

Chronic Kidney Disease?



Chronic Kidney Disease

Stage	Description	GFR (ml/min)
1	Kidney damage (proteinuria) with normal or increased GFR	>90
2	Kidney damage with mild decrease in GFR	60 to 89
3	Moderate decrease in GFR	30 to 59
4	Severe decrease in GFR	15 to 29
5	Kidney failure	< 15 or RRT

Case

- 18 yr female Phys Ed student – acute attack of asthma.
- BP 110/70, creatinine 65umol/l, eGFR 64ml/min, dipstick urine 2+ protein – urinary protein 240mg/24hr. Protein creatinine ratio = 16
- Do you refer?

Case

- 38 yr old male referred to OP clinic
- Hypertension 158/98
- Proteinuria 3+ dipstick analysis
urinary protein/creatinine ratio 123gm/mmol
Creatinine 110 $\mu\text{mol/l}$ – eGFR 72ml/min
- Do you refer?

Case

- 58 yr male, smoker & hypertension.
- BP 150/80
- Creatinine 260umol/l, eGFR 30ml/min
- No proteinuria
- Do you refer?

Case

- 78 year old woman type 2 DM 5 years diet controlled & controlled hypertension. (BP 122/76)
- Hb1Ac 6.5%, creatinine 120umol/l
eGFR 50ml/min
urinary albumin/creatinine ratio 22
- Do you refer?

