NICE National Institute for Health and Care Excellence

NICE guideline

Acute kidney injury: prevention, detection and management

NICE guideline
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Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the Yellow Card Scheme.

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

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This guideline replaces CG169.

This guideline is the basis of QS76.

Overview

This guideline covers preventing, detecting and managing acute kidney injury in children, young people and adults. It 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 acute kidney injury.

Who is it for?

- Healthcare professionals
- Commissioners and providers
- People with or at risk of acute kidney injury and their families and carers

Recommendations

People have the right to be involved in discussions and make informed decisions about their care, as described in NICE's information on making decisions about your care.

Making decisions using NICE guidelines explains how we use words to show the strength (or certainty) of our recommendations, and has information about prescribing medicines (including off-label use), professional guidelines, standards and laws (including on consent and mental capacity), and safeguarding.

Health professionals should follow our general guidelines for people delivering care:

- Patient experience in adult NHS services
- Babies, children and young people's experience of healthcare
- Shared decision making
- Medicines adherence
- Medicines optimisation
- Decision making and mental capacity

1.1 Assessing risk of acute kidney injury

Identifying acute kidney injury in people with acute illness

1.1.1 Investigate for acute kidney injury, by measuring serum creatinine and comparing with baseline, in adults with acute illness if any of the following are likely or present:

- chronic kidney disease (adults with an estimated glomerular filtration rate

[eGFR] less than 60 ml/min/1.73 m^2 are at particular risk)

- heart failure
- liver disease
- diabetes
- history of acute kidney injury
- oliguria (urine output less than 0.5 ml/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 non-steroidal anti-inflammatory drugs [NSAIDs], aminoglycosides, angiotensin-converting enzyme [ACE] inhibitors, angiotensin II receptor antagonists [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. **[2013]**

1.1.2 Investigate for acute kidney injury, by measuring serum creatinine and comparing with baseline, in children and young people with acute illness if any of the following are likely or present:

- chronic kidney disease
- heart failure

- liver disease
- history of acute kidney injury
- oliguria (urine output less than 0.5 ml/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. **[2013]**

Identifying acute kidney injury in people with no obvious acute illness

1.1.3 Be aware that in adults, children and young people with chronic kidney disease and no obvious acute illness, a rise in serum creatinine may indicate acute kidney injury rather than a worsening of their chronic disease. **[2013]**

1.1.4 Ensure that acute kidney injury is considered when an adult, child or young

person presents with an illness with no clear acute component and has any of the following:

- chronic kidney disease, especially stage 3B, 4 or 5 as shown in table 1, or urological disease
- new onset or significant worsening of urological symptoms
- symptoms suggesting complications of acute kidney injury
- symptoms or signs of a multi-system disease affecting the kidneys and other organ systems (for example, signs or symptoms of acute kidney injury, plus a purpuric rash). **[2013]**

Assessing risk factors in adults having iodine-based contrast media

1.1.5 Discuss the benefits and risks of tests or treatments that use iodine-based contrast media with the person, and their family members and carers if appropriate. Follow the recommendations in the NICE guideline on shared decision making. **[2024]**

1.1.6 Be aware that there is a small but increased risk of acute kidney injury associated with an eGFR less than 30 ml/min/1.73 m^2. **[2024]**

Emergency department and urgent inpatient settings

1.1.7 Do not delay the use of iodine-based contrast media in an emergency if the risk of delaying the contrast media is likely to be clinically significant. **[2024]**

Outpatient, non-urgent inpatient and community settings

1.1.8 Before requesting a non-urgent iodine-based contrast media CT scan, assess whether the person has pre-existing kidney disease. **[2024]**

1.1.9 If available, use an eGFR measurement from the past 6 months to support decision making about the use of iodine-based contrast media. If the person has been acutely unwell or clinically unstable since their last eGFR test, consider using a more recent eGFR. **[2024]**

1.1.10 If no eGFR is available from the past 6 months, ask the person, or their family members and carers if appropriate, the following screening questions:

