Ward reduction without general anaesthesia versus reduction and repair under general anaesthesia for gastroschisis in newborn infants (Review)

Davies MW, Kimble RM, Woodgate PG


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ABSTRACT

Background

Gastroschisis is a congenital anterior abdominal wall defect with the abdominal contents protruding through the defect. Reduction of the abdominal contents is required within hours after birth as the infant is at risk not only of water and heat loss from the exposed bowel but also of compromised gut circulation with ischaemia and infarction. To avoid the complications of general anaesthetic and mechanical ventilation it has been proposed that the reduction of abdominal contents can be achieved without endotracheal intubation or anaesthesia.

Objectives

To determine which approach to the immediate surgical treatment of gastroschisis has the better outcomes: ward reduction without general anaesthetic or reduction and repair of the abdominal wall defect under general anaesthesia.

Search methods

The standard search strategy of the Cochrane Neonatal Review Group was used. This included searches of electronic databases: Oxford Database of Perinatal Trials; Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library, Issue 2, 2003); MEDLINE (1966 to July 2003); CINAHL (1982 to July 2003); and previous reviews including cross references, abstracts, conferences, symposia proceedings, expert informants and journal hand searching mainly in the English language.

This search was updated in December 2009.

Selection criteria

Randomised, controlled trials (RCT) comparing ward reduction with reduction under general anaesthesia, for neonates with gastroschisis.
Data collection and analysis
No studies were found meeting the criteria for inclusion in this review.

Main results
No studies were found meeting the criteria for inclusion in this review.

Authors’ conclusions
There is no evidence from RCTs to support or refute the practice of ward reduction for the immediate management of gastroschisis. There is an urgent need for RCTs to compare ward reduction versus reduction under general anaesthesia in infants with gastroschisis. Initial trials would best be limited to those infants with uncomplicated gastroschisis (using pre-defined selection criteria excluding infants that are unstable, have gut perforation, necrosis or atresia, have other organs requiring reduction besides bowel, or are considered to need a silo prior to any reduction). Trials should use adequate pain relief and specify a pre-defined time period after which manual reduction is abandoned.

**PLAIN LANGUAGE SUMMARY**

Ward reduction without general anaesthesia versus reduction and repair under general anaesthesia for gastroschisis in newborn infants

Ward reduction for newborn infants with gastroschisis is not supported or refuted by evidence from randomised controlled trials. Newborn babies with gastroschisis are born with their gut hanging out of a hole in their belly. If the gut is not put back they could get sick from fluid and heat loss or part of the gut could die or they could get a life-threatening infection. Traditionally the gut is pushed back inside the belly under anaesthetic in the operating theatre but in some hospitals they push the gut back without anaesthetic in the neonatal ward (i.e., ward reduction). It is not known which method gives better outcomes. The reviewers did not identify any randomised studies comparing the two approaches. They concluded that there is no evidence either supporting or refuting ward reduction of gastroschisis.

**BACKGROUND**

Description of the condition
Gastroschisis is a congenital anterior abdominal wall defect with the uncovered abdominal contents protruding through the defect. The defect is immediately lateral to, and usually to the right of, a normal umbilicus. Usually small and large bowel protrude through the defect and occasionally other abdominal organs. Reduction of the abdominal contents is required within hours after birth as the infant is at risk not only of water and heat loss from the exposed bowel, but also, of compromised gut circulation with ischaemia and infarction.