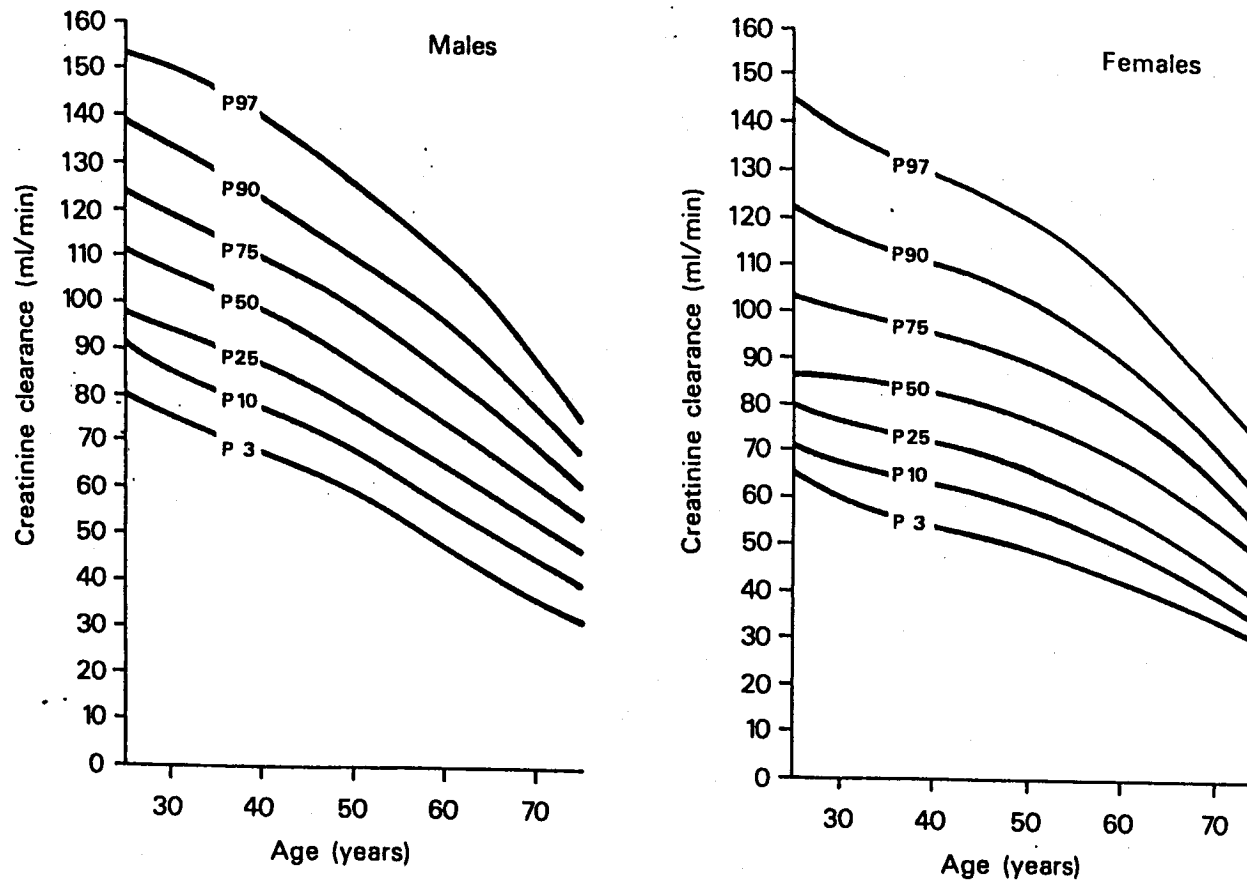
eGFR

- Limitations:
Derived from MDRD study.
Accuracy around stage 3a CKD
eGFR40 -59 ml/min
- Inaccurate above 60 ml/min
- Underestimates GFR compared to Cockcroft & Gault (tends to over estimate GFR).

eGFR

- Major determinant is AGE
- Lab variation in creatinine
+/- 20umol/l
- No estimation related to weight
(muscle bulk) – source of creatinine

Renal Function: Age-related changes.



Elseviers et al, Lancet 1987; 1 : 457

	26.Jul.2011	06.Oct.2011	06.Mar.2012	11.Jun.2012
	08:50	08:45	08:30	09:14
Sodium	147	143	142	142
Potassium	4.5	4.6	4.4	4.4
Creatinine	223	237	255	260
Uric Acid				
eGFR	27	25	23	22
				
				
Urea	12.6	12.7	11.7	12.6

The GFR range for a young adult male is 87-167. From ag

65 year old male:

Please review deteriorating kidney function

	28.Nov.2009	27.Feb.2010	12.May.2010	21.Jun.2010	26.Jul.2010	01.Nov.2010	08.Feb.2011	08.Apr.2011	12.Jul.2011	26.Jul.2011	06.Oct.2011	06.Mar.2012	11.Jun.2012	09.Jul.2012
	09:30	10:04	08:15	09:45	08:39	08:25	08:40	08:30	08:35	08:50	08:45	08:30	09:14	08:38
Sodium	143	139	140	135	145	143	143	144	142	147	143	142	142	146
Potassium	4.5	3.4	3.3	4.5	4.5	4.7	4.7	4.5	4.6	4.5	4.6	4.4	4.4	4.6
Creatinine	219	229	279	271	217	230	219	217	243	223	237	255	260	233
Uric Acid			0.67											0.51
eGFR	29	28	22	21	28	26	27	28	24	27	25	23	22	25
														
Urea	11.6	15.7	16.1	17.6	10.6	11.8	11.4	10.7	13.1	12.6	12.7	11.7	12.6	
														



No change in eGFR over 3 years.

Variation around a mean.

Calculated creatinine clearances 42 – 36 ml/min.

Interpreting eGFR

- Extra creatinine values last 4 years very useful.
- Important to add other variables
proteinuria and blood pressure control.