- do they have kidney disease or a kidney transplant?
- have they seen or are waiting to see a kidney specialist, or a kidney surgeon or urologist?
- do they have symptoms of acute illness likely to cause acute kidney injury such as diarrhoea, vomiting, fever, hypovolaemia, infection or difficulty passing urine? **[2024]**

1.1.11 If the screening questions indicate a history of kidney disease or acute illness to suggest that acute kidney injury is likely, consider an eGFR test to support decision making. **[2024]**

1.1.12 If the screening questions do not indicate a history of kidney disease and the person is clinically stable, consider proceeding with iodine-based contrast media CT scan without the need for further blood tests before the scan. **[2024]**

For a short explanation of why the committee made these recommendations and how they might affect practice, see the rationale and impact section on assessing risk factors in adults having iodine-based contrast media.

Full details of the evidence and the committee's discussion are in evidence review B: risk prediction tools and eGFR for the prediction of iodine-based contrast media-associated acute kidney injury.

Assessing risk factors in adults having surgery

1.1.13 Assess the risk of acute kidney injury in adults before surgery. Be aware that increased risk is associated with:

- emergency surgery, especially when the person has sepsis or hypovolaemia
- intraperitoneal surgery
- chronic kidney disease (adults with an eGFR less than 60 ml/min/1.73 m^2 are at particular risk)
- diabetes
- heart failure
- age 65 years or over
- liver disease
- use of drugs that can cause or exacerbate kidney injury in the perioperative period (in particular, NSAIDs after surgery).

Use the risk assessment to inform a clinical management plan. **[2013]**

1.1.14 Include the risks of developing acute kidney injury in the routine discussion of risks and benefits of surgery. Follow the recommendations in the NICE guideline on shared decision making. **[2013]**

1.2 Preventing acute kidney injury

Ongoing assessment of the condition of people in hospital

1.2.1 Follow the recommendations in the NICE guideline on acutely ill adults in hospital on the use of track and trigger systems (early warning scores) to identify adults who are at risk of acute kidney injury because their clinical condition is deteriorating or is at risk of deteriorating. **[2013]**

1.2.2 When adults are at risk of acute kidney injury, ensure that systems are in place to recognise and respond to oliguria (urine output less than 0.5 ml/kg/hour) if the track and trigger system (early warning score) does not monitor urine output. **[2013]**

1.2.3 Consider using a paediatric early warning score to identify children and young people admitted to hospital who are at risk of acute kidney injury because their clinical condition is deteriorating or is at risk of deteriorating.

- Record physiological observations at admission and then according to local protocols for given paediatric early warning scores.
- Increase the frequency of observations if abnormal physiology is detected. **[2013]**

1.2.4 If using a paediatric early warning score, use one with multiple-parameter or aggregate weighted scoring systems that allow a graded response and:

- define the parameters to be measured and the frequency of observations
- include a clear and explicit statement of the parameters, cut-off points or scores that should trigger a response. **[2013]**

1.2.5 If using a paediatric early warning score, use one with multiple-parameter or aggregate weighted scoring systems that measure:

- heart rate
- respiratory rate
- systolic blood pressure
- level of consciousness
- oxygen saturation
- temperature
- capillary refill time. **[2013]**

1.2.6 When children and young people are at risk of acute kidney injury because of risk factors listed in the recommendation in the section on identifying acute kidney injury in people with acute illness:

- measure urine output
- record weight twice daily to determine fluid balance

- measure urea, creatinine and electrolytes
- think about measuring lactate, blood glucose and blood gases. **[2013]**

Preventing acute kidney injury in adults having iodine-based contrast media

1.2.7 Encourage oral hydration before and after procedures using intravenous iodine-based contrast media in adults at increased risk of contrast-associated acute kidney injury (see the recommendation on increased risk in the section on assessing risk factors in adults having iodine-based contrast media). **[2019]**

1.2.8 For inpatients having iodine-based contrast media, consider intravenous volume expansion with either isotonic sodium bicarbonate or 0.9% sodium chloride if they are at particularly high risk, for example, if:

- they have an eGFR less than 30 ml/min/1.73 m^2
- they have had a renal transplant
- a large volume of contrast medium is being used (for example, higher than the standard diagnostic dose or repeat administration within 24 hours)
- intra-arterial administration of contrast medium with first-pass renal exposure is being used.

