PrescQIPP Community Interest Company

Bulletin 281. Part 2 - Acute Kidney Injury (AKI) in children, young people and adults

This bulletin looks at the prevention, detection and management of Acute Kidney Injury (AKI) in-line with guidance from the National Institute for Health and Care Excellence (NICE) and considers medication-related harm in primary care.

It is the second of two bulletins focusing on kidney health. Along with the associated support materials it provides advice and support to assist a range of primary care health professionals including GPs, nurses and pharmacists to improve the care of people with AKI.

Separate bulletins consider Acute Kidney Injury (AKI) - Sick day guidance and the management of Chronic Kidney Disease (CKD) in adults (Part 1).

Recommendations

- People who are acutely unwell and have one or more risk factors for AKI should be tested for AKI by measuring the serum creatinine and comparing it to baseline.
- Consider AKI in anyone with nausea, vomiting, diarrhoea, evidence of dehydration, reduced urine output, changes to urine colour, confusion, fatigue, and drowsiness.
- Consider AKI in anyone with an illness with no clear acute component, but has CKD, urological symptoms, symptoms of AKI, or signs/symptoms of disease affecting the kidneys and other organs (e.g. signs/symptoms of AKI, plus a purpuric rash).
- Consider AKI in anyone with CKD and no obvious acute illness and a rise in serum creatinine as this may indicate AKI rather than a worsening of their chronic disease.
- Serum creatinine should be monitored regularly in people of any age who have, or are at risk of AKI.
- Primary care health professionals should be aware of AKI warning stage test results and know how to respond to them.
- Identify and record the cause(s) of AKI in the person's notes. When being admitted to hospital, good transfer of information could support hospital care and outcomes.
- Offer written information as support for patients (parents and carers if appropriate) at risk of developing AKI. Specifically on the risk associated with conditions leading to dehydration and drugs that can cause or exacerbate kidney injury.
- Discuss and give information to people (include parents and carers if appropriate) on immediate and long-term treatment options, monitoring, prognosis, self-management and support options.
- Do not routinely offer low-dose dopamine or loop diuretics to treat AKI.
- Serum creatinine should be monitored after AKI and referral to a nephrologist considered when estimated glomerular filtration rate (eGFR) is 30ml/min/1.73m^2 or less in adults, children and young people.

- Considering temporarily stopping angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs) in anyone with diarrhoea, vomiting or sepsis until their clinical condition has improved and stabilised. Refer to PrescQIPP resources: AKI – Sick day guidance
- People with AKI should have all of their medicines reviewed. Seek advice from a pharmacist about optimising medicines and drug dosing in anyone with, or at risk of, AKI.
- Reassess renal function and drug dosing in situations where eGFR and/or creatinine clearance (CrCl) change rapidly, such as in patients with AKI.

Background

AKI is a term covering a spectrum of injury to the kidneys which can result from a number of causes. It is a clinical syndrome rather than a biochemical diagnosis and it is characterised by a decline in renal excretory function over hours or days that can result in failure to maintain fluid, electrolyte, and acid-base homeostasis.[1] It is rarely caused by trauma to the kidneys.[2] The term AKI has replaced the concept of acute renal failure as it more accurately describes that injury to the kidney can occur before function fails. The causes of AKI can be divided into:[1]

- **Pre-renal** – This is the most common and is due to reduced perfusion of the kidneys which leads to a decreased glomerular filtration rate (GFR). It is usually reversible with appropriate early treatment. Causes include hypovolaemia, decreased cardiac output and drugs that reduce blood pressure, circulating volume, or renal blood flow. For example ACE inhibitors, ARBs, non-steroidal anti-inflammatory drugs (NSAIDs) and loop diuretics.
- **Intrinsic renal** - a consequence of structural damage to the kidney, for example, tubules (e.g. acute tubular necrosis, rhabdomyolysis, myeloma), glomeruli (e.g. glomerulonephritis), interstitium (e.g. interstitial nephritis, lymphoma infiltration), and intrarenal blood vessels. It may result from persistent pre-renal or post-renal causes damaging renal cells, toxins and drugs (for example, antibiotics, contrast, chemotherapy).
- **Post-renal** – This is the least common cause accounting for around 10% of AKI. It is due to acute obstruction of the flow of urine resulting in increased intratubular pressure and decreased GFR. Causes of obstructions can include renal stones, blocked catheter, enlarged prostate, genitourinary tract tumours/masses, neurogenic bladder.

