Systematic review and meta-analysis of the diagnostic and therapeutic role of water-soluble contrast agent in adhesive small bowel obstruction

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CRD summary
This review concluded that water soluble contrast agent was effective in predicting the need for surgery in patients with adhesive small bowel obstruction and reduced the need for operation and shortened hospital stay. These conclusions were supported by the data presented, but should be interpreted with some caution due to the possibility of publication bias and quality of the studies.

Authors' objectives
To assess the diagnostic and therapeutic role of water-soluble contrast agent (WSCA) in adhesive small bowel obstruction.

Searching
PubMed, EMBASE and The Cochrane Library were searched from 1985 to July 2009. Search terms were reported. The related articles function in PubMed was used to identify additional studies. Reference lists of primary studies and review articles were screened. The review was restricted to studies published in English.

Study selection
Prospective studies on the diagnostic role of WSCA and randomised controlled trials (RCTs) that compared WSCA in combination with conventional treatment (nil by mouth, nasogastric aspiration and intravenous fluid rehydration) to conventional treatment alone were eligible for inclusion. Studies had to be conducted in patients with adhesive small bowel obstruction (defined as admission to hospital with abdominal pain, vomiting and abdominal distension with dilated small bowel loops and air-fluid levels on initial imaging). Studies in which patients had surgery four to six weeks before the obstructive episode or had signs of strangulation were excluded, as were patients with abdominal malignancy or non-reducible abdominal hernia. The primary outcome for the diagnostic role of WSCA was the prediction of need for surgery in adhesive small bowel obstruction. Primary outcomes for the therapeutic role were rate of resolution of small bowel obstruction without surgery, time from admission to resolution of small bowel obstruction, duration of hospital stay, complications and mortality.

Studies on the diagnostic role of WSCA used 50mL to 100mL of Gastrografin or 40mL Urografin and obtained abdominal plain radiographs after four to 24 hours. Patients were considered to have partial small bowel obstruction if the contrast reached the colon and complete small bowel obstruction if not. Most studies on the therapeutic role of WSCA compared conventional treatment plus 100mL Gastrografin or 50mL to 100mL Urografin orally or via nasogastric tube to conventional treatment alone. One study compared Gastrografin to placebo.

Two reviewers independently assessed studies for inclusion. Disagreements were resolved through referral to a third reviewer.

Assessment of study quality
Therapeutic studies were assessed for methodological quality using the Jadad criteria to assign studies a score out of 5. Diagnostic studies were assessed for methodological quality according to the following criteria: appropriate reference standard; independent interpretation of test results and reference standard; blinding of person interpreting index test and reference standard; appropriate patient spectrum; reproducibility of test result and observer variation; and details of index test execution. Studies were assigned a score out of 6 based on the number of items fulfilled.

Two reviewers independently assessed study quality. Disagreements were resolved through referral to a third reviewer.

Data extraction
Data were extracted as 2x2 tables of test performance for diagnostic studies and used to calculate sensitivity, specificity and positive and negative predictive values. For therapeutic studies, dichotomous data were extracted as number of
events and number of participants in the intervention and control arms and used to calculated odds ratios and 95% confidence intervals (CIs). Continuous data were extracted as means and standard deviations in intervention and control groups and used to estimate mean differences and 95% CIs.

One reviewer extracted data and a second reviewer checked the extraction.

**Methods of synthesis**

For diagnostic studies, summary sensitivity, specificity, positive and negative likelihood ratios and positive and negative predictive values were estimated. For therapeutic studies, summary odds ratios and weighted mean differences were estimated. All meta-analysis were based on the DerSimonian and Laird random-effects model and 95% CIs were calculated for each summary estimate. Heterogeneity was assessed using $\chi^2$ and $I^2$ statistics.

**Results of the review**

Fourteen studies were included: seven assessed the diagnostic role of WSCA; and nine assessed the therapeutic role (two studies assessed both diagnosis and therapy).

**Diagnostic role of WSCA (seven studies, n=508)**

Four studies were observational cohort studies (n=385) and three were RCTs (n=123). The cohort studies scored between 2 and 3 on the quality assessment and the RCTs all scored 2. There was no diagnostic standard in any of the studies; patient outcome and need for surgery were used as the reference standard.

Summary sensitivity for the prediction of resolution of small bowel obstruction was 96% (95% CI 95% to 97%) and summary specificity was 98% (95% CI 94% to 99%). There was no evidence of heterogeneity (p=0.54 for sensitivity and 0.37 for specificity). The timing of radiography did not affect summary estimates.

**Therapeutic role of WSCA (nine RCTs, n=765)**

One study scored 5 out of 5 points on the Jadad scale, two studies scored 3 and six scored 2. Only the study that scored 5 was reported to be double blinded. Randomisation methods and allocation concealment was unclear in the studies that scored 2. Withdrawals and dropouts were described in all studies and all performed an intention to treat analysis. One study was excluded from the meta-analysis due to protocol violation.

Compared to conventional treatment alone, use of WSCA resulted in a significant reduction in need for surgery (OR 0.62, 95% CI 0.44 to 0.88; eight studies), faster resolution of obstruction (WMD -19.43, 95% CI -22.7 to -16.2; five studies) and shorter duration of hospital stay (WMD -1.87, 95% CI -2.21 to -1.52; seven studies). There was no evidence of heterogeneity for need for surgery or hospital stay (p=0.34 and 0.80), but there was substantial heterogeneity for time to resolution of obstruction (p<0.001). There was no difference in mortality (seven studies) or incidence of complications (eight studies).

**Authors’ conclusions**

Water soluble contrast agent was effective in predicting the need for surgery in patients with adhesive small bowel obstruction, reduced the need for operation and shortened hospital stay.

**CRD commentary**

The review addressed a clear question supported by defined inclusion criteria. The literature search was adequate for published studies, but restriction of the review to published English-language studies meant that there was a possibility of language and publication biases. Appropriate steps were taken to minimise bias and errors at all stages of the review process. Study quality was assessed using appropriate criteria for the different types of study. However, for diagnostic studies, results were presented only as summary quality scores with no details on the individual items fulfilled; therefore, the quality of these studies remained unclear. Appropriate steps were taken to pool data and the results were clearly presented in the text and tables and graphically using forest plots.

The authors conclusions were supported by the data presented, but should be interpreted with some caution due to the possibility of publication bias, unclear quality of diagnostic studies and poor quality of therapeutic studies.
Implications of the review for practice and research

Practice: The authors stated that this review supported both diagnostic and therapeutic use of WSCA in patients with adhesive small bowel obstruction.

Research: The authors stated that further studies were needed to make definitive conclusions regarding use of WSCA compared with conventional management.

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