  For more information on managing intravenous fluid therapy, see the NICE guideline on intravenous fluid therapy in adults in hospital. **[2019]**

1.2.9 Consider temporarily stopping ACE inhibitors and ARBs in adults having iodine-based contrast media if they have chronic kidney disease with an eGFR less than 30 ml/min/1.73 m^2. **[2013, amended 2024]**

1.2.10 Discuss the person's care with a nephrology team before offering iodine-based contrast media to adults on renal replacement therapy, including people with a renal transplant, but do not delay emergency imaging for this. **[2019]**

For a short explanation of why the committee made the 2019 recommendations and how they might affect practice, see the rationale and impact section on preventing acute kidney injury in adults having iodine-based contrast media.

Full details of the evidence and the committee's discussion are in evidence review A: preventing contrast-induced acute kidney injury.

Monitoring and preventing deterioration in people with or at high risk of acute kidney injury

1.2.11 Consider electronic clinical decision support systems (CDSS) to support clinical decision making and prescribing, but ensure they do not replace clinical judgement. **[2013]**

1.2.12 When acquiring any new CDSS or systems for electronic prescribing, ensure that any systems considered:

- can interact with laboratory systems
- can recommend drug dosing and frequency
- can store and update data on patient history and characteristics, including age, weight and renal replacement therapy
- can include alerts that are mandatory for the healthcare professional to acknowledge and review. **[2013]**

1.2.13 Seek advice from a pharmacist about optimising medicines and drug dosing in adults, children and young people with or at risk of acute kidney injury. **[2013]**

1.2.14 Consider 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. **[2013]**

1.3 Detecting acute kidney injury

1.3.1 Detect acute kidney injury, 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:

- a rise in serum creatinine of 26 micromol/litre or greater within 48 hours
- a 50% or greater rise in serum creatinine known or presumed to have occurred within the past 7 days (see also an algorithm for early identification of acute kidney injury, endorsed by NHS England)
- a fall in urine output to less than 0.5 ml/kg/hour for more than 6 hours in adults and more than 8 hours in children and young people
- a 25% or greater fall in eGFR in children and young people within the past 7 days. **[2013]**

1.3.2 Monitor serum creatinine regularly in all adults, children and young people with or at risk of acute kidney injury. Frequency of monitoring should vary according to clinical need, but daily measurement is typical while in hospital. **[2013]**

1.4 Identifying the cause(s) of acute kidney injury

1.4.1 Identify the cause(s) of acute kidney injury and record the details in the person's notes. **[2013]**

Urinalysis

1.4.2 Perform urine dipstick testing for blood, protein, leucocytes, nitrites and glucose in all people as soon as acute kidney injury is suspected or detected. Document the results and ensure that appropriate action is taken when results are abnormal. **[2013]**

1.4.3 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 acute kidney injury has urine dipstick results showing haematuria and proteinuria, without urinary tract infection or trauma due to catheterisation. **[2013]**

Ultrasound

1.4.4 Do not routinely offer ultrasound of the urinary tract when the cause of the acute kidney injury has been identified. **[2013]**

1.4.5 When pyonephrosis (infected and obstructed kidney[s]) is suspected in adults, children and young people with acute kidney injury, offer immediate ultrasound of the urinary tract (to be performed within 6 hours of assessment). **[2013]**

1.4.6 When adults, children and young people have no identified cause of their acute kidney injury or are at risk of urinary tract obstruction, offer urgent ultrasound of the urinary tract (to be performed within 24 hours of assessment). **[2013]**

