Acute Kidney Injury Care Initiative (AKICI) Conference

18 March 2009
Royal College of Physicians, London

Better Kidney Care for All
Organisations Represented:

Association for Clinical Biochemistry
Association of Surgeons of Great Britain and Ireland
British Renal Society
British Society of Interventional Radiology
Intensive-Care National Audit and Research Centre
Intensive Care Society
NHS Kidney Care
National Confidential Enquiry into Patient Outcomes and Death
National Critical Care Outreach Forum
Renal Association
Royal College of Radiologists
Scottish Audit of Surgical Mortality
Society for Acute Medicine
The Vascular Society

Thanks to Dr Andrew Lewington, Leeds Teaching Hospitals NHS Trust, for leading the event, and to Dr Paul Stevens, East Kent Hospitals University NHS Foundation Trust, for facilitating the event.
Acute Kidney Injury (AKI) is common, harmful and treatable. AKI affects up to 1 in 5 people admitted to hospital, and it is associated with substantial mortality and morbidity. Modest changes in serum creatinine are associated with a 6.5 times increase in mortality. Even the early stages of AKI result in prolonged episodes of inpatient care and the subsequent need for ongoing rehabilitation.

AKI can occur in many settings but it is often predictable and preventable. It is increasingly recognised that chronic kidney disease (CKD), which affects up to 10% of the adult population, is both a risk factor for AKI and a consequence of AKI. Although less obvious to clinicians than severe AKI requiring dialysis, AKI that does not require dialysis may be of equal or greater importance from a public health perspective. Prevention and effective treatment of hospital acquired AKI should be a national priority.

The National Service Framework for Renal Services (Part 2) recognised the importance of AKI and highlighted the need for multidisciplinary working to improve patient experience and outcomes in AKI. The lack of a unified definition of AKI and the relatively few data regarding its incidence, epidemiology and quality of care has resulted in confusion and controversy.

The purpose of this consensus conference was to review the available evidence regarding optimal practice in AKI and to identify how best to:
1. develop a shared consensus definition of AKI
2. detect and prevent AKI
3. improve clinical training to enable best practice management of AKI
4. identify quality markers for optimal practice for AKI

Following this consensus conference, the National Confidential Enquiry into Patient Outcomes and Death (NCEPOD) AKI study was published on 11 June 2009. It reported that only 50% of patients who died of AKI received good care, and identified that delays were often encountered in the recognition of AKI, particularly in those who developed AKI after admission. The study recommended a number of actions that should be implemented to ensure that AKI is identified early and treated effectively.

NHS Kidney Care and the professional societies can now build on the foundations laid out during this conference to help drive improvements in patient care to support the prevention, early identification and treatment of AKI across the NHS, whatever the clinical or organisation setting.

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Foreword
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An Acute Kidney Injury Care Initiative (AKICI) conference was held at the Royal College of Physicians on 18 March 2009 supported by NHS Kidney Care. Representatives from different specialist communities from around the UK were invited to share their own perspectives of AKI and how it impacts on patients managed in their specialty.

Acute kidney injury (AKI) is a major issue for a range of communities in clinical medicine and has a significant impact on patient morbidity and mortality and on NHS resources. The National Service Framework (NSF) for Renal Services (Part 2) identified AKI, previously known as acute renal failure, as a national priority and states:

“People at risk of, or suffering from, acute renal failure are identified promptly, with hospital services delivering high quality, clinically appropriate care in partnership with specialised renal teams”

The National Confidential Enquiry into Patient Outcomes and Death (NCEPOD) AKI study was published on 11 June 2009. The study reported that only 50% of patients who died of AKI received good care. Delays were identified in the recognition of AKI particularly in those who developed AKI after admission. The report has raised the importance of AKI throughout the NHS and will act as a catalyst to drive improvements in patient care.

The aims of the conference were for the delegates to work collaboratively and consider the following areas:

1. How to work towards a consensus definition for AKI.
2. How to detect and prevent AKI.
3. How to improve medical training curriculae for both undergraduate and postgraduate trainees and enable best practice management of AKI.
4. How to share Datasets and Codes to allow the identification of quality markers to drive improvements and inform tariff development.

The following document provides a summary of the presentations and discussions that were held at the conference and recommendations for the next steps.
Definitions

The adoption of a universal definition of AKI would improve detection and allow the assessment of the true incidence of AKI in primary and secondary care in the UK. It would allow the standardisation of benchmarking and the timing of interventions in prevention and treatment.