Description of the intervention
A newborn infant with gastroschisis will traditionally have the abdominal contents reduced under general anaesthetic in the operating theatre. Surgical repair of gastroschisis usually requires transporting the infant from the neonatal unit to the operating theatre, endotracheal intubation and general anaesthesia, some exploration of the abdomen and its contents, and mechanical ventilation for a variable amount of time. If reduction of the abdominal contents is not possible at the first procedure an artificial pouch, or silo, can be constructed around the gut and attached to the edge of the defect so that it contains the eviscerated abdominal contents. With the silo in place the gut can be reduced over a longer period of time by decreasing the size of the silo. Recent case series of infants with gastroschisis are summarised in the Table (see additional Table 1). Three of the case series describe some of the outcomes for the traditional approach (reduction of the abdominal contents under general anaesthetic) - Snyder 1999; Driver 2000; Kitchanan 2000. Mortality is around 10%, often related to septicaemia. Only one of the series reports a duration...
of ventilation, with a median of 4.5 days (Driver 2000). Delay in establishing full enteral feeding is usual with median durations of around three to four weeks - total parenteral nutrition (TPN) is required for most of this time. The median duration of hospital stay is around 6 weeks. The need for a silo is common - in up to 30% of cases. Survivors may require more than one surgical procedure and compromised segments of bowel may need to be removed. Other possible complications of gastrochisis include haemodynamic compromise of the lower abdomen, kidneys and lower limbs, gastrointestinal tract perforation, abdominal scars and/or a cosmetically abnormal umbilicus, late surgery for gut adhesions or scar cosmesis, compromised nutrition, and adverse neurological outcome (Burge 1997; Langer 1996; Davies 1997).

To avoid the complications of general anaesthetic and mechanical ventilation it has been proposed that the reduction of abdominal contents can be achieved without endotracheal intubation or anaesthesia - usually in the neonatal unit. For the purposes of this review we have defined 'ward reduction' as "manual reduction of the abdominal organs without general anaesthetic and without surgical incision, at the initial attempt to reduce the abdominal contents".

How the intervention might work

The first series of patients to undergo ward reduction without anaesthesia was described by Bianchi and Dickson (Bianchi 1998). They questioned the need for general anaesthesia and reported a pilot study in which the infants with gastrochisis were treated with reduction of their gut in the neonatal unit without general anaesthesia, sedation, or analgesia. There were no exclusion criteria, and there was a planned delay of four hours in the reduction as it was felt that the infants were most stable at this time. After the bowel had been returned to the abdominal cavity, the umbilical cord was sutured to the edges of the abdominal wall defect to act as a "plug". The outcomes are summarised in the Table (see additional table 01). After publication of this first case series there was concern voiced by health care professionals regarding Bianchi’s technique because of lack of pain control (Huth 1999). Further caution was urged after a report by Dolgin et al (Dolgin 2000) of four patients who had manual reduction of a gastrochisis. Three of the four cases had significant adverse outcomes with multiple surgical procedures and prolonged hospitalisation. The most recent, and largest, case series was reported by Kimble et al (Kimble 2001) - see the Table (see additional table 01). Ward reduction was contemplated in infants who met well-defined selection criteria, which excluded infants that were unstable, or had gut perforation, necrosis or atresia. There was no planned delay and no sutures were used. Analgesia with rectal paracetamol was used. During the study period 35 infants with gastrochisis were encountered: manual reduction was attempted in 29 and was successful in 25. Because of the selection criteria the patients undergoing an initial attempt at ward reduction did well with no mortality, shorter time requiring TPN and decreased duration of hospital stay (when compared with the other case series above - Snyder 1999; Driver 2000; Kitchanan 2000).

Why it is important to do this review

Comparisons between case series are not likely to be valid because of case selection bias. Case series describing outcomes following the traditional approach usually report outcomes on all cases of gastrochisis whereas those reporting ward reduction can be selective and outcomes may differ. Outcomes may also differ if the newborn infant is term or preterm, whether analgesia is used or not, and whether the manual reduction procedure is halted after a pre-defined time period or not.

This review updates the existing review of "Ward reduction without general anaesthesia versus reduction and repair under general anaesthesia for gastrochisis in newborn infants" which was last published in the Cochrane Library, Issue 2, 2003 (Davies 2003).

OBJECTIVES

To determine which approach to the immediate surgical treatment of gastrochisis has the better outcomes: ward reduction without general anaesthetic or reduction and repair of the abdominal wall defect under general anaesthesia.

Subgroup analyses were planned to determine whether the results differed by:

- Population:
  1. gestational age - preterm or term.

- Intervention:
  1. the planned use of analgesia or local anaesthesia with ward reduction or not;
  2. use of pre-defined selection criteria (for example excluding infants that are unstable, have gut perforation, necrosis or atresia, have other organs requiring reduction besides bowel, or are considered to need a silo prior to any reduction commencing) prior to attempting manual reduction;
  3. use of a pre-defined time period (30, 60, 90 or 120 minutes) after which manual reduction is abandoned.

