CONTRAST INDUCED NEPHROPATHY
DISCUSSION PAPER
Rapid Response to Contrast Induced Nephropathy
Email Discussion

NSW THERAPEUTIC ADVISORY GROUP
JUNE 2008

Scope:
This document summarises policies submitted to NSW Therapeutic Advisory Group in response to the email discussion on contrast induced nephropathy (CIN).

A small number of evidence based reviews/guidelines regarding strategies to prevent CIN published in 2008 are summarised. Further reading is presented.

Evidence on assessment of renal function using Australian guidelines is presented.

The document does not discuss risk factors or risk stratification for development of CIN.

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Email Discussion Question: (circulated June 3rd 2008)

Based on discussions at the recent NSW TAG and TAGNet meetings we are interested in reviewing current practice in the prevention/management of contrast induced nephropathy (CIN). Does your hospital have any CIN guidelines in place? If so would you mind sending a copy to the NSW TAG office?

NSW TAG received 12 policies, 1 fact sheet and an article of interest from facilities in NSW, Victoria, Northern Territory and Western Australia. Details of policies submitted are available in the members section of the NSW TAG website (a user name and pass word are required). The overall approach to CIN prevention is varied – summarised in Table 1. There was variability in recommendations for methods of preventing CIN as well as in methods of assessing risk via renal function testing. This variability may reflect the lack of certainty in the available evidence for preventing CIN.

The following summarises the institution-based recommendations/guidelines for preventing CIN:

- 10 policies recommended *intravenous hydration with normal saline* – taking into account patient fluid status.
- 8 policies recommended *oral N-acetylcysteine*. Of these, 7 policies recommended a dose of 600 mg bd for 2 days and 1 policy recommended a dose of 1200 mg PO bd for 2 days.
- 8 policies recommended *withholding nephrotoxic drugs*
- 7 policies recommended using *iso-osmolar contrast*. Of these 5 recommended using contrast in the lowest possible dose.
- 6 policies recommended *oral hydration* taking into account patient fluid status
- 6 policies recommended *intravenous bicarbonate infusion*
- 5 policies recommended *considering alternative imaging*
- 5 policies recommended *consulting specialist radiologist or nephrologist* where necessary

The following summarises institution-based recommendations for assessing renal function to determine risk of CIN:

- 5 policies recommended serum urea and/or creatinine levels
- 5 policies recommended using estimated glomerular filtration rate (eGFR)
- 2 policies recommended using the Cockroft-Gault calculation
- 2 policies recommended using creatinine clearance without specifying a preferred method
- 3 policies recommended more than one method in different sections of the policy

Comment on preventing CIN

This variability may reflect lack of certainty in the evidence for preventing CIN. Some recent evidence based reviews / guidelines may help facilities wishing to update their policies. These are summarised here.

A) Pre*vention of radiocontrast media-induced acute renal failure. Published February 2008, UpToDate®*

Key recommendations from this document are:

- Use alternative imaging (eg ultrasonography, MRI without gadolinium contrast, or CT scanning without radiocontrast) wherever possible
- Use of iso-osmolar agents rather than low-osmolar agents (Grade 2B) or high osmolar agents (Grade 1A)
- Use lower doses of contrast and avoid repetitive, closely spaced studies
- Avoid volume depletion and non-steroidal anti-inflammatory drugs
- If not contraindicated, hydrate patients with intravenous fluids before and after contrast administration (Grade 1B). Isotonic bicarbonate is preferred to isotonic saline (Grade 2B).
Intravenous hydration is superior to oral hydration and oral hydration with water alone should not be used

- Acetylcysteine, 600 -1200 mg PO bd, administered the day before and the day of the procedure, can be used (Grade 2B). If patient is hydrated with bicarbonate then administer acetylcysteine at a dose of 1200 mg PO bd the day before and the day of the procedure
- Only use diuretics only in patients who are volume overloaded
- Preventive haemofiltration or haemodialysis after contrast exposure is not recommended in patients with stage 3 or 4 chronic kidney disease (Grade 1B). Haemodialysis after contrast exposure could be performed in patients with stage 5 chronic kidney disease if they have a functioning hemodialysis access (Grade 2C)

