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The following guidelines have been developed following review of other hospital and national guidelines.

1. Introduction

The development of acute renal failure (ARF) is a significant complication of intravascular contrast medium (CM) use. Prospective studies of patients admitted with ARF have demonstrated that intravascular contrast medium was responsible in 11 – 14.5% of cases. Thus contrast induced nephropathy (CIN) is a relatively common cause of ARF. The increasing use of CM in an aging population in which there is an increasing incidence of chronic kidney disease (CKD) will result in an increasing incidence of CIN. The two most common procedures associated with CIN are contrast enhanced CT and coronary angiography. The following protocol is drawn from other research and published guidance and is aimed at reducing the risk of CIN within patients scanned in the trust.

In patients in whom CM administration is anticipated, initial assessment and appropriate precautions should be taken in those with renal impairment.

2. Renal Function Assessment

Renal function and impairment can be defined in several ways including serum creatinine levels, creatinine clearance and Glomerular Filtration Rate (GFR). The eGFR is an estimate of GFR and can be estimated from several factors including serum creatinine levels and the patient’s age. At St Helens and Knowsley NHS Trust the eGFR is available on U&E results and thus is widely available. The referring clinician is responsible for providing the radiology department with an e GFR result where applicable.

3. Definition of Contrast Induce Nephropathy CIN

CIN is an acute deterioration in renal function that occurs 24-48 hours after contrast media administration. The most common definition is a rise in serum creatinine of 25% above the previous baseline without any other adequate explanation. In most patients the serum creatinine returns to normal within 14 days but some patients progress to ARF.

CIN is one of the most serious adverse effects that can occur with CM administration. It is associated with increased mortality and morbidity rates and increased length of stay.

The presence of chronic kidney disease (CKD) is the most important predictor of the incidence of CIN associated with CM administration. The risk can be further stratified. Prior to CM use patients should be assessed for the presence of pre-existing risk factors as in the following table.

4. Risk Factors for Development of CIN

Diabetes
Existing renal disease or single kidney
Sepsis or acute hypotension
Age>70 years
Dehydration
Chemotherapy
Ischaemic Heart disease
5. Risk Assessment

Risk Assessment for Likelihood of CIN should be based on eGFR measurement as below:

- eGFR >60 ml/min: normal or near normal renal function. Low risk for CIN. No specific prophylaxis or follow up required.
- eGFR 30 – 60ml/min : moderate renal impairment and low to moderate risk of CIN
- eGFR < 30ml/min: severe renal impairment with high risk for CIN
- eGFR < 15ml/min: renal failure. Usually on dialysis

Patients who are recovering from Acute Tubular Necrosis (ATN) from whatever cause are at higher risk of developing CIN.

6. Strategies for Reducing the Risk of CIN Development

These include:

- Risk factor reduction: eg stop NSAIDS and other nephrotoxic drugs
- Fluid administration: oral or iv depending on circumstances to improve renal perfusion
- Volume of CM given. Risk of CIN increases with increasing quantity used.
- Use of low-osmolar CM in patients with impaired renal function. The previous recommendation of using an iso-osmolar agent (eg Visipaque) cannot now be justified
- Use of N-Acetylcysteine: evidence not clear cut but can be recommended. Can be given orally

7. Guidance on Management of the Patient

The following appendices give guidance regarding management of patients attending for imaging where CM is used or likely to be used. They include management pathways for patients with different levels of renal impairment. In the emergency situation obviously the necessity for prompt scanning may preclude knowledge of eGFR or institution of any renal protective measures prior to scanning. Clinicians however should be aware of any potential risks.
RISK ASSESSMENT FOR DEVELOPMENT OF CIN

UNDER 65 YEARS OLD

Assess Risk of renal impairment

- History of renal disease: YES/NO
- Prior kidney surgery: YES/NO
- Hypertension: YES/NO
- Gout: YES/NO
- Diabetes Mellitus: YES/NO

If the answer to any of the questions is YES, then measuring e-GFR is a mandatory requirement for in-patient
Within 3 months for out-patients

OVER 65 YEARS OLD

Measuring e-GFR is a mandatory requirement

e-GFR

Must be within 1 week of the examination for in-patient
Within 3 months for out-patients

ORAL PREHYDRATION

Recommended for all patients
100 ml/hour for 3 hours before roughly equivalent to three cups of tea or other liquid
**APPENDIX 2**

**MANAGING THE RISK OF CIN**

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**e-GFR 30-59 ml/min (CKD 3)**

The management depends on the expected volume of IVCM and route delivery

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**e-GFR 30-59 ml/min (CKD 3)**

**Intravenous contrast medium <100ml**

Stop Metformin on day of test

Limit does of contrast medium to <100ml

Stop NSAIDS where possible for one day before and two days after

Premedication with N-acetyl cysteine (Parvolex) not required

Oral prehydration 100ml/hour for 3 hours before and 6 hours after, equivalent to 3 cups of water/tea before and 5 cups afterwards

Recheck e-GFR* at 48-72 hours post-procedure if the patient is on Metformin

If the patient does not take Metformin the e-GFR post-procedure does not need to be repeated

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**e-GFR 30-59 ml/min (CKD 3)**

**Intra-arterial IVCM or intravenous dose > 100ml**

Stop Metformin on day of test

Limit does of contrast medium as much as possible

Stop NSAIDs for one day before and two days after

Premedication with N-acetyl cysteine (Parvolex) not required

IV volume expansion for 3 hours before and 6 hours after exposure with 1.5ml/kg/hour IV isotonic crystalloid (as long as the fluid balance status will allow this).

Recheck e-GFR* at 48-72 hours in all patients

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* If the e-GFR has decreased by 20% or more then further ‘renal’ treatment may be required. The referring clinicians should be involved in this.
MANAGING THE RISK OF CIN

**e-GFR <30 ml/min (CKD 4 and 5)**

The management depends is the same regardless of the route of delivery and expected volume of IVCM.

This management strategy also applies to patients on dialysis (CAPD or haemodialysis) who pass urine with a volume >500ml/24 hours.

**e-GFR <30 ml/min (CKD 4 and 5)**

**Elective imaging**

Consider alternative investigations – US, MR, MRA (non contrast)

Nephrology consultation and dialysis planning

Stop Metformin on day of test if the patient is taking this and refer to Diabetes nurse as the patient should not be taking Metformin

Limit dose of contrast medium as much as possible

Stop NSAIDs for 24 hours before and for 48 hours after

Premedication with oral N-acetyl cysteine (Parvolax) IS required (600mg bd on day before and day of imaging)

IV volume expansion for 3 hours before and 6 hours after exposure with 1.5ml/kg/hour IV isotonic crystalloid (as long as the fluid balance status allows this). These patients will require prior admission to allow this

Recheck e-GFR* at 48-72 hours in all patients

**e-GFR <30 ml/min (CKD 4 and 5)**

**Emergency imaging**

Discuss with clinician prior to scan RE risks and planning for possible acute renal failure

Stop Metformin if the patient is taking this and refer to Diabetes nurse as the patient should not be taking Metformin

Limit dose of contrast medium as much as possible

Stop NSAIDs for 48 hours after

Oral N-acetyl cysteine (Parvolex) should be given for one day following the exposure (600mg bd)

Maintain hydration after the investigation

Recheck e-GFR* at 24 and 72 hours in all patients

* If the e-GFR has decreased by 20% or more then further ‘renal’ treatment may be required. The referring clinicians should be involved in this.