METHODS

Criteria for considering studies for this review
Types of studies
Randomised, controlled trials comparing ward reduction with reduction under general anaesthesia, for neonates with gastroschisis. Quasi-randomised trials were not considered for inclusion.

Types of participants
Neonates with gastroschisis.

Types of interventions
Ward reduction versus reduction under general anaesthesia.
‘Ward reduction’ is defined as reduction without anaesthesia and without surgical incision, at the initial attempt to reduce the abdominal contents.
‘Reduction under general anaesthesia’ is defined as reduction of the abdominal contents and abdominal defect repair with general anaesthesia (with or without surgical incision in the abdominal wall to facilitate reduction), at the initial attempt to reduce the abdominal contents.

Types of outcome measures
Mortality (neonatal, before discharge)
Need for total parenteral nutrition or not
Duration of total parenteral nutrition (days)
Time to full enteral feeds - reaching feed volumes of either 150 ml/kg/day or 180 ml/kg/day (days)
Need for a silo
Infection - sepsicaemia
Infection - wound infection
Gastro-intestinal tract perforation
Length of bowel lost/resected
Need for a general anaesthesia ever and after initial first attempt reduction procedure
Need for mechanical ventilation
Duration of mechanical ventilation (days)
Duration of respiratory support (IPPV or CPAP) (days)
Duration of oxygen therapy (days)
Need for further operative procedure after initial reduction
Duration of hospital stay (days)
Cosmesis - umbilicus looks normal or not, other abdominal scar or not, needs further cosmetic surgery to umbilicus or other abdominal scar
Nutritional status - need for calorie supplementation after discharge or not, weight <3rd percentile at discharge, or at 3 months, 6 months or 12 months
Neurodevelopmental outcome (cerebral palsy, sensorineural hearing loss, visual impairment and/or developmental delay)
Immediate adverse effects such as altered haemodynamics or cerebral blood flow, and oxygenation.

Search methods for identification of studies
The standard search strategy for the Cochrane Neonatal Review Group was used. This included searches of electronic databases: Oxford Database of Perinatal Trials; Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library, Issue 2, 2003); MEDLINE (1966 to July 2003); and CINAHL (1982 to July 2003) using MeSH terms ‘gastroschisis’ and ‘infant, newborn’; and previous reviews including cross references, abstracts, conference and symposia proceedings, expert informants, journal hand searching. Searches were not restricted to publications in the English language. We did not limit our search to published data. In 2009 December, we updated the search as follows: MEDLINE (search via PubMed), CINAHL, EMBASE and CENTRAL (The Cochrane Library) were searched from 2002 to December 2009. Search term: gastroschisis. Limits: human, newborn infant and clinical trial. No language restrictions were applied.

Data collection and analysis
The standard method of the Cochrane Collaboration and its Neonatal Review Group were used.

Selection of studies
All randomised and quasi-randomised controlled trials fulfilling the selection criteria described in the previous section were included. The three reviewers worked independently to search for and assess trials for inclusion. The review authors resolved any disagreement by discussion.

Data extraction and management
If eligible studies were located, we planned to independently extract the data. If differences were noted, we planned to resolve differences by discussion and consensus. If necessary, we planned to contact investigators for additional information or data.

Assessment of risk of bias in included studies
We planned to assess studies using the following key criteria: allocation concealment (blinding of randomisation), blinding of intervention, completeness of follow-up, and blinding of outcome measurement/assessment. For each criterion, assessment was yes, no, can't tell. The review authors planned to separately assess each study and add this information to the Characteristics of Included Studies Table.
In addition, for the update in 2010, we planned to evaluate the following issues and enter the information into the Risk of Bias Table:
1) Sequence generation (checking for possible selection bias). Was the allocation sequence adequately generated?
For each included study, we planned to categorize the method used to generate the allocation sequence as:
- adequate (any truly random process e.g. random number table; computer random number generator);
- inadequate (any non random process e.g. odd or even date of birth; hospital or clinic record number);
- unclear.

