GUIDELINES FOR PREVENTION OF CONTRAST INDUCED ACUTE KIDNEY INJURY IN CORONARY ANGIOGRAPHY AND ANGIOPLASTY IN ADULTS

This guidance does not override the individual responsibility of health professionals to make appropriate decision according to the circumstances of the individual patient in consultation with the patient and /or carer. Health care professionals must be prepared to justify any deviation from this guidance.

Introduction

Coronary angiogram and angioplasty are commonly used and relatively safe but there are subgroups of patients for whom the administration of iodinated contrast media poses increased risk.

This Guideline is for Use by the Following Staff Groups:

All clinicians and staff groups looking after patients who undergo coronary angiography and angioplasty.

Lead Clinician(s) Dr Helen Routledge	Consultant Cardiologist
Approved by Cardiology Directorate Meeting on:	15th October 2025
Review Date: This is the most current document and should be used until a revised version is in place	15th October 2028

Key amendments to this guideline

Date	Amendment	Approved by:
15th October 2025	Approved by Cardiology Directorate Committee	Dr Trevelyan

Introduction

Contrast-induced Acute Kidney Injury (CI-AKI) is an iatrogenic renal injury caused by intravascular administration of contrast media (CM) in susceptible individuals. The first description of CI-AKI was during the 1950s in case reports of fatal acute kidney injury following intravenous pyelography in patients with renal disease.[1] Despite many advances in technology, CI-AKI remains a cause of hospital-acquired acute kidney injury (AKI).[2]

The adoption of primary PCI for the treatment of STEMI, significantly improves cardiovascular outcomes but has increased the incidence of CI-AKI due to the inherent difficulties in rapidly assessing CI-AKI risk and instigating prophylactic measures, the haemodynamic compromise and often higher contrast volumes used. These are all known risk factors for CI-AKI.

Pre-existent CKD3, defined as an estimated glomerular filtration rate (eGFR)<60 mL/min/1.73 m2 for greater than 3 months, is the most commonly identified risk factor for CI-AKI. CI-AKI can occur with no underlying CKD if other risk factors are present.

Definition & Staging of CI-AKI

The incidence of CI-AKI is 1-2%. It occurs within 72 hours of receiving contrast media and usually recovers over the following five days.[3] **It is important to exclude other causes of AKI in unwell patients admitted acutely.**[4]

The international kidney disease: Improving Global Outcomes definition of contrast induced-acute kidney injury (CI-AKI)[6] is when one of the following criteria is met:

- Serum creatinine rises by ≥ 26micromol/L within 48 hours **or**
- Serum creatinine rises ≥ 1.5-fold from the baseline value, within one week **or**
- urine output is < 0.5ml/kg/hr for >6 consecutive hours

CI-AKI Stage	Serum creatinine (Cr) criteria	Urine output criteria
1	increase ≥ 26 micromol/L within 48hrs or increase ≥1.5- to 1.9 X baseline Cr	<0.5 mL/kg/hr for > 6 consecutive hrs
2	increase ≥ 2 to 2.9 X baseline Cr	<0.5 mL/kg/ hr for > 12 hrs
3	increase ≥3 X baseline Cr or * Increase 354 micromol/L or commenced on renal replacement therapy (RRT) irrespective of stage	<0.3 mL/kg/ hr for > 24 hrs or anuria for 12 hrs

Risk Assessment

Stable patients identified as high risk may be discussed with a renal physician to assess the individual risk/benefit associated with a specific procedure. In some patients the risk of CI-AKI is outweighed by the potential benefit from the procedure; this should be explained to the patient. Imaging should not be delayed if the benefit of early imaging outweighs the risk of waiting.

The risk of CI-AKI is low, 1-2% in patients with normal kidney function.[3]

The risk of CI-AKI is as high as 25% in patients with a combination of CKD; diabetes, cardiac failure, older age and exposure to nephrotoxic drugs.[8] Acutely ill patients with sepsis and/or hypotension are particularly vulnerable.

