Subject: Clinical guidelines to reduce the risk of contrast induced nephropathy

Objective: To implement all possible measures to reduce the risk of nephropathy from intravascular contrast media. Trust wide.

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Introduction/ Background:

Contrast nephropathy can occur in any patient who receives intravenous or intra-arterial contrast. There are measures available to reduce this complication and should be targeted at those patients who have pre-existing risk factors.

At the same time, the risk of contrast nephropathy should not delay imaging in emergency situations. This guideline is designed to help clinicians undertake such interventions in a safe and timely manner.

Exceptions:

Avoid IV fluids in patients who are volume overloaded.

Avoid N Acetylcysteine [NAC] in patients with a history of allergic reactions to NAC.

Continue nephrotoxic drugs if the risk of stopping them outweighs the risk of kidney injury and there are no safe alternatives.
Reduction of Contrast Nephropathy Risk:

In any patient with known renal dysfunction and eGFR < 60 ml/min, consider non-contrast imaging. If the use of iodinated contrast is unavoidable, employ the smallest effective dose of iso/hypo-osmolar, non-ionic contrast. If it is necessary to use Gadolinium as a contrast agent, use the smallest effective dose of a cyclic Gadolinium compound. Only hydration is required for Gadolinium studies, not NAC or Sodium bicarbonate. Space contrast studies at least 48 hrs apart.

Stop all potential nephrotoxins for 48 hrs post procedure (if clinically appropriate).

(eg NSAIDs, COX2 inhibitors, ACE inhibitors, angiotensin receptor blockers, diuretics, aminoglycosides)

Metformin: Stop Metformin in patients with eGFR <60ml/min for 48 hours after the procedure. In patients with eGFR >60ml/min, Metformin should be withheld for 48 hours after the procedure if they have received more than 100mL contrast agent or if the intra-arterial route was used to administer the contrast.

**Emergency Imaging**

If Renal Function not known and has risk factors. Treat as high risk. Obtain urgent U&Es

**Stratify Risk According to renal function**

- **High Risk** eGFR < 45 ml/min or AKI
  - If scan can be delayed?
    - Yes
      - Oral hydration 2 litres per day 24 hrs pre to 24 hrs post procedure
    - No
      - If scan with contrast is unavoidable;
        - Give 1200mg oral NAC and 500mg oral NaHCO3 stat,
        - If not overloaded give 250ml 0.9% Saline as a bolus before proceeding to imaging and continue Saline infusion at a rate of 1mL/kg/hour.

- **Low Risk** eGFR 45 - 60ml/min
  - If scan can be delayed;
    - Start oral NAC 600 mg bd, oral NaHCO3 500 mg tds and intravenous 0.9% saline at 1 ml/kg/hour for 12 hours pre imaging

**High risk patients post imaging**

Continue IV 0.9% saline 1 ml/kg/hour for 12 hours post procedure (unless renal function previously unknown and subsequently checked and found to be normal).

Give:
- Oral NAC 600 mg bd for 24 hours post imaging
- Oral NaHCO3 500 mg tds for 24 hours post imaging

Review potential nephrotoxins 48 Hrs post imaging and consider restarting if renal function stable

Check U&Es and eGFR at 24 hours, 72 hours and 5 days post imaging

**Refer to Nephrology post imaging IF**

There is a rise in SeCr of >25micromol/L or drop in eGFR of 25 ml/min or more.

Or

Regarding possible post procedure dialysis IF patient received Gadolinium and eGFR < 30 ml/min

Abbreviations
- NAC = N-Acetyl cysteine
- NaHCO3 = Sodium Bicarbonate
- AKI = Acute Kidney Injury

NAC is an unlicensed medication and will not be available outside pharmacy normal opening hours. If oral NAC is not available the intravenous preparation may be given orally at the same dose.

If patient is nil by mouth give NAC 1gm intravenously in 100ml 0.9% saline on day of contrast and on the day post procedure. In place of 0.9% saline, give 1.26% NaHCO3 IV at a rate of 3 ml/kg/hr for one hour pre and 1ml/kg/hr for 6 hours post procedure and avoid oral NaHCO3.
Reduction of Contrast Nephropathy Risk

Applicable to any patient referred by an Aintree clinician for intravascular contrast – iodinated or gadolinium
[Except for iodinated contrast to study dialysis access or iodinated contrast in anuric dialysis patients]

For Inpatients check U&E’s within 1 week prior to procedure

For Outpatients check U&E’s within 1 month prior to procedure if any of the following apply: Age > 65 yrs, Diabetes Mellitus, Renal dysfunction, Nephrotic, Hypotension, Cardiac failure, Dehydration, Multiple Myeloma, Cirrhosis, Anaemia, Renal Transplant, Diuretics, Nephrotoxins, Se Albumin < 35 g/L,

In any patient with known renal dysfunction and eGFR < 60 ml/min, consider non contrast imaging. If the use of iodinated contrast is unavoidable, employ the smallest effective dose of iso/hypo-osmolar, non-ionic contrast. If it is necessary to use Gadolinium as a contrast agent, use the smallest effective dose of a cyclic Gadolinium compound. Only hydration is required for Gadolinium studies, not NAC or Sodium bicarbonate. Space contrast studies at least 48 hrs apart.

