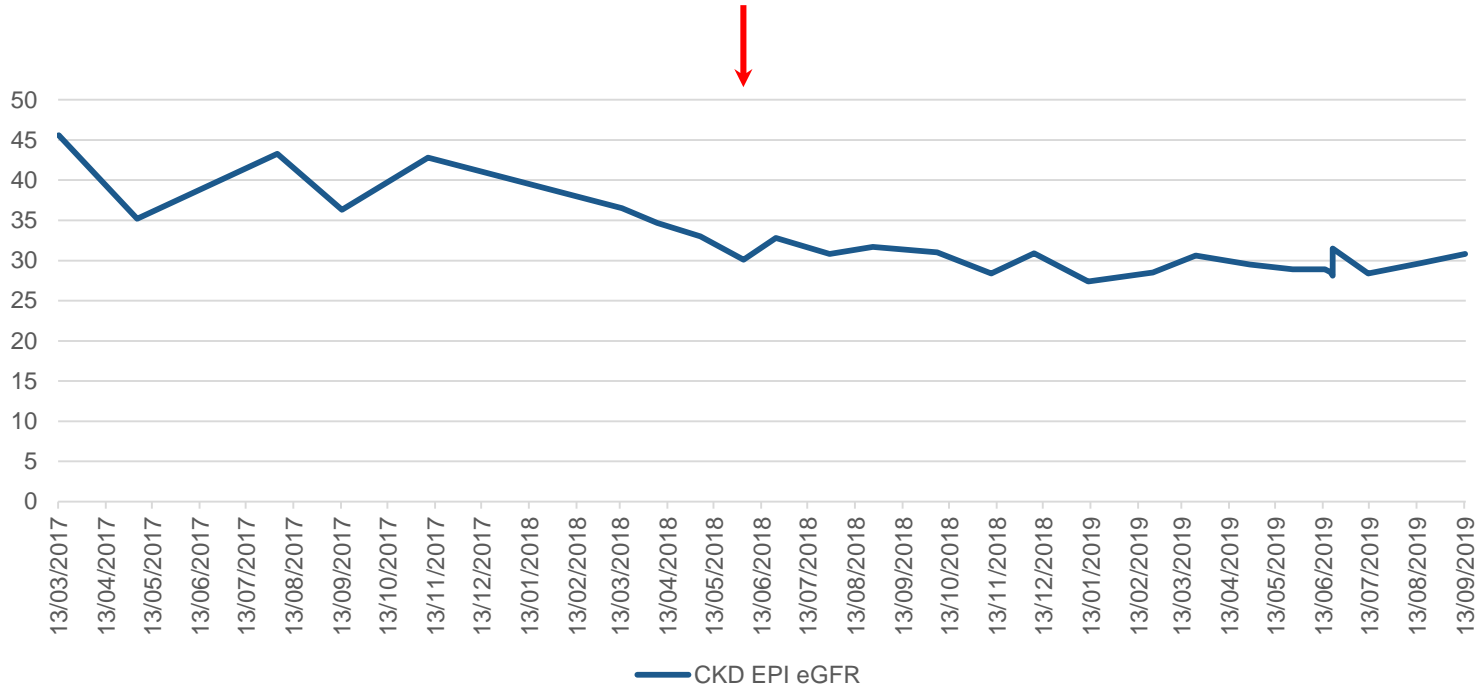
The Synergistic Relationship between Estimated GFR and Microalbuminuria in Predicting Long-term Progression to ESRD or Death in Patients with Diabetes. Amin et al; AJKD 2013