(2) Allocation concealment (checking for possible selection bias). Was allocation adequately concealed?
For each included study, we planned to categorize the method used to conceal the allocation sequence as:
- adequate (e.g. telephone or central randomisation; consecutively numbered sealed opaque envelopes);
- inadequate (open random allocation; unsealed or non-opaque envelopes, alternation; date of birth);
- unclear.

(3) Blinding (checking for possible performance bias). Was knowledge of the allocated intervention adequately prevented during the study? At study entry? At the time of outcome assessment?
For each included study, we planned to categorize the methods used to blind study participants and personnel from knowledge of which intervention a participant received. We planned to assess the blinding separately for different outcomes or classes of outcomes.
We planned to categorize the methods as:
- adequate, adequate or unclear for participants;
- adequate, adequate or unclear for personnel;
- adequate, inadequate or unclear for outcome assessors.
In some situations there may be partial blinding e.g. where outcomes are self-reported by unblinded participants but they are recorded by blinded personnel without knowledge of group assignment. Where needed, we planned to add "partial" to the list of options for assessing quality of blinding.

(4) Incomplete outcome data (checking for possible attrition bias through withdrawals, dropouts, protocol deviations). Were incomplete outcome data adequately addressed?
For each included study and for each outcome, we planned to describe the completeness of data including attrition and exclusions from the analysis. We planned to note whether attrition and exclusions were reported, the numbers included in the analysis at each stage (compared with the total randomised participants), reasons for attrition or exclusion where reported, and whether missing data were balanced across groups or were related to outcomes. Where sufficient information was reported or supplied by the trial authors, we planned to re-include missing data in the analyses. We planned to categorize the methods as:
- adequate (< 20% missing data);
- inadequate (≥ 20% missing data):
- unclear.

(5) Selective reporting bias. Are reports of the study free of suggestion of selective outcome reporting?
For each included study, we planned to describe how we investigated the possibility of selective outcome reporting bias and what we found. We planned to assess the methods as:
- adequate (where it is clear that all of the study’s pre-specified outcomes and all expected outcomes of interest to the review have been reported);
- inadequate (where not all the study’s pre-specified outcomes have been reported; one or more reported primary outcomes were not pre-specified; outcomes of interest are reported incompletely and so cannot be used; study fails to include results of a key outcome that would have been expected to have been reported);
- unclear.

(6) Other sources of bias. Was the study apparently free of other problems that could put it at a high risk of bias?
For each included study, we planned to describe any important concerns we had about other possible sources of bias (for example, whether there was a potential source of bias related to the specific study design or whether the trial was stopped early due to some data-dependent process). We planned to assess whether each study was free of other problems that could put it at risk of bias as:
- yes; no; or unclear.
If needed, we planned to explore the impact of the level of bias through undertaking sensitivity analyses.

**Measures of treatment effect**
If studies were identified, we planned to perform statistical analyses using Review Manager software. For individual trials, we planned to report mean differences (and 95% confidence intervals) for continuous variables such as duration of oxygen therapy. For categorical outcomes such as mortality, we planned to report the relative risk and risk difference (and 95% confidence intervals).

**Assessment of heterogeneity**
We planned to evaluate the heterogeneity between trials by inspecting the forest plots and quantifying the impact of heterogeneity using the I² statistic.

**Data synthesis**
If multiple trials were identified, we planned to perform meta-analysis using Review Manager software (RevMan 5) supplied by the Cochrane Collaboration. For estimates of typical relative risk and risk difference, we planned to use the Mantel-Haenszel method. For measured quantities, we planned to use the inverse variance method. All meta-analyses were planned to be done using the fixed effect model.

**Subgroup analysis and investigation of heterogeneity**
Subgroup analyses were planned to determine whether the results differed by:
- Population:
  i. gestational age - preterm or term.
Intervention:

i. the planned use of analgesia or local anaesthesia with ward reduction or not;

ii. use of pre-defined selection criteria (for example excluding infants that are unstable, have gut perforation, necrosis or atresia, have other organs requiring reduction besides bowel, or are considered to need a silo prior to any reduction commencing) prior to attempting manual reduction;

iii. use of a pre-defined time period (30, 60, 90 or 120 minutes) after which manual reduction is abandoned.