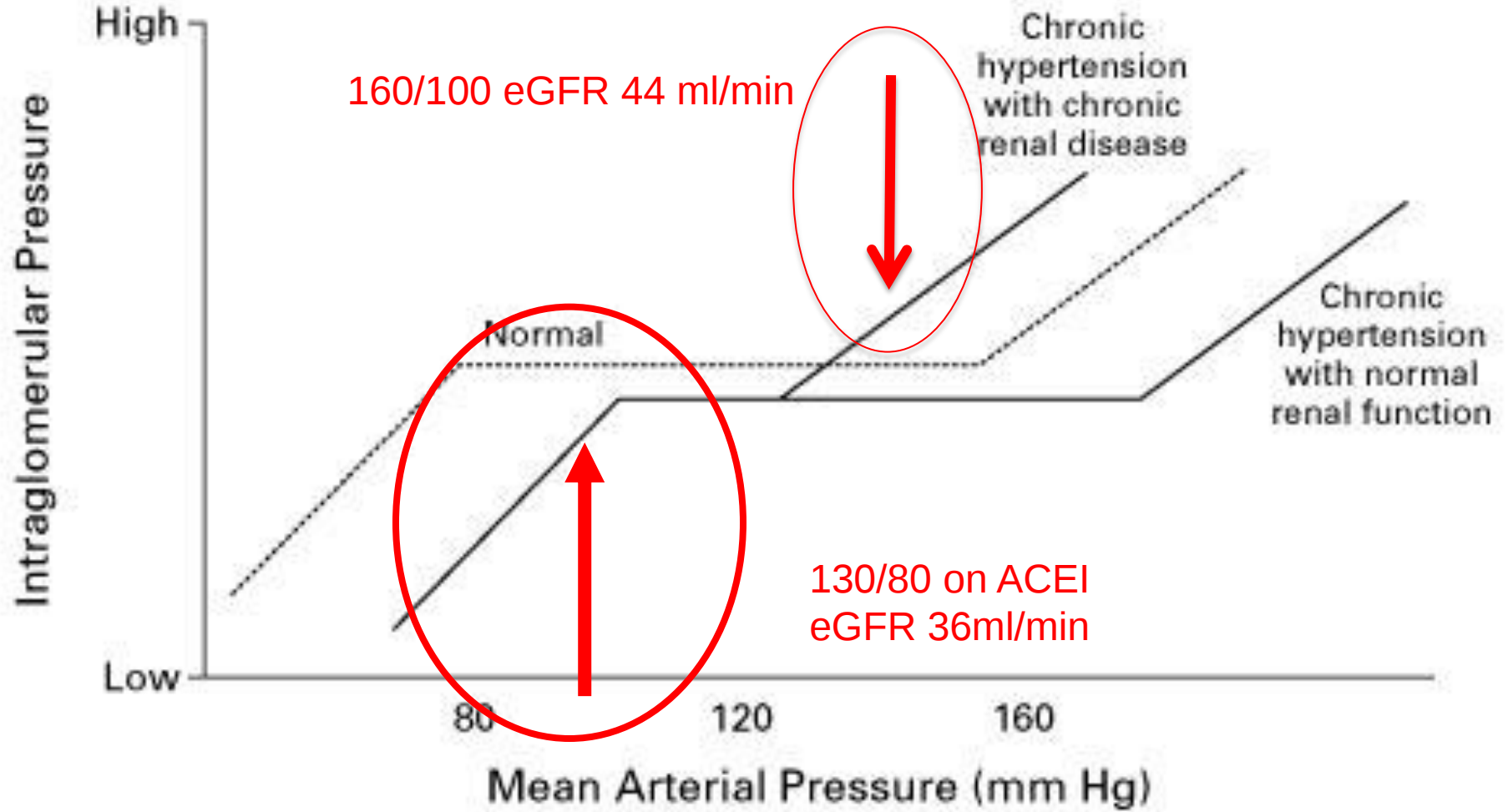
Medications

Proportion muscle mass

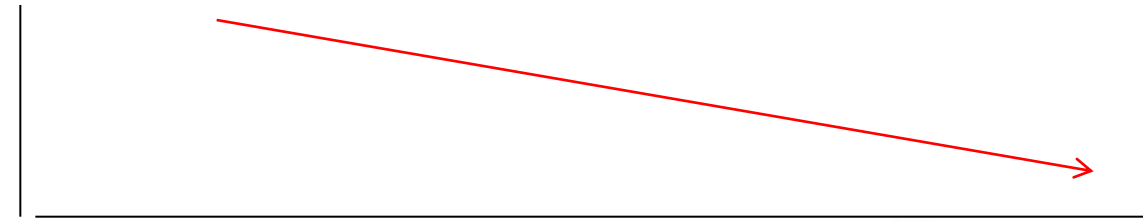
Intercurrent illness or excess activity.

Impact of Vasoactive Drugs on Renal Function

- Systemic effects vs local renal haemodynamic effects
- Need to remember changes over time
- GFR a continuous variable