1.5 Managing acute kidney injury

Relieving urological obstruction

1.5.1 Refer all adults, children and young people with upper tract urological obstruction to a urologist. Refer immediately when one or more of the following is present:

- pyonephrosis
- an obstructed solitary kidney
- bilateral upper urinary tract obstruction
- complications of acute kidney injury caused by urological obstruction. **[2013]**

1.5.2 When nephrostomy or stenting is used to treat upper tract urological obstruction in adults, children and young people with acute kidney injury, carry it out as soon as possible and within 12 hours of diagnosis. **[2013]**

Pharmacological management

1.5.3 Do not routinely offer loop diuretics to treat acute kidney injury. **[2013]**

1.5.4 Consider loop diuretics for treating fluid overload or oedema while:

- 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. **[2013]**

1.5.5 Do not offer low-dose dopamine to treat acute kidney injury. **[2013]**

Referring for renal replacement therapy

1.5.6 Discuss any potential indications for renal replacement therapy with a nephrologist, paediatric nephrologist and/or critical care specialist immediately to ensure that the therapy is started as soon as needed. **[2013]**

1.5.7 When an adult, child or young person has significant comorbidities, discuss with them and/or their parent or carer and within the multidisciplinary team whether renal replacement therapy would offer benefit. Follow the recommendations in the NICE guideline on shared decision making. **[2013]**

1.5.8 Refer adults, children and young people immediately for renal replacement therapy if any of the following are not responding to medical management:

- hyperkalaemia
- metabolic acidosis
- symptoms or complications of uraemia (for example, pericarditis or encephalopathy)
- fluid overload
- pulmonary oedema. **[2013]**

1.5.9 Base the decision to start renal replacement therapy on the condition of the

adult, child or young person as a whole and not on an isolated urea, creatinine or potassium value. **[2013]**

1.5.10 When there are indications for renal replacement therapy, the nephrologist and/or critical care specialist should discuss the treatment with the adult, child or young person and/or their parent or carer as soon as possible and before starting treatment. Follow the recommendations in the NICE guideline on shared decision making. **[2013]**

Referring to nephrology

1.5.11 Refer adults, children and young people with acute kidney injury to a nephrologist, paediatric nephrologist or critical care specialist immediately if they meet criteria for renal replacement therapy in recommendation 1.5.8. **[2013]**

1.5.12 Do not refer adults, children or young people to a nephrologist or paediatric nephrologist when there is a clear cause for acute kidney injury and the condition is responding promptly to medical management, unless they have a renal transplant. **[2013]**

1.5.13 Consider discussing management with a nephrologist or paediatric nephrologist when an adult, child or young person with severe illness might benefit from treatment, but there is uncertainty as to whether they are nearing the end of their life. **[2013]**

1.5.14 Refer adults, children and young people in intensive care to a nephrology team when there is uncertainty about the cause of acute kidney injury or when specialist management of kidney injury might be needed. **[2013]**

1.5.15 Discuss the management of acute kidney injury 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:

- a possible diagnosis that may need specialist treatment (for example, vasculitis, glomerulonephritis, tubulointerstitial nephritis or myeloma)
- acute kidney injury with no clear cause

- inadequate response to treatment
- complications associated with acute kidney injury
- stage 3 acute kidney injury (according to (p)RIFLE, AKIN or KDIGO criteria)
- a renal transplant
- chronic kidney disease stage 4 or 5 as shown in table 1. **[2013]**

1.5.16 Monitor serum creatinine after an episode of acute kidney injury. Base the frequency of monitoring on the stability and degree of renal function at the time of discharge. Consider referral to a nephrologist or paediatric nephrologist when eGFR is 30 ml/min/1.73 m^2 or less in adults, children and young people who have recovered from an acute kidney injury. **[2013]**

1.5.17 Consider referral to a paediatric nephrologist for children and young people who have recovered from an episode of acute kidney injury but have hypertension, impaired renal function or 1+ or greater proteinuria on dipstick testing of an early morning urine sample. **[2013]**