Risk factors for patients developing CI-AKI[10]

- **Chronic kidney disease** **eGFR < 60 mls/min/1.73m2[9]
- **Prior exposure to iodinated contrast** (angiogram or CT on this admission?)
- **Age > 75 years**
- **Chronic heart failure, (NYHA III/IV** or recent pulmonary oedema)
- **Nephrotoxic medication**
  - NSAIDs - Naproxen, Ibuprofen, Diclofenac, Celecoxib
  - Antibiotics - Aminoglycosides – Gentamicin, Tobramycin, Amikacin
  - Antifungals – Amphotericin B & Antivirals - Aciclovir, Tenofovir, Foscarnet
  - Immunomodulatory – Ciclosporin A
  - Antineoplastic - Cisplatin, Ifosfamide, Mitomycin
- **Hypotension** (SBP <80 mm/Hg / inotropic support / IABP)
- **Anaemia** (male: HCT<0.39, female: HCT<0.36)
- **Large contrast volume**

***[eGFR can only be applied to patients with stable kidney function, not in patients with AKI].*

Strategies to Prevent CI-AKI

IV fluids: It is recommended that all patients with CKD who undergo coronary interventions should receive preventive hydration with sodium chloride 0.9%.[11,16] Although the randomised data is inconsistent in demonstrating a benefit (and there is limited data comparing isotonic with hypotonic saline[12] or with sodium bicarbonate.[13,14]); given the known impact of low circulating volumes on the risk, there is still consensus that adequate hydration is likely to prevent CI-AKI.

Other measures: the PRESERVE (Prevention of Serious Adverse Events Following Angiography) trial failed to show any benefit of intravenous bicarbonate over intravenous sodium chloride 0.9%, or of oral acetylcysteine over placebo, for the prevention of death or need for dialysis. There is some evidence that high-dose statins are also beneficial.[15] Since they are indicated for all undergoing coronary revascularization irrespective of the risk of CI-AKI, no specific recommendation for CI-AKI is needed. No other strategies for the prevention of CI-AKI have sufficient evidence to justify a recommendation in favour or against.

Details of Guideline[18]

1. *All patients* should be assessed for the risk of contrast-induced nephropathy.
2. **Renal function is checked within 7 days for inpatients, within 3 months for outpatients and elective procedures.**
3. Adequate hydration is recommended pre procedure (see below)
4. **Nephrotoxic medications are withheld if appropriate**
5. Patients with 2 or more CI-AKI risk factors **or** > 200mls contrast used should have their **creatinine re-assessed** at **48-72 hours post-procedure**.
6. If CI-AKI diagnosis criteria is met, liaise with Nephrologists.

*Patients with **moderate or severe CKD** (stages 3b and 4)*

7. Use of **low-osmolar or iso-osmolar contrast media** is recommended.
8. The volume of contrast media should be minimized. **Total contrast volume <350 mL or <4 mL/kg or Total contrast volume/GFR <3.7** is recommended.
9. Pre- and post-hydration with sodium chloride 0.9% should be considered if the expected contrast volume is >100 mL. A standard protocol would be **1 mL/kg/h for 12 hours' pre-procedure** and continued **for 24 hours post procedure**.
10. For **elective day case patients** or for those with **CCF** in whom large volumes of intravenous fluid may provoke pulmonary oedema, it is also reasonable to use a shorter duration and volume of sodium chloride 0.9% **ie 3 mL/kg/h for 1 hour pre-procedure and 1 mL/kg/h for 6hr post-procedure**.
11. In statin-naïve patients, pre-treatment with **high dose statins** should be considered. (atorvastatin 80 mg or rosuvastatin 20mg/40mg)
12. If eGFR <60: Stop Metformin (ideally for 24 hours prior to and 48 hours after the procedure.[20,21]

*Patients with **severe CKD** (National Kidney Foundation stage 4)*

13. Prophylactic haemofiltration 6 hours before complex PCI may be considered

In dialysis dependent patients or those inevitably requiring dialysis within weeks to months there is less concern re contrast nephropathy, but the concern remains regarding fluid overload precipitated by a contrast procedure. Such patients should be discussed with a nephrologist.

