

EffectivenessMatters

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Acute Kidney Injury: the 5Rs approach



- The 5Rs approach to managing AKI includes: **Risk**, **Recognition**, **Response**, **Renal support** and **Rehabilitation**
- Patients at **Risk** of AKI should avoid episodes of dehydration and nephrotoxins
- **Recognition** of AKI is dependent upon good clinical judgement, careful monitoring of urine output and measurement of serum creatinine
- **Rapid Response** to AKI includes screening for sepsis, avoidance of toxins, optimisation of blood pressure and preventing harm (STOP AKI)
- Patients with severe AKI should be referred and receive **Renal support**
- Patients with or at risk of AKI, and their carers, should receive appropriate **Rehabilitation** including details about risk factors for AKI, preventative measures, treatment options and possible outcomes

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Background

Acute kidney injury (AKI), previously known as acute renal failure, is a rapid reduction in kidney function over hours or days. The definition is based on rises in creatinine or reductions in urine output. AKI is associated with up to 100,000 deaths each year in UK hospitals.¹

A recent meta-analysis of the global burden of AKI found that 1 in 5 adults and 1 in 3 children worldwide experience AKI during a hospital stay.² The pooled AKI-associated all-cause mortality rate was 22.4% (95% CI, 20.5 to 24.4) and increased with severity.³ The onset of AKI is insidious and often goes unrecognised, allowing deterioration that can result in uraemia, acidaemia, hyperkalaemia and ultimately death.¹ AKI is a risk factor for chronic kidney disease and end-stage renal disease.⁴ However, with the correct care and treatment, around 30% of cases of AKI could be avoided.¹

There is an urgent need to raise awareness and improve the care of people at risk of, or with AKI.⁵ This edition of *Effectiveness Matters* summarises the national guidance and introduces the conceptual approach of the 5Rs to managing AKI.⁶ The evidence relates to adults and children from 1 month to 18 years of age.

Risk of AKI

Acutely ill patients or patients undergoing major surgery are at particular risk especially in the presence of additional risk factors (Table 1).⁷ It is most commonly secondary to hypotension and sepsis and more rarely due to primary kidney disease such as vasculitis or acute interstitial nephritis.^{1,8} It is rarely caused by direct trauma to the kidneys.

There is no universally accepted validated risk score for AKI for either primary or secondary care.^{7,8} Identifying relevant risk factors and undertaking appropriate blood biochemistry and urine output monitoring are key to recognising those at risk of, or with AKI in order to prevent onset or deterioration.^{7,9} This should include ensuring a baseline serum creatinine measurement for all acutely ill patients on admission.¹⁰

If an acutely ill patient has or is likely to have any of the established risk factors listed in Table 1, they should be investigated for AKI by clinical examination, urine output measurement and checking serum creatinine levels with a baseline measurement.⁷

Iodinated contrast agents used in imaging can result in or exacerbate AKI; specific risk factors should be assessed, but should not delay emergency imaging.⁷ Further information about those at risk of developing AKI is available in the NICE guidance and through the NHS England 'think Kidneys' campaign.^{7,8}

Recognising AKI

AKI can be easily recognised clinically in some cases by a low urine output (oliguria), or no urine output (anuria) but can occur without symptoms. A

comparison of serum creatinine levels with baseline will identify the presence and/or severity of AKI.^{1,9}

A national algorithm which standardises the definition of AKI and facilitates automated detection based on changes in serum creatinine levels has been introduced.⁹ A Patient Safety Alert directive requires integration of the algorithm into laboratory information management systems that communicate with patient management systems.¹¹

A study looking specifically at the NHS England AKI algorithm found it performed well as a diagnostic adjunct in clinical practice.¹² However, without baseline data AKI may only be identified in retrospect, so active clinical care remains essential.

There is some indication from reviews that in general early warning systems when combined with rapid response may have the potential to reduce cardiac arrests and unplanned ICU admissions.^{13,14} A more recent prospective observational study found that an interruptive alert as part of an electronic recognition system for AKI significantly increased the completion rate of the AKI care bundle.¹⁵

New biomarkers such as neutrophil gelatinase-associated lipocalin (NGAL), kidney injury molecule-1 (KIM-1), N-acetyl- β -d-glucosaminidase (NAG), and Interleukin-18 (IL-18), for the early detection of AKI have been the subject of recent reviews.¹⁶⁻¹⁸ Heterogeneity in populations, settings, definitions of AKI and levels of serum creatinine used for diagnosis, are consistent confounders in the evidence base. The reviews all conclude that while promising, the value of biomarkers in the early detection of AKI has yet to be demonstrated.

Response

Patients at risk

NICE guidance for recognition of and response to acute illness in adults in hospital recommends that staff have competencies in monitoring, measurement, interpretation and prompt response to the acutely ill patient. This is essential to the effective use of early warning systems.¹⁹ Trigger thresholds for track and trigger systems should be set locally and reviewed regularly.

Identifying patients at risk of AKI means their serum creatinine levels can be monitored for changes while preventative measures are taken to avoid injury or deterioration. Evidence shows poor outcomes once AKI has progressed, making prevention even more important.^{1,7,20}

Sick day medication guidance

Prescribed medicines are implicated in around 20% of cases of AKI.²¹ When vulnerable patients develop dehydrating illnesses such as diarrhoea, vomiting or infection, they are at risk of developing hypotension. If they are taking antihypertensive medications e.g. ACE inhibitors, angiotensin-II receptor antagonists

or diuretics it may be advisable to temporarily withhold the medication.⁷

'Think Kidneys' have issued an interim statement on sick day medication guidance for patients in the community when they are acutely ill. The guidance urges caution on advising patients managing their own medication and advises this should be done in discussion with their GP.²² The statement does not cover clinical management of acutely ill in-patients.