1.6 Information and support for patients and carers

1.6.1 Discuss immediate treatment options, monitoring, prognosis and support options as soon as possible with people with acute kidney injury and/or, if appropriate, their parent or carer. Follow the recommendations on patient views and preferences and shared decision making in the NICE guidelines on patient experience in adult NHS services, shared decision making and decision making and mental capacity. **[2013]**

1.6.2 Give information about long-term treatment options, monitoring, self-management and support to people who have had acute kidney injury (and/or their parent or carer, if appropriate) in collaboration with a multidisciplinary team appropriate to the person's individual needs. **[2013]**

1.6.3 Give information about future care to people needing renal replacement therapy after discharge following acute kidney injury. This should include information

about the frequency and length of dialysis sessions and the preparation needed (such as having a fistula or peritoneal catheter). **[2013]**

1.6.4 Discuss the risk of developing acute kidney injury, particularly 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), with people who are at risk of acute kidney injury, particularly those who have:

- chronic kidney disease with an eGFR less than 60 ml/min/1.73 m^2
- neurological or cognitive impairment or disability, which may mean limited access to fluids because of reliance on a carer.

Involve parents and carers in the discussion if appropriate. **[2013]**

Terms used in this guideline

This section defines terms that have been used in a particular way for this guideline. For other definitions see the NICE glossary.

First-pass renal exposure

First-pass renal exposure is when the contrast medium reaches the renal arteries in a relatively undiluted form, for example, through injection into the left heart, thoracic and suprarenal abdominal aorta, or the renal arteries.

Stages of chronic kidney disease

Table 1 The stages of chronic kidney disease

Stage	eGFR (ml/min/1.73 m2)	Description	Qualifier
1	≥90	Kidney damage, normal or increased GFR	Kidney damage (presence of structural abnormalities and/or persistent haematuria, proteinuria or microalbuminuria) for ≥3 months

Stage	eGFR (ml/min/1.73 m2)	Description	Qualifier
2	60 to 89	Kidney damage, mildly reduced GFR	Kidney damage (presence of structural abnormalities and/or persistent haematuria, proteinuria or microalbuminuria) for ≥3 months
3A	45 to 59	Moderately reduced GFR ± other evidence of kidney damage	GFR <60 ml/min for ≥3 months ± kidney damage
3B	30 to 44	Moderately reduced GFR ± other evidence of kidney damage	GFR <60 ml/min for ≥3 months ± kidney damage
4	15 to 29	Severely reduced GFR ± other evidence of kidney damage	GFR <60 ml/min for ≥3 months ± kidney damage
5	<15	Established kidney failure	GFR <60 ml/min for ≥3 months ± kidney damage

Recommendations for research

As part of the 2024 update, the guideline committee made a new recommendation for research (marked **[2024]**). Recommendations for research retained from previous updates are labelled **[2019]** and **[2013]**.

Key recommendations for research

1 Risk factor-based screening tool for adults having iodine-based contrast media

What validated risk assessment tools could be used to predict the occurrence of contrast-associated acute kidney injury following the administration of intravenous iodine-based contrast media? **[2024]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on assessing risk factors in adults having iodine-based contrast media.

Full details of the evidence and the committee's discussion are in evidence review B: risk prediction tools and eGFR for the prediction of iodine-based contrast media-associated acute kidney injury.

2 Risk stratification for contrast-induced acute kidney injury

Can risk of contrast-induced acute kidney injury be stratified by eGFR thresholds? **[2019]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on preventing acute kidney injury in adults having iodine-based contrast media.

Full details of the evidence and the committee's discussion are in evidence review A: preventing contrast-induced acute kidney injury.

3 Different oral fluids and oral fluid regimens

What is the relative effectiveness and cost effectiveness of different oral fluids and different oral fluid regimens, both with and without oral N-acetylcysteine, at preventing contrast-induced acute kidney injury? **[2019]**

For a short explanation of why the committee made this recommendation for research, see the rationale section on preventing acute kidney injury in adults having iodine-based contrast media.