Often more than one contributing cause is present.[1]

AKI is seen in 13% to 18% of all people admitted to hospital, with older adults being particularly affected. These people are usually under the care of healthcare professionals practising in specialties other than nephrology, who may not always be familiar with the optimum care of people with AKI. The number of inpatients affected by AKI means that it has a major impact on healthcare resources. The costs to the NHS of AKI (excluding costs in the community) are estimated to be between £434 million and £620 million per year, which is more than the costs associated with breast cancer, or lung and skin cancer combined. The inpatient mortality of AKI varies considerably, depending on its severity, setting (intensive care or not), and many other patient-related factors, but in the UK it might typically be 25% to 30% or more. In view of its frequency and mortality rate, prevention of just 20% of cases of AKI would prevent a large number of deaths and substantially reduce complications and their associated costs.[3] Community-acquired AKI is thought to be up to three times more common than hospital-acquired AKI. A Welsh prospective cohort study calculated an incidence of 577 per 100,000 population in a six month period from 17,689 episodes of AKI, of which 49.3% were community acquired.[1] The incidence of AKI is increasing, possibly as a result of the number of people in the population who are elderly or at-risk with multiple comorbidities. Improved detection of AKI is also likely to have contributed to this rise.[1]

Complications from AKI arise as a result of impairment of the kidney's excretory, endocrine, and

metabolic actions. The risk of complications is related to the stage of AKI. Complications include:[1]

- Hyperkalaemia - This is usually asymptomatic until severe, but can then cause muscle weakness, paralysis, cardiac arrhythmias, or (in extreme cases) cardiac arrest.
- Other electrolyte imbalances – Examples include hyperphosphataemia, hyponatraemia, hypermagnesaemia, hypocalcaemia.
- Metabolic acidosis - Can present with altered level of consciousness, circulatory collapse, and hyperventilation.
- Volume overload (peripheral and pulmonary oedema) - Signs include tachypnoea, tachycardia, cyanosis, and lung crepitations. Often this is caused by excessive intravenous fluids being given to people in hospital who are anuric or oliguric.
- Uraemia - Occurs in severe AKI and requires dialysis. Symptoms include confusion, lethargy, and altered level of consciousness.
- CKD and end-stage renal disease - People who have experienced AKI have an increased risk of hypertension and CKD, which can be end-stage. Predictors for CKD after AKI include older age, lower baseline estimated glomerular filtration rate (eGFR), higher baseline albuminuria, and higher stages of AKI.

National guidance

The NICE guideline (NG148) on the prevention, detection and management of AKI in children, young people and adults aims to improve assessment and detection by non-specialists, and specifies when people should be referred to specialist services. This will improve early recognition and treatment, and reduce the risk of complications in people with AKI.[3]

NICE have produced a rapid guideline about managing COVID-19 which includes a section on preventing and managing acute complications in people with COVID-19 (NG191). Information to help healthcare professionals prevent, detect and manage AKI in adults in hospital with known or suspected COVID-19 is included.[4] NICE guideline (NG160) is another COVID-19 rapid guideline about dialysis service delivery which aims to maximise the safety of patients on dialysis, while protecting staff from infection. It also enables dialysis services to make the best use of NHS resources and match the capacity of dialysis services to patient needs if these become limited because of the COVID-19 pandemic.[5]

Health Improvement Scotland and the Scottish Patient Safety Programme recognised that harm from AKI cuts across boundaries and specialties in both primary and secondary care and is associated with high mortality, adverse long term outcomes and increased healthcare costs. An improvement collaborative was run between August 2017 and March 2019, across primary care and acute care settings, to test approaches to reduce harm from AKI through improved recognition, response and review.[6,7] The Acute Kidney Injury Impact and Learning Report found that implementation of an AKI algorithm and e-alerts has been a critical step to support recognising AKI and guide treatment. Education and awareness has been equally important to support staff and patients to recognise the importance of AKI and understand what steps they can take to prevent further deterioration.[7]

Think Kidneys is a national awareness raising campaign supported by NHS England and the UK Renal Registry. The Think Kidneys website has a section dedicated to AKI which includes case studies, data, resources and information for the public.[8]