Recently there have been three staging systems proposed; the RIFLE staging system, the Acute Kidney Injury Network (AKIN) staging system and, more recently, a definition based on creatinine kinetics (Table 1). The RIFLE and AKIN staging systems rely on changes in serum creatinine (SCr) or urine output. It is recognised that accurate recording of urine output is not universally performed outside of renal units and critical care facilities, which has meant most studies have concentrated on using the serum creatinine criteria. The third most recent definition has proposed that any definition of AKI should incorporate absolute changes in SCr over a 24 to 48 hour time period.
The true incidence of AKI is currently difficult to assess because of the lack of a universal definition and standardised data collection. The incidences of AKI that have been determined are dependent on the definition used and the cohorts studied. Historically, studies of AKI have estimated an incidence of 3-7% in hospitalised patients. However two recent studies using the RIFLE staging system identified 20% and 18% of patients admitted to medical centres in USA and Japan respectively as having evidence of AKI. Figures for rates of AKI in Intensive Care Units (ICUs) are 35-85%. The incidence for patients with AKI requiring RRT is 1% for patients admitted to hospital and 5-15 % for those in ICU. AKI has a significant impact on patient morbidity and mortality making early detection and prevention essential to reduce this.

### Epidemiology

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<tr>
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<th>Serum creatinine criteria</th>
<th>Urine output criteria</th>
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<tr>
<td><strong>RIFLE</strong></td>
<td></td>
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<tr>
<td>Risk</td>
<td>▲ SCr $\geq$ 1.5X from baseline or ▼ GFR $\geq$ 25%</td>
<td>$&lt;$0.5mL/kg/h $\geq$ 6 h</td>
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<td>Injury</td>
<td>▲ SCr $\geq$ 2.0X from baseline or ▼ GFR $\geq$ 50%</td>
<td>$&lt;$0.5mL/kg/h $\geq$ 12 h</td>
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<td>Failure</td>
<td>▲ SCr $\geq$ 3.0X from baseline or ▼ GFR $\geq$ 75% or an acute ▲ SCr $\geq$ 44µmol/L from baseline SCr $\geq$ 354µmol/L</td>
<td>$&lt;$0.3mL/kg/h $\geq$ 24 h or anuria $\geq$ 12 h</td>
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<tr>
<td>Loss</td>
<td>Complete loss of kidney function $&gt;$ 4 wks</td>
<td></td>
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<tr>
<td>ESKD</td>
<td>End-stage kidney disease $&gt;$ 3 months</td>
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<tr>
<td><strong>AKIN</strong></td>
<td></td>
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<tr>
<td>Stage 1</td>
<td>▲ SCr $\geq$ 1.5X or ▲ SCr 26.4µmol/L from baseline</td>
<td>$&lt;$0.5mL/kg/h $\geq$ 6 h</td>
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<tr>
<td>Stage 2</td>
<td>▲ SCr $\geq$ 2.0X from baseline</td>
<td>$&lt;$0.5mL/kg/h $\geq$ 12 h</td>
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<tr>
<td>Stage 3</td>
<td>▲ SCr $\geq$ 3.0X from baseline or an acute ▲ SCr $\geq$ 44 µmol/L from baseline SCr $\geq$ 354 µmol/L or initiated on RRT (irrespective of stage at time of initiation)</td>
<td>$&lt;$0.3mL/kg/h $\geq$ 24 h or anuria $\geq$ 12 h</td>
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<tr>
<td><strong>AKI</strong></td>
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<td>(Bonventre)</td>
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<td>STAGING</td>
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<tr>
<td>Stage 1</td>
<td>▲ SCr $\geq$ 26.4µmol/L over 24 hrs or ▲ SCr $\geq$ 44µmol/L over 48 hrs</td>
<td>None</td>
</tr>
<tr>
<td>Stage 2</td>
<td>▲ SCr $\geq$ 44µmol/L over 24 hrs or ▲ SCr $\geq$ 88µmol/L over 48 hrs</td>
<td></td>
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<tr>
<td>Stage 3</td>
<td>▲ SCr $\geq$ 88µmol/L over 24 hrs or ▲ SCr $\geq$ 132µmol/L over 48 hrs</td>
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**Table 1.** Only one criterion (serum creatinine, GFR or urine output) has to be fulfilled to qualify for a specific category. Baseline serum creatinine is considered to be within one week for RIFLE and within 48 hours for AKIN. SCr = serum creatinine, GFR = glomerular filtration rate, AKIN = Acute Kidney Injury Network, RRT = renal replacement therapy. The patient should be adequately fluid resuscitating and post renal causes excluded prior to staging.
There should be further work and discussion regarding the adoption of an interim definition of AKI. The adoption of an interim definition of AKI would potentially allow the development of a hospital electronic results alert system to help healthcare professionals identify patients at risk of or developing AKI. Further advice could be provided by an electronic clinical support tool, such as the Map of Medicine algorithmic pathways.