Full details of the evidence and the committee's discussion are in evidence review A: preventing contrast-induced acute kidney injury.

4 Long-term outcomes of acute kidney injury

What are the long-term outcomes of acute kidney injury in adults, children and young people? **[2013]**

5 Rapid referral to nephrology services for moderate to severe acute kidney injury

What is the clinical and cost effectiveness of rapid referral (within 12 hours) to nephrology services for adults with moderate to severe (stage 2 to 3) acute kidney injury not needing critical care? **[2013]**

6 Definition of acute kidney injury – system for staging and detection

Can a simplified definition and staging system, based on Système International (SI) units, be used to predict short- to medium-term outcomes in acute kidney injury? **[2013]**

Other recommendations for research

7 Introducing renal replacement therapy

What is the clinical and cost effectiveness of early versus later introduction of renal replacement therapy in patients with acute kidney injury stages 2 and 3, when there is no urgent need for therapy? **[2013]**

8 Preventing deterioration

What is the clinical and cost effectiveness of continuing ACE inhibitor or ARB treatment, versus stopping treatment 24 hours before cardiac surgery and resuming 24 hours after, in people with chronic kidney disease and an eGFR of less than 30 ml/min/1.73m^2? **[2013]**

Rationale and impact

This section briefly explains why the committee made the recommendations and how they might affect practice. It links to details of the evidence and a full description of the committee's discussion.

Assessing risk factors in adults having iodine-based contrast media

Recommendations 1.1.5 to 1.1.12

Why the committee made the recommendations

The evidence for the accuracy of risk assessment tools or questionnaires to predict an acute kidney injury after administration of iodine-based contrast media was lacking in both quantity and quality. The majority of the risk prediction tools were included in a small number of studies, with low numbers of participants and a younger population than would usually be seen in practice, so limiting the certainty of their accuracy. Therefore, the committee made recommendations based on their knowledge and expertise. They also made a recommendation for research on what validated risk assessment tools should be used to predict contrast-associated acute kidney injury following intravenous iodine-based contrast media.

The evidence for the prognostic accuracy of estimated glomerular filtration rate (eGFR) for iodine-based contrast media-associated acute kidney injury showed that a lower eGFR is associated with an increased risk of acute kidney injury. No evidence was found comparing an eGFR threshold of 30 ml/min/1.73 m^2 with the currently recommended threshold of 40 ml/min/1.73 m^2. However, the committee agreed that an increased risk is associated with an eGFR less than 30 ml/min/1.73 m^2, and this is currently used to indicate poor kidney function.

In current practice, a person is required to have an eGFR test in the 3 months before undergoing contrast media CT scanning. This often results in delayed scans and increases the burden on patients and clinicians to conduct blood tests that may not be needed. In non-emergency settings, the committee agreed that if an eGFR test from within the past

6 months is available, this should be used to support decisions on contrast media scans. Using an eGFR from the previous 6 months as a reference would be an acceptable reflection of a person's eGFR at the time of iodine-based contrast media use if the person had been clinically stable since the last test. If a recent eGFR is not available, screening questions could be used to assess risk. By including initial questions on pre-existing kidney disease, a large proportion of people would not need blood tests. This is a simple assessment, and if the responses indicate a history of kidney disease, this should prompt clinicians to consider requesting an eGFR test.

The committee noted that people known to have kidney disease would usually have an eGFR result from the past 6 months, because people with a long-term chronic illness are more likely to have regular blood tests to monitor their condition. If a person is acutely unwell at the time of contrast use, an up-to-date blood test would be expected as part of normal practice.

In life-threatening or emergency situations, risk prediction tools should not be applied, and iodine-based contrast media should be administered without delay, if the risk of delaying is likely to be clinically significant.