The Royal College of General Practitioners (RCGP) have an AKI Toolkit for GPs and healthcare professionals. The aim of the toolkit is to disseminate learning highlighted from AKI case notes reviews which was part of the RCGP AKI Quality Improvement project. Working with GP practices, the RCGP has put together resources, alongside national Think Kidneys guidance, to support the implementation of quality improvement methods into routine clinical practice. The toolkit aims to support improvements

in both the recognition and response to AKI for adults in primary care as well as improve the delivery of post-AKI care. The toolkit includes guidance for post-discharge care following AKI. This guidance promotes tailored and timely discharge care for adults who have had a hospital admission complicated by AKI. In particular, it highlights a need to address poor outcomes following AKI for people with heart failure. The guidance table and the 'Top Ten Tips' are designed to support safer transitions of care and are of relevance to both hospital and general practice teams.[9]

Who is at risk of AKI?

Identifying risk factors and acting appropriately to recognise people with AKI aims to prevent cases and limit deterioration. The risk of AKI depends on a person's susceptibility and the type and extent of exposure to a potential insult. AKI should be suspected in anyone who presents with nausea, vomiting, or diarrhoea, evidence of dehydration, reduced urine output or changes to urine colour, confusion, fatigue, and drowsiness.[1] The NICE AKI guideline recommends assessing risk of AKI in adults with acute illness by measuring serum creatinine and comparing with baseline, if any of the following are likely or presents:[3]

- CKD (adults with an eGFR less than 60ml/min/1.73m^2 are at particular risk)
- Heart failure
- Liver disease
- Diabetes
- History of AKI
- Oliguria (urine output less than 0.5ml/kg/hour)
- Neurological or cognitive impairment or disability, which may mean limited access to fluids because of reliance on a carer
- Hypovolaemia
- Use of drugs that can cause or exacerbate kidney injury (such as NSAIDs, ACE inhibitors, ARBs and diuretics) within the past week, especially if hypovolaemic
- Use of iodine-based contrast media within the past week
- Symptoms or history of urological obstruction, or conditions that may lead to obstruction
- Sepsis
- Deteriorating early warning scores
- Age 65 years or over.

The corresponding recommendation for children and young people lists some additional criteria. NICE advice is to investigate AKI in children and young people with acute illness if any of the following are likely or present:[3]

- CKD
- Heart failure
- Liver disease
- History of AKI
- Oliguria (urine output less than 0.5ml/kg/hour)
- Young age, neurological or cognitive impairment or disability, which may mean limited access to fluids because of reliance on a parent or carer
- Hypovolaemia

- Use of drugs that can cause or exacerbate kidney injury (such as NSAIDs, aminoglycosides, ACE inhibitors, ARBs and diuretics) within the past week, especially if hypovolaemic
- Symptoms or history of urological obstruction, or conditions that may lead to obstruction
- Sepsis
- A deteriorating paediatric early warning score
- Severe diarrhoea (children and young people with bloody diarrhoea are at particular risk)
- Symptoms or signs of nephritis (such as oedema or haematuria)
- Haematological malignancy
- Hypotension

NICE also warn that in adults, children and young people with CKD and no obvious acute illness, a rise in serum creatinine may indicate AKI rather than a worsening of their chronic disease. NICE also recommends considering AKI when an adult, child or young person presents with an illness with no clear acute component and has any of the following:[3]

- CKD, especially stage 3B, 4 or 5, or urological disease
- New onset or significant worsening of urological symptoms
- Symptoms suggesting complications of AKI
- Symptoms or signs of a multi-system disease affecting the kidneys and other organ systems (for example, signs or symptoms of AKI, plus a purpuric rash).

Serum creatinine should be monitored regularly in people of any age who have, or are at risk of AKI.