Monitoring

Page/ Section of Key Document	Key control:	Checks to be carried out to confirm compliance with the Policy:	How often the check will be carried out:	Responsible for carrying out the check:	Results of check reported to: (Responsible for also ensuring actions are developed to address any areas of non-compliance)	Frequency of reporting:
	WHAT?	HOW?	WHEN?	WHO?	WHERE?	WHEN?
P1	These are the 'key' parts of the process that we are relying on to manage risk. We may not be able to monitor every part of the process, but we MUST monitor the key elements, otherwise we won't know whether we are keeping patients, visitors and/or staff safe.	What are we going to do to make sure the key parts of the process we have identified are being followed? (Some techniques to consider are; audits, spot-checks, analysis of incident trends, monitoring of attendance at training.)	Be realistic. Set achievable frequencies. Use terms such as '10 times a year' instead of 'monthly'.	Who is responsible for the check? Is it listed in the 'duties' section of the Policy? Is it in the job description?	Who will receive the monitoring results? Where this is a committee the committee's specific responsibility for monitoring the process must be described within its terms of reference.	Use terms such as '10 times a year' instead of 'monthly'.
P2	Patient suitability and risk assessment for CI-AKI	Review renal function GFR/Creatinine, identify risk factors. Risk vs benefit decision documented	Prior to contrast administration	Cardiologist	Cath Lab/Ward ICE Cardiology Directorate	Reviewed prior to procedure and if clinical condition changes
P3	Baseline renal monitoring	Check U&Es. Confirm GFR Annual AUDITS	On admission/pre procedure	Cardiologist	Cath Lab/Ward ICE Cardiology Directorate	Recheck post procedure

						as per protocol
P3	Prevention of CI-AKI	Implement hydration plan as prescribed. Withold nephrotoxic medication where appropriate. Minimise contrast used	Prior and during procedure	Cardiologist	Cath Lab/Ward	Ongoing throughout admission
P4	Contrast administration and documentation	Documentation	Post procedure	Cardiologist Radiographer	Cardiology Directorate	Reviewed post procedure
P4	Post procedure renal monitoring including urine output	Documentation	Post Procedure	Cardiologist Cath Lab, Ward nurses	Cardiology Directorate	Repeat U&Es at 72 hours post procedure
P4	Escalation of deteriorating renal function and specialist input	Documentation	Immediately	Cath Lab, Ward Nurses	Datix monitoring and review Cardiology Directorate	Immediate Each time a reportable issue occurs

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Contribution List

This key document has been circulated to the following individuals for consultation:

Name	Designation
Dr Trevelyan	Cardiology Consultant
Dr Routledge	Cardiology Consultant
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Dr Shaikh	Cardiology Consultant
Sarah Grave	Cath Lab Sister
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Dr Lin Thiri Toon	Cardiology Registrar

This key document has been circulated to the chair(s) of the following committee's / groups for comments:

Committee
Cardiology Directorate Meeting

Supporting Document 1 - Equality Impact Assessment Tool

Equality and Health Inequalities Impact Assessment (EHIA) Tool

Herefordshire & Worcestershire STP - Equality and Health Inequalities Impact Assessment (HEIA) Form
Please read HEIA guidelines when completing this form

Section 1 - Name of Organisation (please tick)

Herefordshire & Worcestershire STP		Herefordshire Council	
Worcestershire Acute Hospitals NHS Trust	✓	Worcestershire County Council	
Worcestershire Health and Care NHS Trust		Wye Valley NHS Trust	
Other (please state)			

Name of Lead for Activity	**Dr Routledge**

Details of individuals completing this assessment	**Name**	**Job title**	**e-mail contact**
Date assessment completed			

Section 2

Activity being assessed (e.g. policy/procedure, document, service redesign, policy, strategy etc.)	**Title:** **GUIDELINES FOR PREVENTION OF CONTRAST INDUCED ACUTE KIDNEY INJURY IN CORONARY ANGIOGRAPHY AND ANGIOPLASTY IN ADULTS**
What is the aim, purpose and/or intended outcomes of this Activity?	The aim of this guideline is to reduce the incidence of contrast induced kidney injury in patients undergoing coronary angioplasty. This guideline provides a standardised approach to prevention, monitoring and escalation of care to promote patient safety, and improve clinical outcomes.

Who will be affected by the development & implementation of this activity?	❑ ✓ ❑ ❑	Service User Patient Carers Visitors	❑ ❑ ❑ ❑	Staff Communities Other _____
Is this:	✓ Review of an existing activity ❑ New activity ❑ Planning to withdraw or reduce a service, activity or presence?			
What information and evidence have you reviewed to help inform this assessment? (Please name sources, eg demographic information for patients / services / staff groups affected, complaints etc.	Trust guidelines Clinical experience within Cath lab, CCU Datix reporting and review			
Summary of engagement or consultation undertaken (e.g. who and how have you engaged with, or why do you believe this is not required)	This guideline has been reviewed by the cardiology directorate, Cath lab and CCU teams.			
Summary of relevant findings	This guideline aims to identify patients at increased risk of CK-AKI and promotes strategies that improve patient safety.			

