

When is it Appropriate to Refer Patients with Chronic Kidney Disease for Evaluation?

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Early versus late referral

- Reduced mortality,
 - Odds ratio: 0.51 at 3 months and 0.45 at 5 years ($p < 0.00001$)
- Initial hospitalisations
 - 8.8 days shorter ($p < 0.00001$)
- Better uptake of home based therapies
- Earlier placed of AV fistulas

Smart et al. Am J Med 2011

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Factors Associated with late referral

- Older Age
- Comorbidities
- Socioeconomic Status
- Specialty / primary care versus general internist looking after patient
- Race
- Male gender
- Delayed recognition

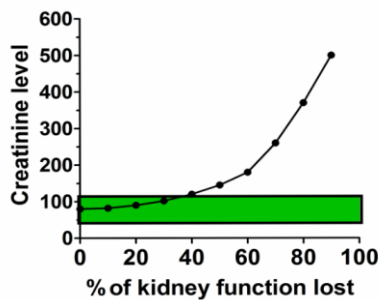
Winkelmeyer WA AJKD 2001

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Delayed recognition: The Patient with Low GFR

- Patients with kidney disease may have a variety of different clinical presentations.
 - Symptoms signs directly referable to the kidney
 - Extrarenal symptoms
 - Many asymptomatic (low GFR / eGFR)

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Difficulty estimating renal function



• Serum creatinine 120umol/L

• eGFR 30mls/min

• Serum Creatinine 120umol/L

• eGFR 130mls/min

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Measuring / Estimating GFR

- Inulin clearance, iothalamate clearance,
- Measured creatinine clearance
- Cockcroft-Gault
- MDRD equation
- CKD-EPI (gender, age, race, creatinine)

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ADULT GFR ESTIMATING EQUATIONS

2009 CKD-EPI creatinine equation: $141 \times \min(\text{SCr}/k, 1)^{\alpha} \times \max(\text{SCr}/k, 1)^{-1.209} \times 0.993^{\text{Age}}$ [$\times 1.018$ if female] [$\times 1.159$ if black], where SCr is serum creatinine (in mg/dl), α is 0.7 for females and 0.9 for males, α is -0.329 for females and -0.411 for males, min is the minimum of SCr/k or 1, and max is the maximum of SCr/k or 1.

Equations expressed for specified sex and serum creatinine level

Gender	Serum creatinine	Equation for estimating GFR
Female	<0.7 mg/dl (<62 μmol/l)	$144 \times (\text{SCr}/0.7)^{0.329} \times 0.993^{\text{Age}}$ [$\times 1.159$ if black]
Female	>0.7 mg/dl (>62 μmol/l)	$144 \times (\text{SCr}/0.7)^{-1.389} \times 0.993^{\text{Age}}$ [$\times 1.159$ if black]
Male	<0.9 mg/dl (<80 μmol/l)	$141 \times (\text{SCr}/0.9)^{-1.411} \times 0.993^{\text{Age}}$ [$\times 1.159$ if black]
Male	>0.9 mg/dl (>80 μmol/l)	$141 \times (\text{SCr}/0.9)^{-1.209} \times 0.993^{\text{Age}}$ [$\times 1.159$ if black]

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Creatinine	152	umol/L	(44 - 80)	HIGH
Urea	21.8	mmol/L	(2.8 - 7.0)	HIGH
Bicarbonate	21	mmol/L	(22 - 28)	LOW
Total Protein	76	g/L	(65 - 85)	
Albumin	58	g/L	(35 - 50)	
Total Bilirubin	15	umol/L	(<17)	
ALT	13	IU/L	(<35)	
Alk. Phos.	68	IU/L	(35 - 105)	
Gamma GT	43	IU/L	(<40)	HIGH
Calcium	2.47	mmol/L	(2.15 - 2.55)	
Corrected Calcium	2.27	mmol/L	(2.15 - 2.55)	
Phosphate	1.35	mmol/L	(0.8 - 1.4)	
CPK	3.3	mg/L	(0 - 5)	
Digoxin	1.17	ug/L	(0.0 - 2.0)	
Age	68	yes		
MRD eGFR	29			
eGFR Comment	eGFR - eGFR units = ml/min/1.73 sq.m SEVERE KIDNEY DYSFUNCTION 15-30ml/min/1.73sq.m Suggest early referral to Nephrologist. ----- MRD eGFR result should be multiplied by 1.21 if patient is of African descent ----- Interpretation is based on Irish CKD guidelines eGFR is NOT applicable to the following of patients: • old people of age or elderly • with extremes of body surface area • muscle wastage, amputees or pregnancy			

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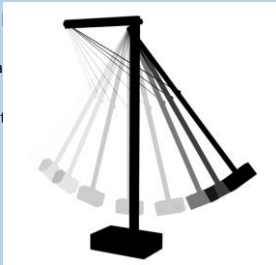
Stages of CKD