Preventing AKI

Up to 30% of deaths from AKI are thought to be preventable by early recognition and management of patient risk factors.[1]

Monitoring and preventing deterioration in people with or at high risk of AKI

Use clinical judgement to decide the frequency of creatinine monitoring, taking into account the individual circumstances. Regular monitoring of renal function is required in people with chronic diseases including CKD, heart failure, liver disease, and diabetes. Close monitoring of renal function is needed in people with acute illness, especially if there is vomiting and/or diarrhoea, or signs of dehydration.[1] Consider electronic clinical decision support systems (CDSS) to support clinical decision making and prescribing, but ensure they do not replace clinical judgement.[3]

Review regular medication and, if possible, avoid drugs that are potentially harmful to the kidneys. Advise the person to seek medical advice in the event of acute illness, for example diarrhoea or vomiting.[1] Consider temporarily stopping ACE inhibitors, ARBs and diuretics in adults, children and young people with diarrhoea, vomiting or sepsis until their clinical condition has improved and stabilised.[1,3] More information on how to manage medication known to impair renal function during illness or fever and reduce the risk of AKI is provided in the PrescQIPP Bulletin 260: Acute Kidney Injury (AKI) - Sick day guidance

Offer written information as support for patients and carers.[1] The PrescQIPP Bulletin 260: Acute Kidney Injury (AKI) - Sick day guidance contains kidney injury postcards, leaflets and letters aimed at patients and carers.

In all people with acute illness consider admitting them to hospital if the person is hypovolaemic and clinical judgement suggests they would benefit from intravenous fluids, especially if they are in an at risk group.[1]

Investigations for AKI

The NICE AKI guideline advises testing for AKI by measuring serum creatinine and comparing with baseline.[3] To obtain a baseline value for the initial AKI, use the lowest creatinine value within seven days of the current value, or (if this is not available), look at older results and use the lowest or mean creatinine value from between seven days and one year before the current value.[1]

If no baseline creatinine value is available, the full version of the NICE AKI guideline advises a by 'imputation' approach. This involves the back calculation of a presumed baseline creatinine for that patient, but the method is prone to error and difficult to implement in practice.[10] The NICE Clinical Knowledge Summary (CKS) describes a slightly different approach for people with suspected AKI who do not require urgent admission to hospital:[1]

- If no baseline creatinine value is available, it may be appropriate to repeat the creatinine measurement after 48-72 hours.
  - Use clinical judgement - monitor the person closely and do not let waiting for a second creatinine result delay treatment or referral if AKI is possible, particularly if the person is unwell or the serum creatinine level is high.
- Take into consideration if the person has:
  - Chronic kidney disease - an increase in creatinine may be because this has progressed.
  - Recently been treated with trimethoprim - this can cause a false positive result as trimethoprim may increase serum creatinine, but not affect glomerular filtration rate.
  - Recently completed a pregnancy - this can cause a false positive result due to an apparent rise in creatinine compared with naturally reduced creatinine values in pregnancy.

Diagnosis of AKI

Detect AKI in line with the (p)RIFLE (paediatric Risk, Injury, Failure, Loss, End stage renal disease), AKIN (Acute Kidney Injury Network) or KDIGO (Kidney Disease: Improving Global Outcomes) definitions, by using any of the following criteria:[3]

- A rise in serum creatinine of 26 micromol/l or greater within 48 hours.
  - Be aware that in the absence of a baseline creatinine value, a high serum creatinine level may indicate AKI, even if the rise in creatinine over 48 hours is less than 26 micromol/L (particularly if the person has been unwell for a few days).[1]
- A 50% or greater rise in serum creatinine known or presumed to have occurred within the past seven days.
- A fall in urine output to less than 0.5ml/kg/hour for more than six hours in adults and more than eight hours in children and young people
- A 25% or greater fall in eGFR in children and young people within the past seven days.

If there is doubt whether a person with CKD has worsening of their condition or has acute-on-chronic kidney disease, consider it to be acute and manage accordingly.[1]

Stage the person's AKI according to the criterion which gives the highest stage. In a primary care setting the creatinine level will usually be the most readily available result, but if urine output is also being monitored, base staging on whichever shows the highest (worst) stage if creatinine and urine output map to different stages.[1]

Table 1: Staging system for AKI in adults (based on the (p)RIFLE†, AKIN‡, and KDIGO§ systems).[1]