ΔGFR



↓ All
vasodilation

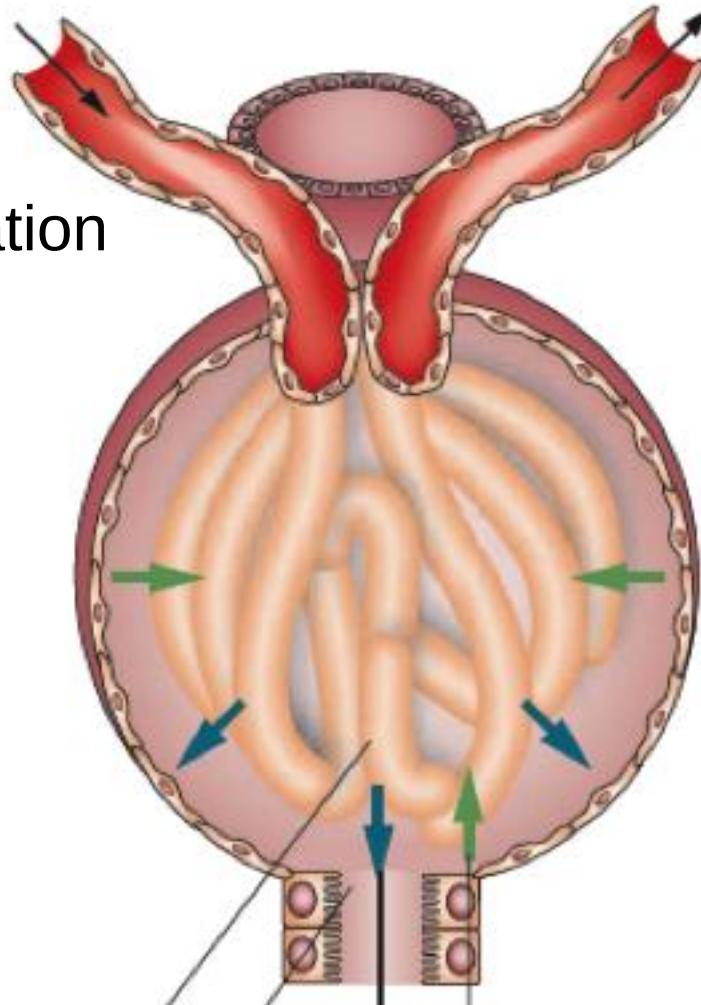
↓ All
vasodilation

$$\text{SNGFR} = K_f \cdot \text{NFP}$$

↑ K_f in
glomerulus

$$P \propto 1/r^4$$

Action of ACEI in
CKD



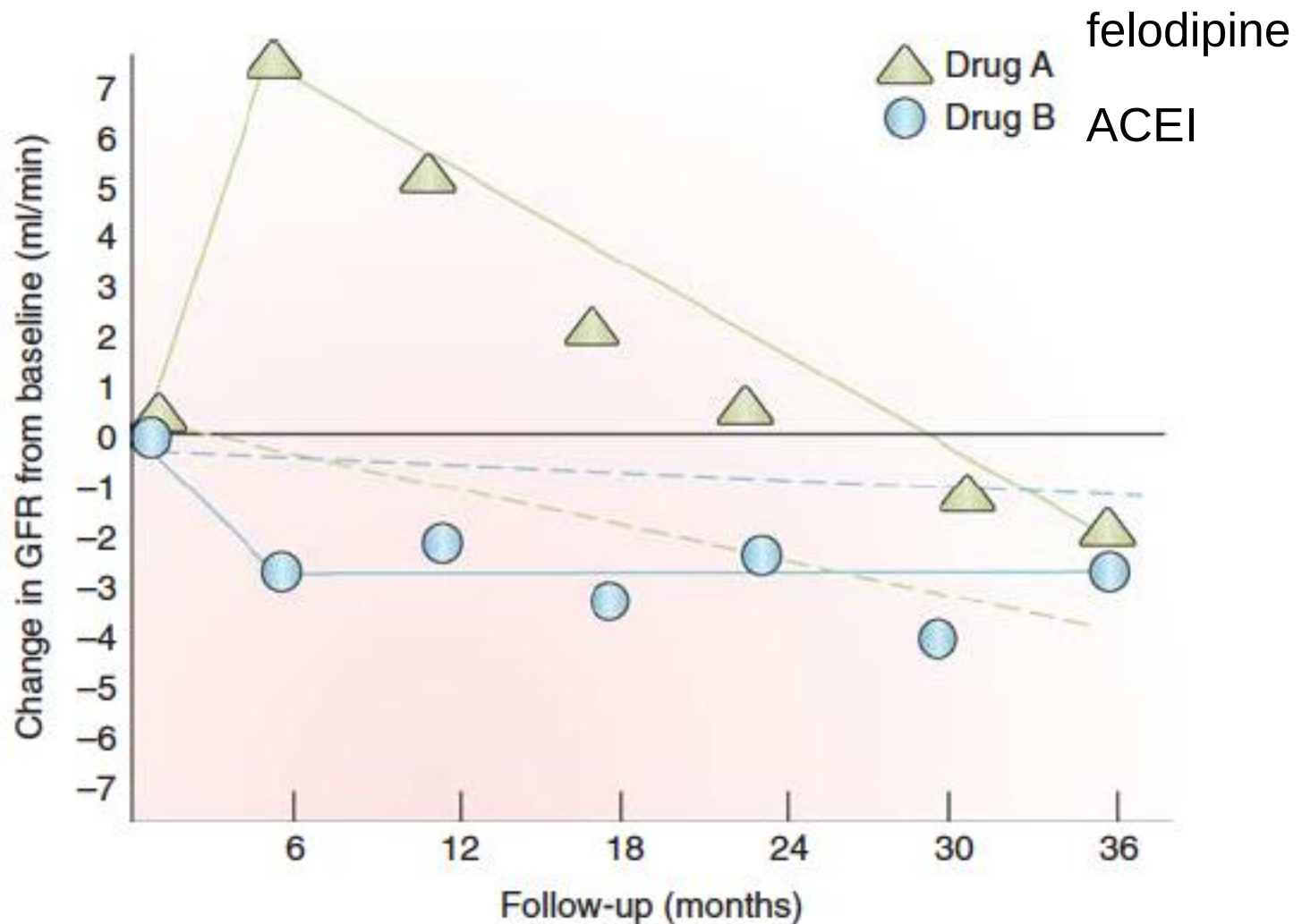


Figure 1 | Illustration of two different patterns of change in estimated GFR, calculated from baseline (solid line) versus 6 months (dashed line) for drug A (triangles) versus drug B (circles). GFR, glomerular filtration rate.