It is recognised that there is considerable day-to-day variation in SCr in individuals, and variations can also occur with different assays and between different laboratories in the UK. Therefore the implementation of the enzymatic serum creatinine assay throughout all biochemistry labs in the UK would enable national comparability. For patients admitted to different hospitals with different biochemistry laboratories, the development of shared databases may improve comparability between labs.
Prevention of AKI in surgical patients

The prevention of AKI in surgical patients is difficult because the size of the problem is not really known. Surgical AKI is one of the sequelae of surgical shock, usually due to bleeding or sometimes secondary to sepsis. It is more common in elderly patients and is associated with a significant increase in mortality. The currently available mortality data only indicate the ‘tip of the iceberg’, and the impact is probably much more significant than currently considered. There is therefore an urgent need for more data regarding the incidence of AKI following vascular surgery.

It is possible to identify people at risk of developing AKI prior to surgery. Elderly patients with diabetes mellitus or congestive heart failure undergoing emergency or abdominal surgery have a 5-10% risk of developing AKI and a significantly increased risk of death (greater than 10%). There are measures that could be employed to mitigate risk, which include a detailed pre-assessment. Alternatively, surgery could be postponed in patients with modifiable risk factors. There is current research looking at how long surgery can be postponed to minimise risk. Patients at risk of developing AKI should be monitored closely post-operatively with a low threshold for renal referral.

Education of health professionals is needed to improve the awareness of patients who are at risk of developing AKI. This should be embedded within all junior doctors’ training curricula, with regular updates provided. Early recognition of AKI would be improved by the introduction of protocols, and triggers such as modified early warning systems (MEWS). Undergraduate and postgraduate training curricula should include recognition of the acutely ill patient (NICE clinical guideline 50).
Post-operative AKI and fluid management

In 1999 a NCEPOD study reported that patients were dying as a result of infusion of too much or too little fluid by inexperienced staff. The report recommended that a fluid prescription should be given the same status as a drug prescription. Post-operative AKI can occur as a result of pre-renal, intrinsic and post-renal factors. Pre-renal problems may occur if there is absolute or relative renal hypoperfusion. Prolonged renal hypoperfusion can lead to intrinsic ischaemic acute tubular necrosis. Post-renal AKI may be due to obstruction of the bladder or ureters. Post-operatively, fluid optimisation is important to maintain adequate renal perfusion.

The publication of the British Consensus Guidelines on Intravenous Fluid Therapy for Adult Surgical Patients in 2008 brought overdue recognition to the importance of this treatment. Emerging evidence indicates that the choice of fluid and resuscitation protocol may affect patient outcomes. However the guidelines identified a lack of randomised controlled trials to assess the optimal type of fluid to administer.

There is an urgent need for more high-quality research in this field.
AKI in the critically ill patient

There are few reports in the literature about AKI in critically ill patients. Generally by the time we see patients in intensive care units, the processes of AKI are well established and little can be modified.

Annually, more than 146,000 patients require intensive care in the UK; 50-60,000 of these die. Survivors suffer an ongoing burden of disease and a reduced quality of life. This poses substantial economic burden on the NHS and on society at large. Most patients in ICU have multisystem disease. Acute kidney injury almost always occurs in the context of not just one disease process but in a whole range of system failures.

AKI is as poorly defined in the intensive care context as elsewhere. There is a lack of standardisation of data, with some hospitals collecting data on AKI and others not. There is huge variability in incidence and prevalence, due to differences in patient population and case mix, and differences between special and tertiary referral units, leading to maldistribution of at-risk patients. There is also large variation in service delivery models.

There are insufficient data on specific patient groups, with little data outside cardiac surgery. Haematologic malignancy is a contentious area, with few patients who require level three intensive care and renal support surviving. Local policies vary and national data collection is needed to give more robust figures on outcomes. The clinical objectives should be clarified in the management of AKI in critically ill patients and these should then inform training objectives.
Contrast induced nephropathy (CIN) represents a well-defined clinical scenario when AKI occurs secondary to administration of iodinated contrast media for radiological studies such as CT or angiography. The definition varies from a 44µmol/l (0.5 mg/dL) increase in serum creatinine concentration or a 25% or greater decrease in estimated glomerular filtration rate (eGFR) within three days after CT to requiring dialysis as a result of contrast administration.

Risk factors for CIN include: pre-existing impaired kidney function (eGFR <60mL/min), diabetes mellitus, age greater than 70 years, dehydration, heart failure, hypertension, non-steroidal anti-inflammatory drugs (NSAIDs), multiple myeloma and nephrotic syndrome. The first two of these risk factors are by far the most important, especially if they co-exist which is often the case. Failure to identify patients at risk of CIN and to minimise those risks can have serious consequences.