Stage	Criteria
1	Creatinine rise of 26 micromol or more within 48 hours OR Creatinine rise of 50-99% from baseline within seven days* (1.50-1.99x baseline) OR Urine output** <0.5ml/kg/hour for more than six hours
2	100-199% creatinine rise from baseline within seven days* (2.00-2.99x baseline) OR Urine output** <0.5ml/kg/hour for more than 12 hours
3	200% or more creatinine rise from baseline within 7 days* (3.00 or more x baseline) OR Creatinine rise to 354 micromol/l or more with acute rise of 26 micromol/l or more within 48 hours or 50% or more rise within 7 days OR Urine output** <0.3ml/kg/hour for 24 hours or anuria for 12 hours
† (paediatric) Risk, Injury , Failure, Loss, End stage renal disease; ‡ Acute Kidney Injury Network; § International Kidney Disease: Improving Global Outcomes * the rise is known (based on previous blood tests) or presumed (based on history) to have occurred within 7 days ** Measurement of urine output may not be practical in a primary care population, but can be considered in a person with a catheter	

A patient safety alert was issued in 2014, focusing on standardising the early identification of AKI. It directed NHS Trust pathology services to implement a nationally agreed automated computer software algorithm to ensure that a timely and consistent approach to the detection and diagnosis of patients with AKI is taken across the NHS. This would enable warnings to be issued regarding test results that suggested AKI. The algorithm is endorsed by NHS England and when integrated into a Laboratory Information Management System (LIMS) the algorithm will identify potential cases of AKI from laboratory data in real time and produce a test result. The laboratory system will then send the test result, using existing IT connections to patient management systems.[11] As a result of NHS England's Safety Alert and detection algorithm, AKI Warning Stage Test Results, are generated when a significant change in creatinine concentration is measured, and sent to IT systems in general practice.[12]

Respond to AKI warning stage test results within an appropriate timescale using clinical judgment, bearing in mind that certain clinical features will prompt an earlier review, for example, poor urine output, evidence of hyperkalaemia, previous AKI, known CKD stage four or five or renal transplant, frailty, chronic disease such as diabetes or heart failure, suspected intrinsic kidney disease or urinary tract obstruction. As a guide:[1]

- If AKI warning stage 1 (current creatinine 1.5 or more times the baseline level or creatinine rise more than 26 micromol/L or greater within 48 hours) and there is a:
  - » Low pre-test probability of AKI (stable clinical context), consider clinical review within 72 hours of the result.
  - » High pre-test probability of AKI (in the context of acute illness), consider clinical review within 24 hours of the result.
- If AKI warning stage 2 (current creatinine two or more times the baseline level) and there is a:
  - » Low pre-test probability of AKI (stable clinical context), consider clinical review within 24 hours of the result.
  - » High pre-test probability of AKI (in the context of acute illness), consider clinical review within six hours of the result.

- If AKI warning stage 3 (current creatinine three or more times the baseline level, or creatinine 1.5 times baseline and more than 354micromol/L) and there is a:
  - » Low pre-test probability of AKI (stable clinical context), consider clinical review within six hours of the result.
  - » High pre-test probability of AKI (in the context of acute illness), consider immediate admission.

Identifying the cause(s) of AKI

For possible underlying causes, ask questions on:[1]

- Current symptoms - is the person is unwell (for example diarrhoea, vomiting).
- Any recent symptoms that may suggest an underlying obstructive cause - for example lower urinary tract symptoms, bloating from a pelvic mass, renal colic.
- History of cardiovascular disease - increasing the risk of impaired renal perfusion.
- Symptoms of an underlying inflammatory process - for example vasculitic rash, arthralgia, epistaxis, or haemoptysis.
- Drug history - any medicines that could cause or exacerbate AKI or accumulate and cause harm, including over the counter formulations and herbal remedies.
- Possibility of rhabdomyolysis - for example, skeletal muscle injury, muscle over-exertion, crush injury, prolonged immobility.

Identify the cause(s) of AKI and record the details in the person's notes.[3] When a person is being admitted to hospital from primary care, good transfer of information that includes details of factors that may have contributed to the AKI could support their hospital care.