Progressive Nephropathy

- Overall in CKD
 - Lose the protective vasodilation or vasoconstriction
 - Kidney senses these highs and lows in perfusion pressure
 - Creatinine does rise and fall as you correct this
 - (a linear relationship almost)
 - Pre-glomerular pressure response lost and post-glomerular compensation lost

Urinalysis



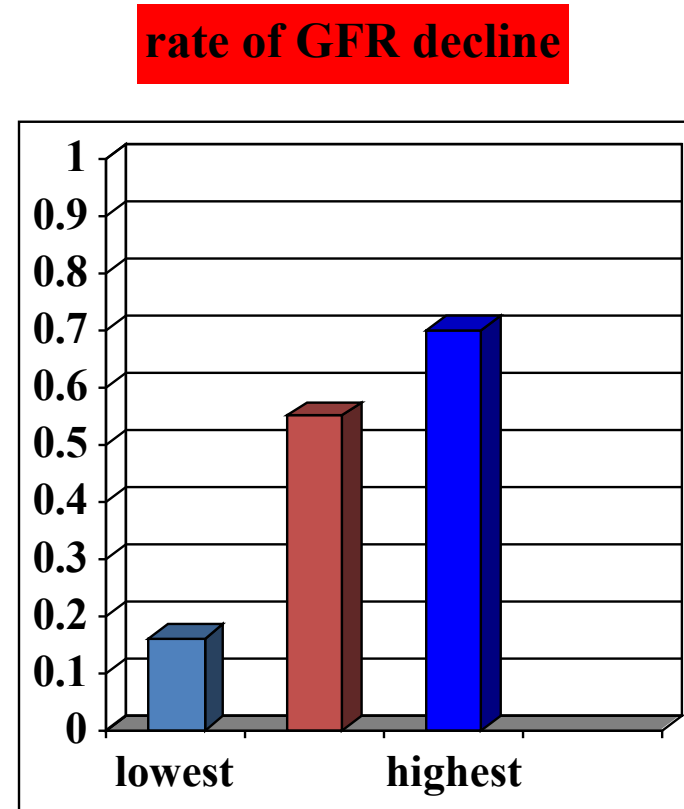
”bubbles appearing on the surface of the urine indicate renal disease with a prolonged course”