RESULTS

Description of studies

See: Characteristics of excluded studies.

No studies were found meeting the criteria for inclusion in this review.

Risk of bias in included studies

No studies were found meeting the criteria for inclusion in this review.

Effects of interventions

No studies were found meeting the criteria for inclusion in this review.

DISCUSSION

The technique of ward reduction, without general anaesthesia, for the reduction of the abdominal contents in infants with gastroschisis was first described in 1998 (Bianchi 1998). Since 1998 there have been three other case series (Dolgin 2000; Kimble 2001; Bianchi 2002) reporting the outcomes for this technique. The main feature that distinguishes the technique of ward reduction from traditional methods is the absence of a general anaesthetic with the attempt at reduction usually taking place in the neonatal unit without the need for any surgical incision or suturing.

This systematic review has failed to determine which approach to the immediate surgical treatment of gastroschisis has the better outcomes, given the lack of any RCTs comparing the two approaches. It may well be beneficial to avoid general anaesthetic and the need for mechanical ventilation; however, it is not known whether this benefit would be accompanied by any disadvantages. Potentially, outcomes such as mortality, incidence of septicemia, and duration of total parenteral nutrition and intensive care and hospital stay, and gut loss, may be increased or decreased with ward reduction. Comparisons between case series do not allow us to determine which approach would be better with regard to these aspects of gastroschisis management. Case series describing outcomes following the traditional approach usually report outcomes on all cases of gastroschisis whereas those reporting ward reduction can be selective and, if so, outcomes will usually be better. Kimble et al (Kimble 2001) attempted ward reduction only in infants who met well-defined selection criteria, which excluded infants that were unstable, or had gut perforation, necrosis or atresia. Future RCTs would best be limited to similar infants with uncomplicated gastroschisis.

AUTHORS’ CONCLUSIONS

Implications for practice

There is no evidence from randomised, controlled trials to support or refute the practice of ward reduction (reduction without anaesthesia and without surgical incision, at the initial attempt to reduce the abdominal contents) for the immediate management of gastroschisis.

Implications for research

There is an urgent need for randomised, controlled trials to compare ward reduction versus reduction under general anaesthesia in infants with gastroschisis. Initial trials would best be limited to those infants with uncomplicated gastroschisis (using pre-defined selection criteria excluding infants that are unstable, have gut perforation, necrosis or atresia, have other organs requiring reduction besides bowel, or are considered to need a silo prior to any reduction). Trials should use adequate pain relief and specify a predefined time period after which manual reduction is abandoned.

ACKNOWLEDGEMENTS

The Cochrane Neonatal Review Group has been funded in part with Federal funds from the Eunice Kennedy Shriver National Institute of Child Health and Human Development National Institutes of Health, Department of Health and Human Services, USA, under Contract No. HHSN267200603418C.
References to studies excluded from this review

Cauchi 2006 {published data only}

Pastor 2008 {published data only}

Additional references

Bianchi 1998

Bianchi 2002

Burge 1997

Davies 1997

Dolgin 2000

Driver 2000

Huth 1999

Kimble 2001

Kitchanan 2000

Langer 1996

Snyder 1999

References to other published versions of this review

Davies 2002

Davies 2003

* Indicates the major publication for the study
## Characteristics of Excluded Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cauchi 2006</td>
<td>Not a randomised or quasi-randomised controlled trial.</td>
</tr>
<tr>
<td>Pastor 2008</td>
<td>Not a comparison of ward reduction versus reduction under general anaesthesia. Ward reduction was allowed in both groups</td>
</tr>
</tbody>
</table>
DATA AND ANALYSES

This review has no analyses.