How the recommendations might affect practice

The recommendations in this update are likely to reduce the volume of eGFR testing, with a set of screening questions removing the need for an eGFR test in people who have a low risk of kidney disease. The recommendation to use an eGFR value from the past 6 months will further reduce the need for testing, resulting in fewer scans being cancelled at short notice.

The committee noted that in practice, clinicians currently use a threshold of 30 ml/min/1.73 m^2, despite NICE having recommended 40 ml/min/1.73 m^2. Therefore, the new threshold of 30 ml/min/1.73 m^2 is not expected to cause a significant change in practice and may further reduce the need for scan cancellations where clinicians had previously followed NICE guidance. Because only people with the greatest risk would need an eGFR test, this new threshold would be cost saving to the NHS because of the reduction in eGFR testing.

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Preventing acute kidney injury in adults having iodine-based contrast media

Recommendations 1.2.7, 1.2.8 and 1.2.10

Why the committee made the recommendations

For adults undergoing procedures with intravenous iodine-based contrast media, the evidence showed that oral fluids were as good as intravenous fluids at preventing contrast-induced acute kidney injury. The evidence did not show that any particular type of oral or intravenous fluids is most effective.

The committee agreed that intravenous fluids are not necessary for outpatients who are usually at a lower risk of contrast-induced acute kidney injury. It also agreed that only inpatients at particularly high risk needed intravenous fluids. Most of the risk factors were agreed when the 2013 version of the guideline was developed – apart from the level of eGFR, which was based on the committee's clinical knowledge and experience in the 2019 update of this section. The committee also agreed that, based on their experience and expertise, the risk for intra-arterial administration depends on the site of the injection, and is particularly high with first-pass renal exposure because the contrast medium passes into the kidneys relatively undiluted.

For inpatients at particularly high risk of contrast-induced acute kidney injury, economic modelling showed that intravenous volume expansion with a regimen containing intravenous sodium chloride 0.9% and/or intravenous sodium bicarbonate provides best value.

Based on the evidence, the committee decided that intravenous volume expansion should be used only for inpatients at particularly high risk and that oral hydration should be encouraged in all other adults at increased risk of contrast-induced acute kidney injury.

The committee agreed that more research on estimating the risk of contrast-induced acute kidney injury would help to inform future guidance, so made a recommendation for research on the use of eGFR thresholds to stratify risk.

Although the committee agreed that oral hydration regimens were non-inferior to intravenous hydration regimens at preventing contrast-induced acute kidney injury, there

was not enough comparative data to enable them to be clear about which oral fluid (if any) was most effective. There was some limited evidence that N-acetylcysteine was not beneficial. However, the committee agreed that, in the absence of evidence of harm, this was not sufficient to make a recommendation to restrict its use. Therefore, it made a recommendation for research on different oral fluids and different oral fluid regimens, with and without N-acetylcysteine.

The committee did not consider it necessary for all patients being offered iodine-based contrast media to be routinely discussed with a nephrology team, but concluded that this was important for adults on renal replacement therapy, including people with a kidney transplant. The radiology team responsible for administering the contrast medium or the healthcare professional offering the procedure, such as a cardiologist, would usually do this. For people with other contraindications to intravenous fluids, the committee agreed that the decision to give iodine-based contrast media was better made by individual healthcare professionals.

How the recommendations might affect practice

The recommendations may result in lower resource use for outpatient procedures because people will not need to be admitted to hospital to be given intravenous fluids for volume expansion before they are given a contrast medium.

The recommendation on intravenous volume expansion reflects current practice so there should be no change in practice for inpatients who are at particularly high risk of contrast-induced acute kidney injury. There may be reduced resource use for lower risk inpatients who will not need intravenous fluids.

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Context

Acute kidney injury, previously known as acute renal failure, encompasses a wide spectrum of injury to the kidneys, not just kidney failure. The definition of acute kidney injury has changed in recent years, and detection is now mostly based on monitoring creatinine levels, with or without urine output. Acute kidney injury is increasingly being seen in primary care in people without any acute illness, and awareness of the condition needs to be raised among primary care health professionals.