Severity of proteinuria is predictive of progressive renal disease

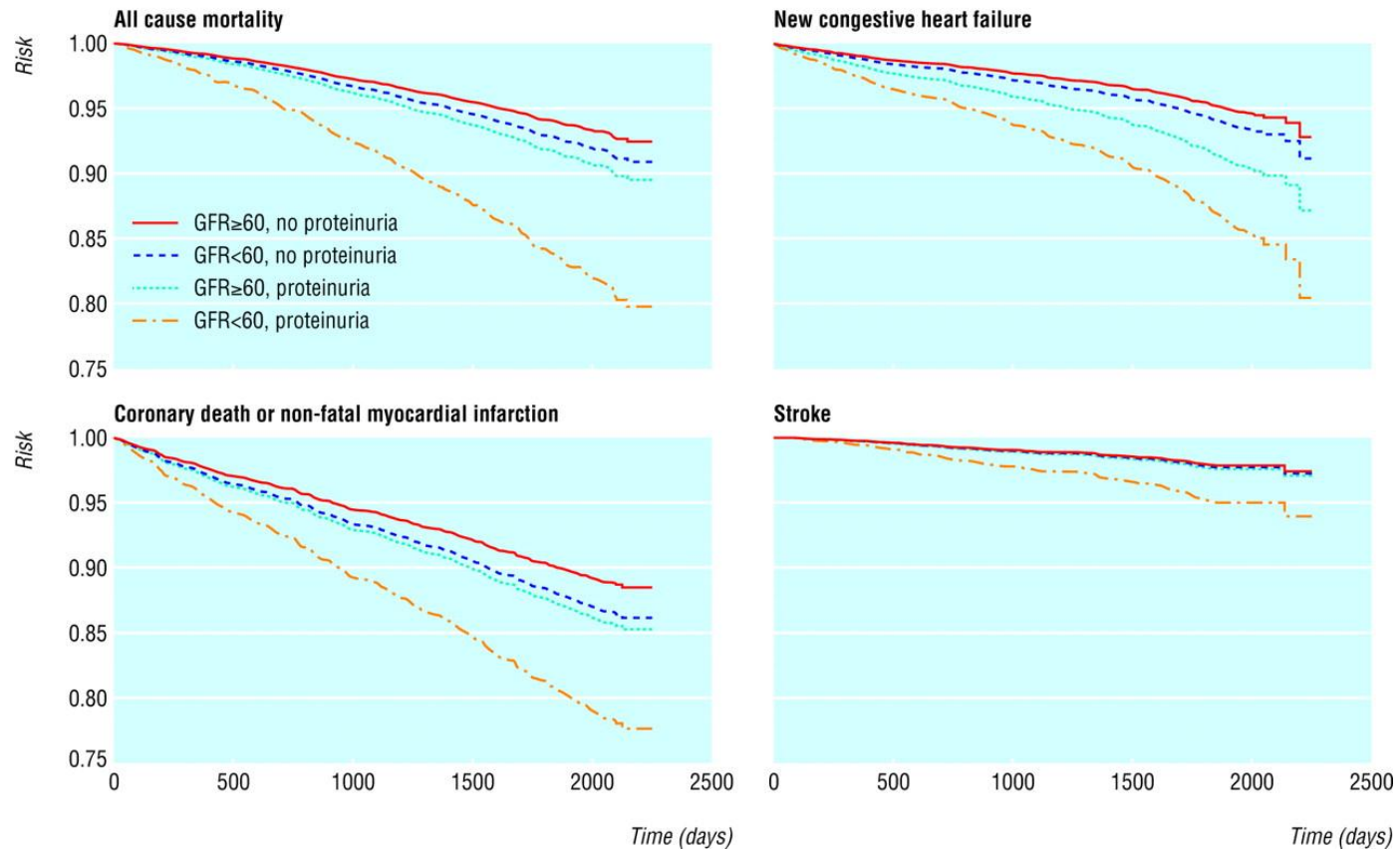
– Iseki	ESRF
• 1+	RR1.0
• 2+	RR7.6
• 3+	RR16.1
• 4+	RR19.5

- Yamagata
 - non-progressors 0.72g/day
vs progressors 2.3g/day



Ruggenti KI 53: 1209-1216 (1998)