Stage I:	Kidney Damage, normal kidney function	"At risk"
Stage II:	Kidney Damage mild ↓ kidney function	
Stage III:	+/- Kidney Damage moderate ↓ kidney function	
Stage IV:	severe ↓ kidney function	Complications of CKD
Stage V:	Kidney Failure	Dialysis therapies, Kidney transplantation

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eGFR reporting

- Has increased accuracy
- Some guidance with



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Case 1 – CKD

- M.T. 70 yo lady
- CVA December 2010
- Total hip replacement - December 2011 (NSAID use prior to this)
- Hypertension

Referred with a creatinine of 165umol/L

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Case 2-

- J.N. 70 yo man
 - Type 2 DM x 25 years
 - IHD, PVD(r. BKA)
 - Referred with a creatinine 230, proteinuria

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Case 3-

- CC 88 yo female
- Progressively rising creatinine over 3-4 months (eGFR 29)
- High potassium
- Symptoms consistent with heart failure, Orthopnea, PND, Ankle oedema

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Case 4-

- MG 80 yo female
- Referred with reduced eGFR 44mls/min/1.73m²
- Creatinine 107
- Urine PCR 6
- Cerebrovascular disease
- Hypertension
- Ischaemic Heart

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GFR and ACR categories and risk of adverse outcomes	ACR categories (mg/minute), description and range		
	<30	30-300	>300
	Increased to mildly increased	Moderately increased	Severely increased
90	G1		
Normal and high			
60-89	G2		
Mild reduction related to normal range for a young adult			
45-59	G3a		
Mild-moderate reduction			
30-44	G3b		
Moderate-severe reduction			
15-29	G4		
Severe reduction			
<15	G5		
Kidney failure			

Increasing risk (horizontal arrow) and Increasing risk (vertical arrow)

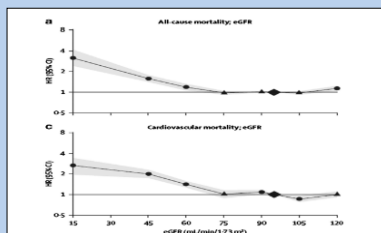
*Consider using eGFR cystatin C for people with CKD G3a-G5 (see recommendations 1.1.14 and 1.1.15)

Abbreviations: ACR, albumin creatinine ratio; CKD, chronic kidney disease; GFR, glomerular filtration rate

Adapted with permission from Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group (2012) KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. Kidney International (Suppl. 3), 1-150

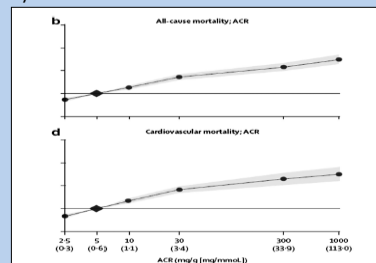
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Mortality and eGFR



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Mortality and Albuminuria



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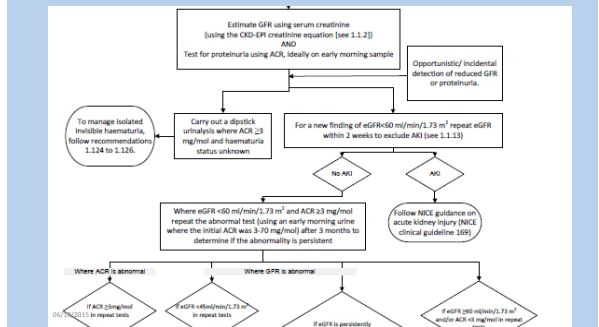
NICE National Institute for Health and Care Excellence

Identification of CKD

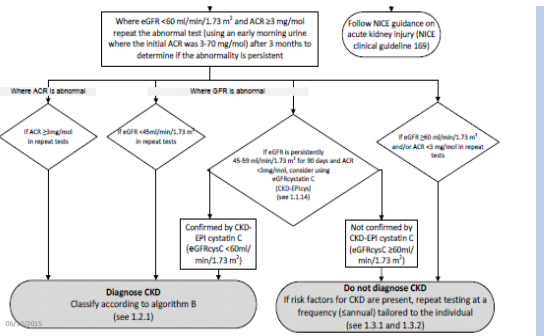
- Offer testing for CKD using eGFR/creatinine and ACR to people with any of the following risk factors:
- diabetes
 - hypertension
 - acute kidney injury
 - cardiovascular disease (ischaemic heart disease, chronic heart failure, peripheral vascular disease or cerebral vascular disease)
 - structural renal tract disease, recurrent renal calculi or prostatic hypertrophy
 - multisystem diseases with potential kidney involvement - for example, systemic lupus erythematosus
 - family history of end-stage kidney disease (GFR category G5) or hereditary kidney disease
 - opportunistic detection of haematuria.