**B) Meta-analysis: Effectiveness of drugs for preventing contrast-induced nephropathy. Published February 2008, Annals of Internal Medicine.**

Key findings of the meta-analysis are:

- Treatments that significantly decreased risk of CIN compared with saline included:
  - N-acetylcysteine - relative risk 0.62, 95% CI, 0.44 - 0.88
  - Ascorbic acid - relative risk 0.46, 95% CI, 0.23 - 0.90
  - Bicarbonate - relative risk 0.12, 95% CI, 0.02 - 0.95
- Treatments with no significant difference on CIN prevention:
  - Theophylline - relative risk 0.49, CI, 0.23 -1.06
- Treatments which increased the risk for CIN
  - Frusemide- relative risk 3.27, 95% CI, 1.48 - 7.26

**C) Manual on contrast media. Published 2008, American College of Radiology.**

Key recommendations include:

- The major preventive action against CIN is adequate hydration. If the patient cannot be hydrated orally, intravenous normal saline can be considered
- For patients with renal insufficiency only low-osmolar or iso-osmolar contrast media should be used
- N-acetylcysteine can be considered, but not instead of adequate hydration and close surveillance of renal function
- Patients with suspected renal impairment or those at risk for contrast nephropathy should have a baseline serum creatinine level before injection of contrast media
- If renal impairment is identified, consultation about alternative imaging is required
- Other preventive measures include increasing the interval between contrast media examinations and reducing the dose of contrast media

**D) Prevention of intravenous contrast-induced nephropathy in hospital inpatients. Published March 2008, Critical Pathways in Cardiology.**

Recommendations for non-high risk patients include:

- Administration of intravenous normal saline taking into account the patient’s fluid status
- N-acetylcysteine 600 mg PO bd for 48 hours (total of 4 doses) beginning the day before contrast exposure
- Avoid of repeated exposure to contrast agents within any 72-hour period
- Discontinue nephrotoxic agents 24 hours before contrast exposure if possible

Recommendations for high risk patients include:

- Direct discussion of the planned interventional or diagnostic procedure with the service
- Sodium bicarbonate as an alternative hydration solution to saline, taking into account the patient’s fluid status
- Higher dose of N-acetylcysteine 1200 mg PO bd for 48 hours
- The use of limited volumes of low or iso-osmolar contrast agents at the discretion of the procedural or diagnostic service
E) Further reading

Other articles published to date in 2008 that may be of relevance include:


Comment on assessment of renal function

The majority of primary studies used serum creatinine levels to define renal impairment. However, this may not be clinically useful as serum creatinine is affected by many factors other than the level of kidney function and varies markedly with age, gender and muscle mass. Many patients may have a normal serum creatinine values with quite reduced renal function as measured by the Cockroft-Gault or Modification of Diet in Renal Disease (MDRD) equations. Nevertheless, monitoring small changes in serum creatinine compared to the patient’s previous results is a reasonable approach.

The Caring for Australians with Renal Impairment guidelines recommend using abbreviated (4-variable) MDRD, 6-variable MDRD and Cockroft-Gault equations for estimating glomerular filtration rate in adults. In children, the Schwartz and Counahan-Barratt equations can be sued to estimate glomerular filtration rate.
### Table 1: Summary of policies for preventing CIN submitted to NSW TAG

<table>
<thead>
<tr>
<th>Facility</th>
<th>Assessment of renal function</th>
<th>Oral Hydration</th>
<th>IV normal saline</th>
<th>IV bicarbonate</th>
<th>Acetylcysteine 600 mg PO bd for 2 days</th>
<th>Iso-osmolar contrast</th>
<th>Alternative imaging</th>
<th>Withhold nephrotoxic drugs</th>
<th>Consult specialist if unsure</th>
<th>Other</th>
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<td>1</td>
<td>eGFR</td>
<td>Y</td>
<td>Y - If can’t tolerate oral fluids</td>
<td>Y - in high risk patients</td>
<td>Y but dose of 1200 mg PO bd for 2 days</td>
<td>Y in low dose</td>
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<td>Y - In high risk patients</td>
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<td></td>
<td>Y in low dose</td>
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<td>September 2007</td>
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<td>Consider reduced contrast</td>
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References