

Getting Started:

Elevated Serum Creatinine



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Table 1

Common causes of CKD

- Diabetic nephropathy
- Hypertensive nephrosclerosis
- Ischemic nephropathy
- Chronic glomerulonephritis
- Chronic interstitial nephritis
- Cystic renal disease

Table 2

Who is most at risk?

- Hypertensive patients (risk directly related to magnitude of blood pressure elevation)
- Diabetes patients
- Advanced age
- Patients with atherosclerosis
- Patients with family history of kidney disease
- Common in patients with a history of congestive heart failure and/or myocardial infarction
- Patients of lower educational levels
- Those using non-steroidal anti-inflammatory drugs
- Smoking is becoming a recognized risk factor, especially among patients who have smoked heavily for long periods of time

Some 810 Canadian patients/million population required renal replacement therapy (dialysis and transplant) in 2000.¹ The projected increase in annual incidence rate is 5.8 %.²

Stanley's Struggle



Stanley, 56, presents to his general practitioner for evaluation of right flank pain. His is chronic and progressive, with three associated episodes of gross hematuria in the past two years. He has had hypertension treated with a thiazide diuretic.

For more on Stanley, go to page 70.

Creatinine can be elevated in several conditions (Table 1). Acute renal insufficiency (ARI) is defined as a rise in serum creatinine over a period of days to weeks. ARI is a medical emergency and requires urgent assessment by a nephrologist or other qualified specialist. Chronic renal insufficiency (CRI), also known as chronic kidney disease (CKD), demonstrates a rise in serum creatinine over a period of months to years.

Are there special recommendations for those at highest risk?

Patients at risk (Table 2) should have periodic assessment of their renal function. The creatinine clearance (CrCl) is a reasonable estimate of the glomerular filtration rate (GFR), the standard measure of renal function. The CrCl can be measured

Table 3

Stages of CKD

Stage 1

- Kidney damage with normal GFR
- CrCl* > 90

Stage 2

- Mild
- CrCl 60-89**

Stage 3

- Moderate
- CrCl 30-59

Stage 4

- Severe
- CrCl 15-29

Stage 5

- End-stage renal failure
- CrCl < 15 or dialysis

*CrCl = Creatinine clearance (mL/min/1.73m²)
 CrCl measure/estimated by Cockcroft-Gault Formula:

$$\frac{((140 - \text{age}) \times \text{weight in kg})}{\text{serum Creatinine}} = \text{CrCl in ml/min}$$
 (multiply by 1.2 for males)

**May be normal for age

Table adapted from K/DOQI Clinical Practice Guidelines for Chronic Renal Disease. Am J Kidney Dis, 2002; 39(2, Suppl1):76.

directly using a 24-hour urine collection for creatinine or estimated using the Cockcroft-Gault formula (Table 3).

Evaluating Stanley

Electrolytes: Normal

Urea: 12 mmol/L

Creatinine: 145 mmol/L (105 in 1998)

Urinalysis: 1 g/L protein, 1+ blood, no glucose or white blood cell (WBC)

Renal ultrasound: Bilateral renal enlargement with numerous cortical cysts

No hydronephrosis or stones

For Stanley's diagnosis, go to page 71.

What is the initial workup?

The initial workup should include:

- electrolytes: useful in assessing acid-base balance and identifying hyperkalemia;
- urea;
- creatinine (current and previous): to gauge the acuity of the process;
- calcium, phosphorus and albumin: calcium and albumin rule out hypercalcemia as a cause of RI (hypoalbuminemia can also be a feature of the nephrotic syndrome);
- urinalysis; and
- renal ultrasound: important to evaluate renal mass and character, and to look for obstructive uropathy.

Under certain circumstances the following investigations may be indicated:

- urine protein-to-creatinine ratio,
- 24-hour urine for protein and
- serum protein electrophoresis.

What about early referral?

There is mounting evidence that the diseases causing CKD can be positively impacted. Substantive blood pressure control and the introduction of angiotensin-converting enzymes (ACE) inhibitors and angiotensin receptor blockers



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Stanley's Summary

Stanley is diagnosed with autosomal dominant polycystic kidney disease (PKD). He is referred to a nephrologist for evaluation.

Symptomatic therapy is prescribed for the flank pain. His blood pressure is brought down to target (130/80 mmHg) with the addition of an angiotensin-converting enzyme inhibitor and a no-added-salt diet.

Stanley receives education about his disease and the future implications thereof. He is asked to avoid non-steroidal anti-inflammatory drugs. His children are screened for PKD.

(ARBs) has altered the natural history of proteinuric and some non-proteinuric renal disease alike. The complications that manifest in CKD can most effectively be managed with the input of a renal specialist.

Early referral yields improved health-care outcomes and is expected to lower health-care costs (Table 4). This is effected by identifying those with reversible RI early on, and employing strategies that will delay the rate of progression of CKD.

Patients referred late to a nephrologist are more likely to have hypoalbuminemia and anemia, are later at starting dialysis and are much less likely to have a functioning permanent vascular access for the first hemodialysis.

Patients referred late to dialysis have a lower rate of survival. Conversely, earlier referral is associated with improved patient survival and stabilization of renal function.

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References

1. Canadian Organ Replacement Register, Canadian Institute for Health Information. CORR Preliminary Report For Dialysis and Transplantation 2002. Ottawa: The Register; 2004.
2. Schaubel DE, Morrison HI, Desmeules M, et al: End-stage renal disease in Canada: Prevalence projections to 2005. *CMAJ* 1999; 160(11):1557-63.

Further references available—contact
The Canadian Journal of CME at cme@sta.ca.

Table 4

Who should you refer?

- Patients with a repeatedly elevated serum creatinine or reduced creatinine clearance should be considered for nephrologic evaluation.
- All patients with a newly discovered renal insufficiency (RI) need to undergo investigations to evaluate for potentially reversible causes.
- Patients with stable mild to moderate chronic kidney disease (CKD) may be seen electively, whereas patients with a rapidly rising creatinine (*i.e.* 20% rise in creatinine over weeks to months) or with severe CKD should be seen more urgently.

Take-home message



- Acute renal insufficiency is a medical emergency requiring expeditious workup and urgent contact with a nephrologist or other qualified specialist.
- CKD can be positively impacted with aggressive blood pressure control, patient education and early management of potential complications.
- The patients most at risk for CKD are those with hypertension, diabetes, advanced age, atherosclerosis and/or a family history of kidney disease.