Monitor eGFR at least annually in people prescribed drugs known to be nephrotoxic. (see 1.127 and 1.128)

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Classification and referral for specialist assessment

GFR category (ml/min/1.73m ²)	Description and range	eGFR	ACR categories (mg/mol) Description and range		
			A1	A2	A3
G1	Normal and high	≥90	Normal to mildly increased	Moderately increased	Severely increased
G2	Mild reduction related to normal range for a young adult	60-89	<3	3-29	≥30
G3a	Mild-to-moderate reduction	45-59			
G3b	Moderate-to-severe reduction	30-44			
G4	Severe reduction	15-29			
G5	Kidney failure	<15			

For guidance on frequency of GFR monitoring, see recommendation 1.3.2 in the NICE guideline. For guidance on referral, see also recommendations 1.5.1 to 1.5.3

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GFR category (ml/min/1.73m ²)	ACR categories (mg/mol) Description and range			
	A1	A2	A3	≥30
G1	Normal to mildly increased	Moderately increased	Severely increased	≥30
G2	<3	3-29	≥30	
G3a				
G3b				
G4				
G5				

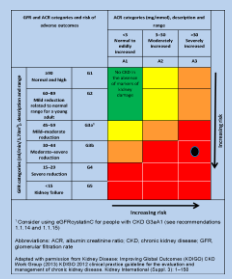
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Case 1:

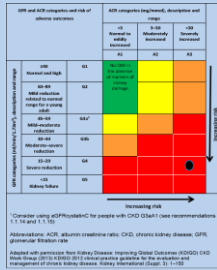
- M.T. Significant NSAID use : twice daily for a year
 - BP 159/72: Urinalysis 3+ prot
 - Repeat Creat: 121umol/L (eGFR 40mls/min/1.73m²)
 - Urine P-C-R: 228mg/mmol
- Dx:** NSAID nephropathy (2^o FSGS) +/- Ischaemic Nephropathy, intermediate to high risk for progression
- Plan**
24 hour BPM: Add ACEi/ ARB
Avoid Nephrotoxins, renal US pending

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Case 2 (2012)

- JN
 - Diabetic retinopathy
 - On Metformin, Glibenclamide – frequent hypos
 - Using occasional Difene
 - BP 170/95, Urinalysis 3+ protein
- Creatinine 267umol/L (eGFR 21mls/min)
- SPEP, C3, C4 – Normal, Urine PCR 623mg/mmol



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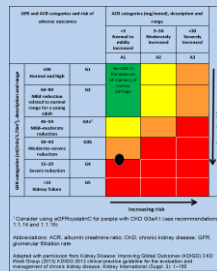
Case 2

- Dx:** Diabetic Nephropathy
Nephrotic Range Proteinuria
 - Plan:** Stop Metformin / Daonil → Glucilaze
Low clearance clinic –
Vaccination – Hep B
Discuss renal replacement options
 - Follow-up:** Patient commenced PD July 2015
- Stage 4 CKD
Poorly Controlled HTN
- Add Frusemide, 24 hour BPM

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Case 3

- CC 88 yo female
- Rx: Aldactone 25 mg OD, Bumetanide 0.5 mg OD, Ramipril 2.5 mg OD, Digoxin 62.5 mg OD, 2 other antihypertensives
 - PND, Orthopnea, Dyspnoea on minimal exertion, Ankle oedema
 - Labs: Creatinine 152, eGFR 29, K 5.8, Fe 6, TSAT 10%, NT ProBNP 1656, Hb 11.6; Urine PCR -10
 - CXR: Pulm congestion



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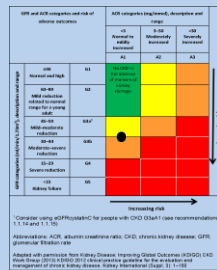
Case 3

- Dx:**
 - Cardiorenal Syndrome (type II):
 - Increased Volume Status
 - Hyperkalemia
 - Iron deficiency
- Rx:** Increase Loop diuretics; stop spironolactone; dietary modifications
- IV iron
- Close monitoring ; Advance care planning

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Case 4

- MG 80 yo female
- Known Arteriopathy
 - Asymptomatic, Euvolemic
 - Labs: Creatinine 107, eGFR 44, Urine PCR -16
 - Low risk for progression



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Summary

- Estimated GFR + e-alerts have increased awareness and referral for CKD
- Estimated GFR alone may be over sensitive
- All Stage IV / V CKD should be referred to a nephrologist
- Stage III CKD which is progressive or in presence of proteinuria / haematuria should be referred
- Progressive hereditary kidney disease should be referred

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Thank you for your attention

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