Perform urine dipstick testing for blood, protein, leucocytes, nitrites and glucose in all people as soon as AKI is suspected or detected. The results should be documented and acted upon if abnormal.[3] The aim of dipstick testing is to detect treatable conditions such as glomerulonephritis, acute pyelonephritis, and interstitial nephritis.[10] AKI with negative urinalysis usually indicates a pre-renal cause, but a drug-cause should also be considered. Positive protein and blood indicators on urinalysis may suggest glomerular disease (particularly with more strongly positive results, for example, 2+ blood, 2+ protein). Increased white cells are non-specific but may suggest infection (most common) or interstitial nephritis. Be aware that dipstick analysis of urine from people with catheters should be interpreted with caution because of the possibility of false-positive results, for example dipstick haematuria as a result of simple trauma.[1]

Think about a diagnosis of acute nephritis and referral to the nephrology team when an adult, child or young person with no obvious cause of AKI has urine dipstick results showing haematuria and proteinuria, without urinary tract infection or trauma due to catheterisation.[3]

NICE do not recommend routinely offering an ultrasound of the urinary tract when the cause of the AKI has been identified. When pyonephrosis is suspected an immediate ultrasound of the urinary tract should be performed within six hours of assessment. If there is no identified cause of AKI or there is a risk of urinary tract obstruction, offer urgent ultrasound of the urinary tract. This should be performed within 24 hours of assessment.[3]

Management of AKI

NICE do not recommend routinely offering low-dose dopamine or loop diuretics to treat AKI. Loop diuretics should only be considered for treating fluid overload or oedema while:[3]

- An adult, child or young person is awaiting renal replacement therapy or
- Renal function is recovering in an adult, child or young person not receiving renal replacement therapy.

NICE recommends discussing the management of AKI with a nephrologist or paediatric nephrologist as soon as possible and within 24 hours of detection when one or more of the following is present:[3]

- A possible diagnosis that may need specialist treatment (for example, vasculitis, glomerulonephritis, tubulointerstitial nephritis or myeloma)
- AKI with no clear cause
- Inadequate response to treatment
- Complications associated with AKI
- Stage 3 AKI (according to (p)RIFLE, AKIN or KDIGO criteria)
- A renal transplant
- CKD stage four or five.

Serum creatinine should be monitored after an episode of AKI and referral to a nephrologist or paediatric nephrologist considered when eGFR is 30ml/min/1.73m^2 or less in adults, children and young people. Consider referral to a paediatric nephrologist for children and young people who have recovered from an episode of AKI, but have hypertension, impaired renal function or 1+ or greater proteinuria on dipstick testing of an early morning urine sample. Adults, children or young people with a clear cause for AKI which is responding promptly to medical management should not be referred to a nephrologist or paediatric nephrologist, unless they have a renal transplant.[3]

To relieve urological obstruction all adults, children and young people with upper tract urological obstruction should be referred to an urologist. If one or more of the following is present immediate referral is required:[3]

- Pyonephrosis
- An obstructed solitary kidney
- Bilateral upper urinary tract obstruction
- Complications of AKI caused by urological obstruction.

All adults, children and young people should be referred to a nephrologist, paediatric nephrologist or critical care specialist immediately for renal replacement therapy, if any of the following are not responding to medical management:[3]

- Hyperkalaemia
- Metabolic acidosis
- Symptoms or complications of uraemia (for example, pericarditis or encephalopathy)
- Fluid overload
- Pulmonary oedema.

Medication review in suspected or established AKI

NICE advises that the use of drugs that can cause or exacerbate kidney injury (such as NSAIDs, aminoglycosides, ACE inhibitors, ARBs and diuretics) and are a risk factor for developing AKI. They advise considering temporarily stopping ACE inhibitors and ARBs in adults, children and young people with diarrhoea, vomiting or sepsis until their clinical condition has improved and stabilised.[3]

NICE advise seeking advice from a pharmacist about optimising medicines and drug dosing in adults, children and young people with or at risk of AKI.[3] The PrescQIPP Bulletin 260: Acute Kidney Injury (AKI) - Sick day guidance provides information on offering individualised sick day guidance to patients when they are well, so that they are able to proactively manage medication known to impair renal function during illness or fever and reduce the risk of AKI. Resources include a medicines optimisation checklist, GP clinical system searches, audit, patient letters, an educational slide set and patient facing materials.