Section 3

Please consider the potential impact of this activity (during development & implementation) on each of the equality groups outlined below. **Please tick one or more impact box below for each Equality Group and explain your rationale**. Please note it is possible for the potential impact to be both positive and negative within the same equality group and this should be recorded. Remember to consider the impact on e.g. staff, public, patients, carers etc. in these equality groups.

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
Age	X			Elderly patients are more at risk of CK-AKI
Disability	X			Patients with disabilities may have high higher rates of co-morbidities
Gender Reassignment		X		This guideline applies equally to all patients regardless of their gender identity
Marriage & Civil Partnerships		X		Marital or civil partnership does not affect this guideline
Pregnancy & Maternity		x		This guideline applies to adult patients undergoing coronary angioplasty. Pregnant patients would be managed under specialised pathways

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
Race including Traveling Communities		X		This guideline applies to adult patients undergoing coronary angioplasty
Religion & Belief		X		This guideline does not conflict with religious or beliefs symptoms
Sex	x			Both male and female patients are supported equally by this guideline
Sexual Orientation		X		This guideline applies equally to all patients regardless of their sexual orientation
Other Vulnerable and Disadvantaged Groups (e.g. carers; care leavers; homeless; Social/Economic deprivation, travelling communities etc.)		X		
Health Inequalities (any preventable, unfair & unjust differences in health status between groups, populations or individuals that arise from the unequal distribution of social, environmental & economic conditions within societies)		X		Patients experiencing health inequalities may have higher rates of comorbidities such as chronic kidney disease. This guideline supports early identification of risk

Section 4

What actions will you take to mitigate any potential negative impacts?	Risk identified	Actions required to reduce / eliminate negative impact	Who will lead on the action?	Timeframe
	Inconsistent use of guideline	Staff education and awareness of CI-AKI risk assessment and monitoring requirements	Clinical lead	Ongoing
	Variation in monitoring compliance	*Audit of contrast documentation*	*Clinical lead Governance*	As per audits
How will you monitor these actions?	Compliance will be monitored trough audits, and Datix reporting and routine governance meetings within cardiology			
When will you review this HEIA? (e.g in a service redesign, this	If there is a change in national guideline, local policy or service redesign			

HEIA should be revisited regularly throughout the design & implementation)	

Section 5 - Please read and agree to the following Equality Statement

1. Equality Statement

1.1. All public bodies have a statutory duty under the Equality Act 2010 to set out arrangements to assess and consult on how their policies and functions impact on the 9 protected characteristics: Age; Disability; Gender Reassignment; Marriage & Civil Partnership; Pregnancy & Maternity; Race; Religion & Belief; Sex; Sexual Orientation
1.2. Our Organisations will challenge discrimination, promote equality, respect human rights, and aims to design and implement services, policies and measures that meet the diverse needs of our service, and population, ensuring that none are placed at a disadvantage over others.
1.3. All staff are expected to deliver services and provide services and care in a manner which respects the individuality of service users, patients, carer's etc, and as such treat them and members of the workforce respectfully, paying due regard to the 9 protected characteristics.

Signature of person completing HEIA	
Date signed	
Comments:	
Signature of person the Leader Person for this activity	
Date signed	
Comments:	

Supporting Document 2 – Financial Impact Assessment

To be completed by the key document author and attached to key document when submitted to the appropriate committee for consideration and approval.

	Title of document:	Yes/No
1.	Does the implementation of this document require any additional Capital resources	No
2.	Does the implementation of this document require additional revenue	No
3.	Does the implementation of this document require additional manpower	No
4.	Does the implementation of this document release any manpower costs through a change in practice	No
5.	Are there additional staff training costs associated with implementing this document which cannot be delivered through current training programmes or allocated training times for staff	No
	Other comments:	

If the response to any of the above is yes, please complete a business case and which is signed by your Finance Manager and Directorate Manager for consideration by the Accountable Director before progressing to the relevant committee for approval.