Fig 1 Time to clinical outcomes by proteinuria and kidney dysfunction

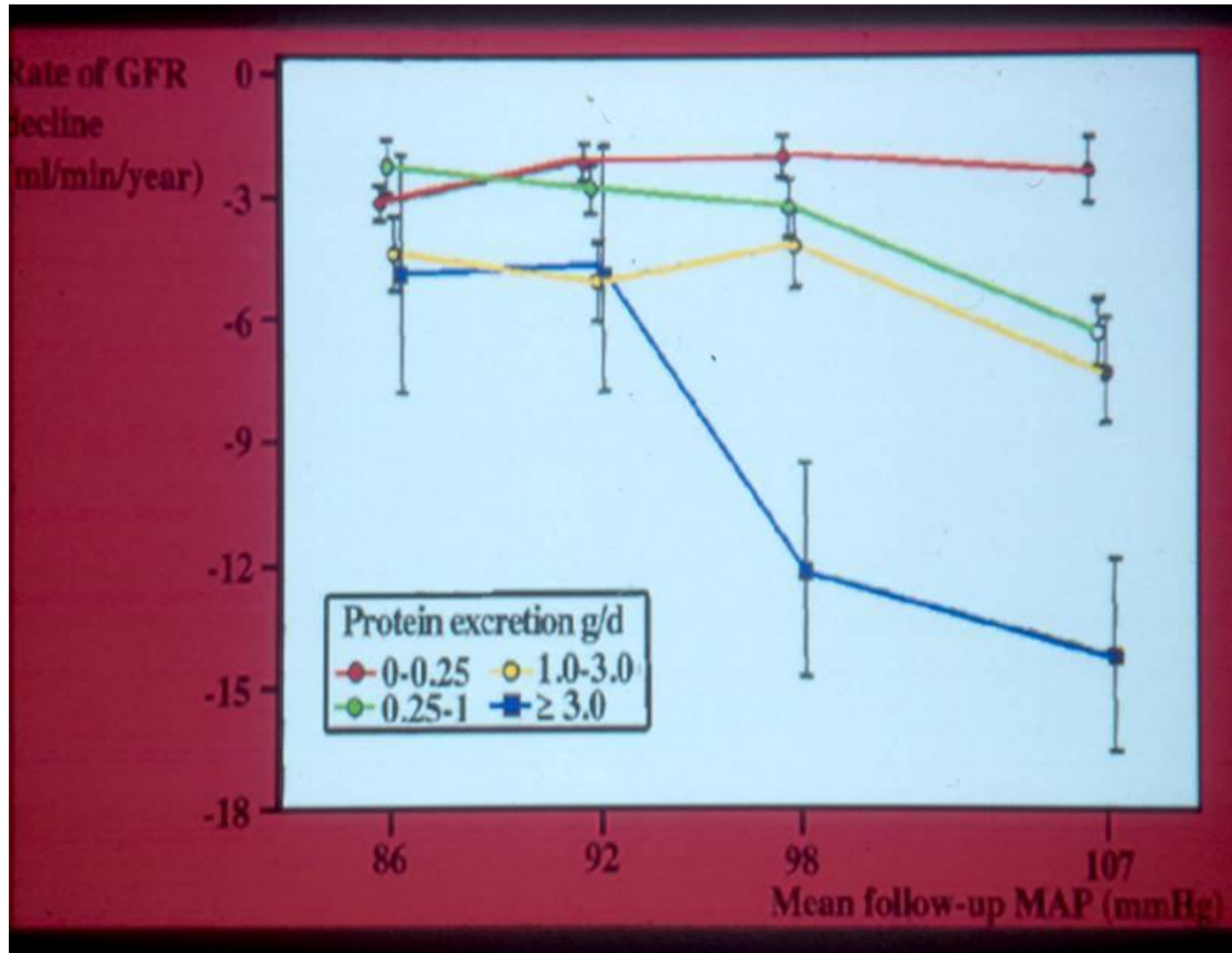


Tonelli, M. et al. BMJ 2006;332:1426

Proteinuria Blood Pressure & Renal Disease

- MDRD study: GFR declined at a slower rate in patients with lower BP.
- Association between initial reduction in proteinuria, residual proteinuria and renal outcome .
- Renoprotective effects of therapy are correlated with degree of anti-proteinuric effect as well as a lower blood pressure.

Proteinuria and progression of renal disease



Proteinuria and progression of CKD

- Diabetic renal disease
Numerous studies type 1 & 2 DM with both ARBs and ACEIs
- Non-diabetic renal disease.
- Rein study (amlodipine vs ramapril)
2mmHg difference BP but marked reduction in proteinuria in ACEI and slowing of progression
- Anti-proteinuric agents – ACEI & ARBs

Case

- 18 yr female Phys Ed student – acute attack of asthma.
- BP 110/70, creatinine 65umol/l, eGFR 64ml/min, dipstick urine 2+ protein – urinary protein 240mg/24hr.
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Assessment of Proteinuria

- Proteinuria influenced by
Exercise
Obesity
Hypertension
- Early morning urine – before physical activity
- Orthostatic benign proteinuria.

The organs of the human body were created to perform ten functions among which is the function of the kidney to furnish the human being with thought.

Leviticus Rabba 3, Talmud Berochoth 6₁b