People with AKI should have all of their medicines reviewed. In cases where the person is not being promptly admitted to hospital this review will need to be undertaken in primary care. 'Think Kidneys' has developed guidelines to support medicines optimisation of patients with AKI in secondary care.[13] Primary care healthcare professionals may also find it of use but should keep in mind that it is written from a secondary care setting perspective, and it should not replace the advice of appropriate specialists where necessary. They have also produced a quick reference guide called 'Acute Kidney Injury - Potentially Problematic Drugs and Actions to Take in Primary Care'.[14]

Medication dosage adjustment in reduced renal function

Many commonly used drugs or their metabolites are excreted by the kidney, which can have significance implications for people with acute or chronic renal impairment. Impaired renal function alters drug pharmacokinetics, potentially changing drug efficacy and increasing the likelihood of unwanted effects, including renal toxicity. There may also be pharmacodynamic changes as a result of uraemia (e.g. increased risk of gastrointestinal bleeding or oedema with NSAIDs). Particular care is needed for drugs with a narrow therapeutic index, for example vancomycin, lithium.[15] Resources such as the BNF and the individual Summary of Product Characteristics (SPC) should be referred to for information about dosage adjustments for specific drugs in renal impairment, alongside information from specialist resources such as the Renal Drug Database and advice from appropriate specialists where needed.

The information on dosage adjustment in the BNF is usually expressed in terms of eGFR. For most drugs and for most adult patients of average build and height, eGFR should be used to determine dosage adjustments.[16,17] However, eGFR can overestimate renal function compared with creatinine clearance (CrCl) in some patient groups or clinical situations. This overestimation can result in patients receiving higher than recommended doses of their medicine in relation to their renal function.[16] Creatinine clearance (CrCl) should be calculated using the Cockcroft-Gault formula to determine dosage adjustments for:[16]

- Direct-acting oral anticoagulants (DOACs) (e.g. apixaban, dabigatran, edoxaban, rivaroxaban).
- Patients taking nephrotoxic drugs (examples include vancomycin and amphotericin B).
- Elderly patients (aged 75 years and older).
- Patients at extremes of muscle mass (BMI<18kg/m^2 or >40kg/m^2).
- Patients taking medicines that are largely renally excreted and have a narrow therapeutic index, such as digoxin and sotalol.

The MHRA advises that renal function and drug dosing is reassessed in situations where eGFR and/or CrCl change rapidly, such as in patients with AKI.[16]

Information and support for patients and carers

The risk of developing AKI should be discussed with people (involve parents and carers if appropriate) who are identified as at risk. Specifically the risk associated with conditions leading to dehydration (for example, diarrhoea and vomiting) and drugs that can cause or exacerbate kidney injury (including over-the-counter NSAIDs). This is important particularly for people who have CKD with an eGFR less than 60ml/min/1.73m^2 and/or neurological or cognitive impairment or disability, which may mean limited access to fluids because of reliance on a carer.[3]

For people (involve parents and carers if appropriate) with AKI discuss and give information on immediate treatment options, long-term treatment options, monitoring, prognosis, self-management and support options as soon as possible in collaboration with a multidisciplinary team.[3]

Give information about future care to people needing renal replacement therapy after discharge following AKI. This should include information about the frequency and length of dialysis sessions and the preparation needed (such as having a fistula or peritoneal catheter).[3]

NICE have produced some information for the public on AKI and the care they should expect. This signposts to useful information:[18]

- The NHS website has more information about AKI.
- Kidney Care UK (01420 541424) for information, advice and support.
- Kidney Research UK (0300 303 1100) for information, advice and support.
- Kidney Wales (Aren Cymru) (02920 343940) for information, advice and support.
- National Kidney Federation (NKF) (0800 1690936) for information, advice and support.

Summary

AKI is frequently encountered in primary care, as community-acquired AKI is thought to be up to three times more common than hospital-acquired AKI.[1] AKI is associated with high mortality, adverse long term outcomes and increased healthcare costs.[6] NICE guidelines on AKI emphasise early intervention and stress the importance of risk assessment and prevention, early recognition and treatment. The prevention, detection and management of AKI, along with CKD, represent a large clinical area and the assessment and management in practice may need substantial input from a range of health care professionals and commissioners in primary (and secondary) care. However, the potential impact in terms of improving patients' outcomes, is significant.

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Additional PrescQIPP resources

Briefing	https://www.prescqipp.info/our-resources/bulletins/bulletin-281-implementing-nice-guidance-in-ckd-and-aki/
Implementation tools	

Information compiled by Sarah Clarke, PrescQIPP CIC, November 2021 and reviewed by Katie Smith, PrescQIPP CIC, January 2022. Non-subscriber publication January 2023.

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