Stop all potential nephrotoxins from 48 hrs pre to 48 hrs post procedure (if clinically appropriate).
(eg NSAIDs, COX2 inhibitors, ACE inhibitors, angiotensin receptor blockers, diuretics, aminoglycosides)

Metformin: Stop Metformin in patients with eGFR <60ml/min for 48 hours before and for 48 hours after the procedure. In patients with eGFR >60ml/min, Metformin should be withheld for 48 hours after the procedure if they have received more than 100mL contrast agent or if the intra-arterial route was used to administer the contrast.

Stratify Risk

<table>
<thead>
<tr>
<th>High risk</th>
<th>Low risk</th>
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<tbody>
<tr>
<td>eGFR &lt;45/ml/min or AKI</td>
<td>eGFR 45 - 60ml/min</td>
</tr>
<tr>
<td>If possible avoid Gadolinium contrast in high risk patients</td>
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</tbody>
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Admit 24 Hrs before imaging
If not overloaded give intravenous 0.9% saline at a rate of 1 ml/kg/hour for 12 hours pre and continue for 12 hours post imaging
Start oral NAC 600 mg bd 24 hours before imaging and continue for 24 hours post imaging
Start oral NaHCO3 500 mg tid for 24 hours before imaging and continue for 24 hours post imaging
Check U&E’s and eGFR at 24 hours, 72 hours and 5 days post imaging

Refer to Nephrology post imaging IF
There is a rise in SeCr of >25micromol/L or drop in eGFR of 25 ml/min or more.
Or
Regarding possible post procedure dialysis IF patient received Gadolinium and eGFR < 30 ml/min

NAC is an unlicensed medication and will not be available outside pharmacy normal opening hours. If oral NAC is not available the intravenous preparation may be given orally at the same dose.

If patient is nil by mouth give NAC 1gm intravenously in 100ml 0.9% saline on day of contrast and on the day post procedure. In place of 0.9% saline, give 1.26% NaHCO3 IV at a rate of 3 ml/kg/hr for one hour pre and 1ml/kg/hr for 6 hours post procedure and avoid oral NaHCO3.

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NaHCO3 = Sodium Bicarbonate

Www.thatbd.com
Appendix A:

Contrast Induced Nephropathy References:


What is contrast induced nephropathy?

Contrast induced nephropathy is an injury to the kidneys caused by some of the substances used to enhance x-ray images. These substances contain iodine and are called contrast materials.

Contrast induced nephropathy usually occurs within 24-48 hours of the x-ray procedure. The kidneys usually recover 7-10 days later but in some cases the damage to the kidneys may be longer lasting.

How does N-Acetylcysteine help to prevent contrast induced nephropathy?

N-Acetylcysteine is an antioxidant. It is thought that an antioxidant may prevent contrast induced nephropathy by neutralizing substances called free radicals which may be harmful to the kidneys. N-Acetylcysteine is an unlicensed medicine.

What is an unlicensed medicine?

The makers of medicines must ask the government for a Product Licence if they want to sell their medicine in the UK. They show the government’s Medicines Regulatory Agency that the medicine works for the illness to be treated and that it does not have too many side effects.

How are medicines tested?

Medicines are tested in clinical trials which are carefully controlled tests to ensure medicines work and are safe.
What are the side effects of N-Acetylcysteine?

Side effects of N-Acetylcysteine are rare and most people do not get any side effects at all.

Occasional side effects (less than 1 in 100 people)
- Headache
- Tinnitus (ringing in the ears)
- Stomatitis (mouth ulcers)

Rare side effects (less than 1 in 1000 people)
- Diarrhoea
- Vomiting
- Heartburn
- Nausea
- Possible increased bleeding

Very rare side effects (less than 1 in 10000 people)
- Allergic type reactions

Is there anything else that can be used to prevent contrast induced nephropathy?

This will depend on how well your kidneys are functioning. Your doctors may suggest you take sodium bicarbonate capsules. They will make sure you are well hydrated before the x-ray procedure either by asking you to drink lots of fluids or by giving you fluids via a drip.

You will also be asked to stop taking drugs which may sometimes harm your kidneys. These include anti-inflammatory drugs (NSAIDS), and ACE inhibitors or Angiotensin receptor blockers. These should be stopped 48 hours before the x-ray procedure.

If you are taking Metformin (an anti-diabetes medicine) this should be stopped 48 hours before the x-ray procedure. If your kidneys are ok 48 hours after the x-ray procedure these medicines will be restarted.

Will N-Acetylcysteine definitely prevent harm to my kidneys from the x-ray contrast material?

There is still a risk of harm to the kidneys from the x-ray contrast material but the risk will be reduced by use of a combination of N-Acetylcysteine, sodium bicarbonate and extra hydration tailored to suit your requirements.

Further Information

If you have any particular questions on taking this medicine you should speak to your doctor to ensure you fully understand the reasons why we recommend it.

The following website provides comprehensive health information as provided by GPs and Nurses during consultations.

www.patient.co.uk

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