54yo woman

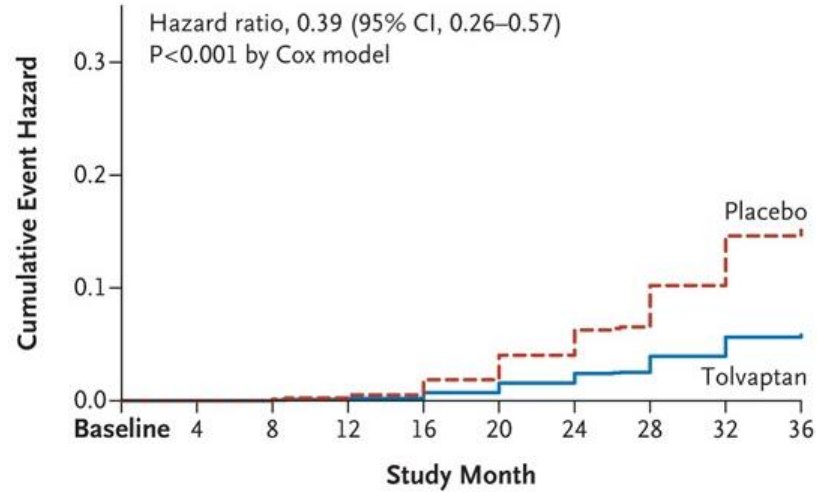
Mother had APKD

Diagnosis APKD since at least 30's

Well managed hypertension



C Risk of Worsening Kidney Function

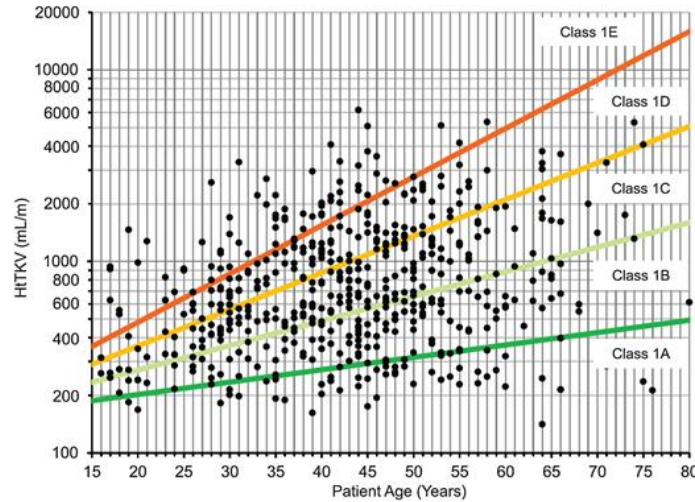


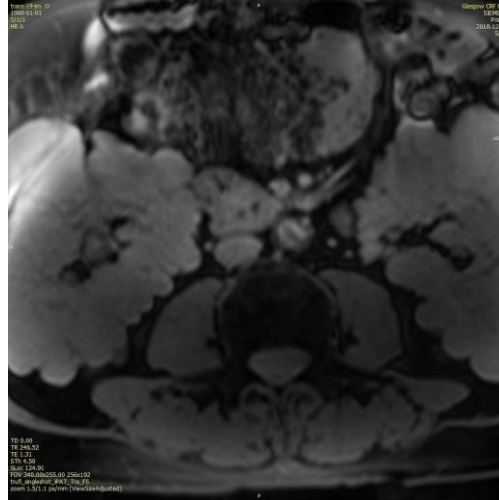
No. at Risk

Tolvaptan	918	868	833	809	791	775	762	751	743	641
Placebo	476	470	461	452	444	436	426	420	416	357

Tolvaptan in Patients with Autosomal Dominant Polycystic Kidney Disease, Torres et al, NEJM 2012

eGFR declining > 5 over years or 2.5 over months
Stable eGFR with high risk imaging features





Total Kidney Volume is the only renal biomarker approved by the FDA in addition to creatinine/eGFR

Existing biomarkers for AKI and CKD do not allow for optimal diagnosis and prognostication

MRI provides non invasive biomarkers which may improve diagnostic accuracy and prognostication

MRI may supplement existing methods of investigation by allowing serial measurement of significant biomarkers

Total kidney volume via MRI is the only FDA approved renal biomarker used to identify high risk patients with PKD

Further research is required to validate MRI biomarkers in individuals and populations with kidney disease



THANK
You!