The most important step in minimising the risk of CIN is recognition of the risk factors. This involves asking the appropriate questions and having the appropriate information about renal function prior to contrast administration. Nephrotoxic drugs such as non steroidal anti-, Cox-2 inhibitors or aminoglycosides should be withdrawn at least 24 hours before contrast administration in patients at risk of CIN. Intravenous 0.9% sodium chloride has been shown to be renoprotective and should be administered prior to iv contrast with a further 1litre afterwards over four hours. There is recent evidence that iv sodium bicarbonate might be more renoprotective than 0.9% sodium chloride but further evidence is awaited. The evidence is also strongly in favour of intravenous rather than oral fluids.

The results of several meta-analyses on pharmacological renoprotection have been conflicting. Currently the Contrast Media Safety Committee of the European Society of Urogenital Radiology does not recommend any pharmacologic manipulation for routine use in the prevention of CIN.

In patients who are identified as being at risk of CIN, especially those with co-existing chronic kidney disease (CKD) and diabetes mellitus, the risk of CIN also increases with increasing volume of contrast. There is a fairly simple calculation that is helpful here. Creatinine clearance x 3.7 will approximate the volume of iodinated contrast in millilitres that can safely be given assuming other renoprotective measures have been taken.

A growing number of international bodies, including the American College of Cardiology/American Heart Association, are recommending iso-osmolar contrast agents in patients at risk of CIN. There is some randomised evidence that this is in the patient’s best interest but further studies are required before it is possible to be definitive.
Acute kidney injury: data collection

The Case Mix Programme is a national, comparative audit of patient outcomes from critical care. Its aim is a performance assessment programme for continued improvement through the provision of comparative data on case mix, outcomes and activity to facilitate local performance management. The remit includes NHS and non-NHS units, with participation on a voluntary basis. Currently, 210 adult general critical care units (more than 85% of NHS units) and five non-NHS units (out of the 10 or 11 level 3 ICUs in the independent sector) take part.

Data on AKI collected as part of the Case Mix Programme includes: chronic renal replacement therapy, lowest/highest serum creatinine and highest serum urea in the first 24 hours in the CCU, urine output in the first 24 hours in the unit and total calendar days of renal support. Renal dysfunction has the second highest mortality for any single organ dysfunction after respiratory failure. Mortality for patients with two organ dysfunctions is highest for those with cardiovascular and renal failure for each year of the programme, while mortality for those with three-organ dysfunction is consistently highest for those with cardiovascular and renal failure and metabolic acidosis.

It was recommended that it is essential to have an agreed definition for AKI as a starting point for data collection. A definition based on treatment received should be avoided. The data collection system should have high coverage in terms of both locations and patients. The data collected should include all relevant variables and aim for high levels of completeness. The people collecting the raw data should be provided with rules and definitions for collection. This should be followed up by validity and reliability checking of data. The Intensive-Care National Audit and Research Centre (ICNARC) would be willing to help develop such a project.
Workshops

Two workshops were held during the conference for which a number of different recommendations were developed.

AKICI Recommends that:

1. A national group is convened to work collaboratively enabling real improvements in the prevention, detection and treatment of AKI throughout the UK.

2. An acceptable working definition for AKI is developed by performing a multicentre study using different staging systems and correlated with outcomes.

3. Enzymatic serum creatinine assay should be implemented in all biochemistry labs throughout the UK to ensure national comparability. For patients admitted to different hospitals with different biochemistry laboratories the development of shared databases should be created to improve comparability between laboratories.

4. An electronic alert biochemistry system should be developed which is compliant with the AKI Map of Medicine.

5. The National Vascular Database should be reviewed and updated to ensure AKI data is collected and audited post surgery. The incidence and outcome of AKI in patients undergoing vascular surgery/interventional procedures will be captured routinely.

6. Further local AKI audits should be encouraged to assess the incidence of AKI among other specialty patient groups.

7. There must be a co-ordinated approach to improving both undergraduate and postgraduate education for AKI. Core competencies must be developed to improve the identification and management of patients at risk of developing AKI, including the acutely ill patient (NICE CG 50).

8. District general hospitals (DGHs) without renal services should develop links with local renal services and develop agreed care pathways for patients who develop AKI, enabling optimisation of patient care and efficient transfer of patients to a renal unit if appropriate.

9. Identification of new and improved biomarkers allowing earlier detection of AKI should be developed to improve the potential for targeted therapeutic intervention.

10. Renal units should work together locally with radiology and cardiology departments to ensure shared guidelines are in place to prevent contrast induced nephropathy.