Renal replacement therapies for prevention of radiocontrast-induced nephropathy: a systematic review

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CRD summary
The review concluded that renal replacement therapy did not decrease the risk of radiocontrast-induced nephropathy compared with standard medical therapy, and that this risk was in fact increased with haemodialysis. Haemofiltration and haemodiafiltration reduced the chances of needing acute renal replacement therapy. The reliability of the conclusions is uncertain due to heterogenous and low quality evidence.

Authors' objectives
To assess whether renal replacement therapies could prevent radiocontrast-induced nephropathy and its associated complications.

Searching
MEDLINE and EMBASE were searched up to March 2011 with no language restrictions. Reference lists from eligible studies, review articles and relevant citations were checked for additional studies. Search terms were reported.

Study selection
Studies that assessed the effect of periprocedural renal replacement therapy compared with standard medical therapy on the risk of radiocontrast-induced nephropathy were eligible. The following study designs were eligible: prospective or retrospective cohort studies, case-control studies and randomised controlled trials (RCTs). Studies had to include at least 10 participants.

The primary outcome was radiocontrast-induced nephropathy, defined as an increase in serum creatinine of at least 0.5mg/dL (44μmol/L). Secondary outcomes of interest were: need for temporary acute renal replacement therapy; need for chronic or permanent renal replacement therapy (end-stage renal disease); long-term changes in renal function; and death. Authors were contacted for missing or incomplete data as necessary.

Patients were on average between 60 and 70 years old and most had significant chronic kidney disease (stage 4 or 5). Haemodialysis, haemofiltration and haemodiafiltration were all evaluated; haemodialysis was the most common. For haemodialysis studies, mean/median delay time from contrast exposure to the start of haemodialysis ranged from 20 to 280 minutes (where reported), except for one study where both were performed simultaneously. All studies used low osmolar or iso-osmolar contrast agents and only one used N-acetylcysteine.

Two reviewers independently screened all references for inclusion. Disagreements were resolved via discussion.

Assessment of study quality
Methodological quality was assessed using the Jadad 5-point scale for randomisation, blinding, withdrawals and drop-outs. Two reviewers independently assessed study quality.

Data extraction
Data on number of participants and events were extracted to obtain risk ratios and 95% confidence intervals (CIs) for each outcome.

Two reviewers independently extracted data. Disagreements were resolved through consensus or with the help of a third reviewer.

Methods of synthesis
Estimates of risk ratios were pooled using a random-effects model. Heterogeneity was assessed using $I^2$. Preplanned sensitivity analyses were used to assess the effect of different types of renal replacement therapy (haemodialysis versus haemofiltration/haemodiafiltration), study design and sample size on outcomes of interest. Additional subgroup
analyses were defined *a posteriori* to compare outcomes by level of kidney disease severity.

**Results of the review**

Eleven studies (nine RCTs and two observational studies) were included in the review. The methodological quality of the studies was low (all except one had a score of two or less out of five on the Jadad scale). All were performed in a single centre, none were blinded and patients were generally not followed-up after hospital discharge. The analysis included 1,010 patients (445 received renal replacement therapy and 565 were in the standard medical therapy group). Eight studies evaluated haemodialysis, two studied haemofiltration and one haemodiafiltration.

Overall, renal replacement therapy did not reduce the risk of radiocontrast-induced nephropathy compared with standard medical therapy. An analysis which only included haemodialysis interventions showed that prophylactic haemodialysis had a significantly higher risk of radiocontrast-induced nephropathy compared with standard therapy (RR 1.61; 95% CI 1.13 to 2.28; six studies; 572 patients; *I²*=8%).

A subgroup analysis showed that those receiving haemofiltration and haemodiafiltration had a lower risk of needing acute temporary renal replacement therapy compared with control (RR 0.22; 95% CI 0.06 to 0.74; three studies; 257 patients; *I²*=36%). Other secondary outcomes were reported.

**Authors' conclusions**

Periprocedural renal replacement therapy did not decrease the incidence of radiocontrast-induced nephropathy compared with standard medical treatment. Haemodialysis was associated with increased risk of radiocontrast-induced nephropathy. Haemofiltration and haemodiafiltration appeared to reduce the need for acute temporary renal replacement therapy.

**CRD commentary**

The review question and inclusion criteria were clear. The search appeared appropriate. Study selection, data extraction and quality assessment were conducted with sufficient attempts to minimise error and bias. Data extraction was thorough and study details were well reported overall.

The methodological quality of the evidence was low, which limited the reliability of the review findings. Patients were generally not followed-up after hospital discharge, which made the long-term effect of the intervention unclear.

Subgroup analyses should be interpreted with caution, as they were based on a small number of single-centre studies. Statistical heterogeneity was generally high, which may have limited the reliability of the results. Despite the use of sensitivity and subgroup analyses, the sources of heterogeneity remained largely unclear.

The primary outcome was based on serum creatinine levels. The authors noted in the discussion section that this may have biased the short-term results in favour of the intervention since renal replacement therapy may lead to an initial reduction in creatinine levels due to creatinine removal. This may need to be considered when interpreting the findings of the review.

The conclusions reflected the evidence presented, but the reliability of the findings was uncertain due to weak evidence and heterogeneity.

**Implications of the review for practice and research**

**Research:** The authors stated that future RCTs should focus on patients with severe chronic kidney disease (stages 4 and 5), with standardised use of renoprotective measures such as N-acetylcysteine and bicarbonate-based hydration across all study groups. Further research was required to understand the mechanisms through which different therapies, notably haemodialysis versus haemofiltration and haemodiafiltration may affect patients. The role of these treatments in preventing radiocontrast-induced nephropathy particularly needs to be investigated in the highest risk group (estimated glomerular filtration rate below 15-20mL/min).

**Practice:** The authors did not report any implications for practice.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.