Acute kidney injury 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 acute kidney injury. The number of inpatients affected by acute kidney injury means that it has a major impact on healthcare resources. The costs to the NHS of acute kidney injury (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.

There have been concerns that suboptimal care may contribute to the development of acute kidney injury. In 2009, the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) reported the results of an enquiry into the deaths of a large group of adults with acute kidney injury. This described systemic deficiencies in the care of people who died from acute kidney injury: only 50% of these had received 'good' care. Other deficiencies in the care of people who died of acute kidney injury included failures in acute kidney injury prevention, recognition, therapy and timely access to specialist services. This report led to the Department of Health's request for NICE to develop its first guideline on acute kidney injury in adults and also, importantly, in children and young people.

This guideline emphasises early intervention and stresses the importance of risk assessment and prevention, early recognition and treatment. It is primarily aimed at the non-specialist clinician, who will care for most people with acute kidney injury in a variety of settings. The recommendations aim to address known and unacceptable variations in recognition, assessment, initial treatment and referral for renal replacement therapy. The inpatient mortality of acute kidney injury varies considerably, depending on its severity, setting (intensive care or not), and many other patient-related factors, but in the UK might typically be 25% to 30% or more. In view of its frequency and mortality rate, prevention or amelioration of just 20% of cases of acute kidney injury would prevent a large number of

deaths and substantially reduce complications and their associated costs.

In 2023, the NICE surveillance team reported that the recommendation to measure eGFR in all adults with risk factors for acute kidney injury before a contrast scan may lead to unnecessary cancellation of CT scans. In addition, concerns about the risk of iodine-based contrast media have decreased since the recommendations were originally developed. Not all people need eGFR testing before having a scan, but it should be restricted to those at greatest risk. There is also a view that the current eGFR risk threshold is too high. Some recent evidence has shown that contrast media may only pose a risk for people with an eGFR of 30 ml/min/1.73 m^2 or less. The NICE recommendations were developed in 2013, and since then, several external guidelines have moved away from a 'test all' position to a risk stratification policy. This allows a more personalised consideration of the risks of iodine-contrast media versus the benefits from the scan. The 2024 guideline update has made new recommendations on assessing risk factors for acute kidney injury in adults having iodine-based contrast media.

Finding more information and resources

To find NICE guidance on related topics, including guidance in development, see the NICE topic page on acute kidney injury.

For full details of the evidence and the guideline committee's discussions, see the evidence reviews. You can also find information about how the guideline was developed, including details of the committee.

NICE has produced tools and resources to help you put this guideline into practice. For general help and advice on putting NICE guidelines into practice, see resources to help you put guidance into practice.

Update information

October 2024: We have reviewed the evidence and made new and updated recommendations, and a recommendation for research, on risk factors for acute kidney injury in adults having iodine-based contrast media. These recommendations are labelled **[2024]**.

We have also made the following changes:

The eGFR for adults with chronic kidney disease in recommendation 1.2.9 was changed from less than 40 ml/min/1.73 m^2 to less than 30 ml/min/1.73 m^2 for consistency with the rest of the guideline. This is labelled **[2013, amended 2024]**.

The term 'contrast-induced kidney injury' was updated to 'contrast-associated acute kidney injury' in recommendation 1.2.7 in line with current terminology.

A link to our guideline on decision making and mental capacity was added to recommendation 1.6.1.

December 2019: We have reviewed the evidence and made new recommendations on preventing acute kidney injury in adults having iodine-based contrast media. These recommendations are marked **[2019]**.

Recommendations marked **[2013]** last had an evidence review in 2013. In some cases minor changes have been made to the wording to bring the language and style up to date, without changing the meaning.

Minor changes since publication

October 2021: We added a link to NICE's guideline on shared decision making, in recommendations 1.5.7, 1.5.10 and 1.6.1.

September 2021: In recommendation 1.3.1 we added a cross-reference to an algorithm endorsed by NHS England for early identification of acute kidney injury.

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