Fluid Management

Maintaining adequate hydration and optimal mean arterial pressure, avoiding hypotension, and minimizing exposure to nephrotoxic agents are general strategies that help reduce the risk of AKI in hospital in-patients.⁷ NICE guidance recommends that ward reviews should include assessment and management of patients' fluid and electrolyte needs.²³ Patients should be encouraged to help maintain their own hydration by drinking fluids, with intravenous (IV) fluid therapy only used when oral or enteral intake is insufficient.^{19,23}

IV fluids should be prescribed, delivered and monitored in accordance with a protocol following NICE recommended algorithms for Resuscitation, Routine maintenance, Replacement, Redistribution and Reassessment, depending on the clinical needs of the patient.²³ The need for careful fluid management has been highlighted in a systematic review which found an association between fluid overload and increased mortality in critically ill adult patients with AKI.²⁴

A review of interventions to prevent contrast-induced AKI found little high quality evidence, and concluded that at present hydration/volume expansion is the most effective preventative measure.²⁵ Another review found no difference in effectiveness of oral vs IV hydration in the prevention of contrast-induced AKI.²⁶ A third review found that mannitol had no benefits and was actually detrimental for preventing contrast-induced AKI.²⁷

Early and aggressive fluid resuscitation for patients with sepsis is recommended by the Surviving Sepsis Campaign.²⁸ The use of crystalloids rather than hydroxyethyl starches (HES) is supported by a subsequent systematic review, which found HES was associated with an increase in AKI incidence, need for renal replacement therapy, blood transfusion, and 90-day mortality, in patients with sepsis.²⁹ NICE guidance on sepsis is to be published in July 2016.³⁰

Care bundles

The 100,000 Lives Campaign shows that evidence-based interventions implemented together as a care bundle, have significantly better outcomes than when implemented individually.³¹ A recent prospective observational study found significantly lower risk of in-hospital case fatality in patients who had AKI care bundles completed within 24 hours.¹⁵ A systematic review found bundled care for sepsis significantly

**Table 1:
Risk factors for AKI in acutely ill patients**

- chronic kidney disease
 - heart failure
 - liver disease
 - diabetes mellitus
 - history of acute kidney injury
 - neurological or cognitive impairment or disability, which may mean limited access to fluids because of reliance on a carer
 - hypovolaemia e.g. diarrhoea
 - nephrotoxins e.g. NSAIDs, iodinated contrast
 - symptoms or history of urological obstruction
 - sepsis
 - hypertension
 - antihypertensive medications in the setting of hypotension
- Additional factors for children and young people:*
- severe diarrhoea
 - haematological malignancy
 - hypotension

improved survival, however the eight included studies all had limitations.³² While completion of a care bundle does not require special resources or prior training, it does need all the tasks to be carried out.³¹

NICE guidance recommends the cause of AKI be established and recorded in the patient's notes. When no identified cause of AKI is found at assessment or the patient is at risk of urinary tract obstruction, urgent (within 24 hours) ultrasound of the urinary tract should be performed.⁷

The Royal College of Physicians have recently published Acute Care Toolkit No. 12 on AKI and intravenous fluids which includes the STOP AKI management plan (Table 2).³³

**Table 2:
STOP AKI management plan**

- | |
|--|
| Sepsis - screen for sepsis |
| Toxins - avoid/stop toxins |
| Optimise blood pressure - assess volume status <ul style="list-style-type: none"> • IV fluids • hold antihypertensives • consider vasopressors |
| Prevent harm <ul style="list-style-type: none"> • identify cause/urinalysis • treat complications • review medications/fluids |

Renal support

The management of AKI should be discussed with a nephrologist within 24 hours of detection of any of the following: the diagnosis is one that may need specialist treatment; there is no clear cause; poor response to treatment; complications arise; stage 3 acute kidney injury; renal transplant; or chronic kidney disease stage 4 or 5.⁷

Rehabilitation

Information and support for patients and carers

There is no good quality evidence directly looking at what AKI patients and carers want with respect to information and support but based on general qualitative studies of patients on dialysis, NICE provide recommendations.⁷

Information and support should include details about immediate and long-term treatment options, the likely monitoring required, self-management options, as well as likely prognosis. Discussions should include parents, families and/or carers if appropriate and take place in collaboration with a multidisciplinary team appropriate to the person's individual needs.⁷

It is recognised that opportunities to provide information or choices regarding lifesaving interventions may be limited because the patients are critically ill and any delay may risk death or significant morbidity.⁷ The 'Think Kidneys' campaign provides information for the public (www.thinkkidneys.nhs.uk).³⁴

Commissioning for Quality and Innovation (CQUIN)

The care of patients with AKI is a new theme in the national CQUIN scheme for 2015/16. The goal is to improve the follow up and recovery for those who have sustained AKI, reduce the risks of readmission, re-establishing medication for other long term conditions and improving follow up of AKI.³⁵

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About Effectiveness Matters

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