ADDITIONAL TABLES

Table 1. Summary of recently published case series

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>USA</td>
<td>England</td>
<td>Australia</td>
<td>England</td>
<td>Australia</td>
</tr>
<tr>
<td>Method of closure</td>
<td>Reduction under general anaesthesia</td>
<td>Reduction under general anaesthesia</td>
<td>Reduction under general anaesthesia</td>
<td>Ward reduction</td>
<td>Ward reduction</td>
</tr>
<tr>
<td>Number</td>
<td>185</td>
<td>91</td>
<td>21</td>
<td>14</td>
<td>29</td>
</tr>
<tr>
<td>Gestational age, median (range) weeks</td>
<td>36.6 (mean)</td>
<td>36.7 (mean)</td>
<td>?</td>
<td>? (31 - 40)</td>
<td>37 (mean, N=25)</td>
</tr>
<tr>
<td>Birthweight, median (range) kilograms</td>
<td>2.50 (mean)</td>
<td>2.37 (1.29 - 3.47)</td>
<td>2.56</td>
<td>? (1.5 - 2.5)</td>
<td>2.46 (mean, N=25)</td>
</tr>
<tr>
<td>Antenatal diagnosis (N, %)</td>
<td>51 (29%)</td>
<td>89 (98%)</td>
<td>21 (100%)</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Inborn (N, %)</td>
<td>0 (0%)</td>
<td>81 (89%)</td>
<td>17 (81%)</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Caesarean section (N, %)</td>
<td>68 (37%)</td>
<td>24 (27%)</td>
<td>?</td>
<td>1 (7%)</td>
<td>15 (52%)</td>
</tr>
<tr>
<td>Primary closure achieved at first procedure (N, %)</td>
<td>131 (71%)</td>
<td>72 (80%)</td>
<td>?</td>
<td>14 (100%)</td>
<td>25 (86%)</td>
</tr>
<tr>
<td>Use of a silo (N, %)</td>
<td>51 (29%)</td>
<td>18 (20%)</td>
<td>?</td>
<td>0 (0%)</td>
<td>4 (14%)</td>
</tr>
<tr>
<td>Required further surgery after primary procedure (N, %)</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>3 (21%)</td>
<td>3 (10%)</td>
</tr>
<tr>
<td>Death prior to first procedure (N, %)</td>
<td>?</td>
<td>1 (1%)</td>
<td>?</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Overall mortality (N, %)</td>
<td>17 (9%)</td>
<td>7 (8%)</td>
<td>2 (10%)</td>
<td>2 (14%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

Ward reduction without general anaesthesia versus reduction and repair under general anaesthesia for gastroschisis in newborn infants (Review)
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### Table 1. Summary of recently published case series  
*(Continued)*

<table>
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<th>4.5</th>
<th>?</th>
<th>?</th>
<th>?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duration of ventilatory support, median days</strong></td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td><strong>Time to full oral feeding, median (range) days</strong></td>
<td>?</td>
<td>30 (5 - 160)</td>
<td>24</td>
<td><em>Full feeds in 11 infants from 11 to 32 days, and in 8 infants by 18 days</em></td>
<td>?</td>
</tr>
<tr>
<td><strong>Duration of TPN, median days</strong></td>
<td>?</td>
<td>?</td>
<td>23</td>
<td>?</td>
<td>17 (mean)</td>
</tr>
<tr>
<td><strong>Duration of hospital stay, median (range) days</strong></td>
<td>39.3</td>
<td>42 (11 - 183)</td>
<td>?</td>
<td>?</td>
<td>20.5 (mean)</td>
</tr>
</tbody>
</table>

### WHAT’S NEW

Last assessed as up-to-date: 11 March 2010.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 March 2010</td>
<td>New search has been performed</td>
<td>This updates the review “Ward reduction without general anaesthesia versus reduction and repair under general anaesthesia for gastroschisis in newborn infants” published in the Cochrane Database of Systematic Reviews (<em>Davies 2003</em>). Updated search found no new trials. No changes to conclusions.</td>
</tr>
</tbody>
</table>

### HISTORY

Protocol first published: Issue 2, 2002

Review first published: Issue 3, 2002
CONTRIBUTIONS OF AUTHORS

MWD - instigated review, searched for studies, wrote review
RMK - revised review
PGW - searched for studies, revised review

The March 2010 update was conducted centrally by the Cochrane Neonatal Review Group staff (Yolanda Montagne, Diane Haughton, and Roger Soll). This update was reviewed and approved by MWD.

DECLARATIONS OF INTEREST

None

SOURCES OF SUPPORT

Internal sources
- Grantley Stable Neonatal Unit, Royal Women's Hospital, Brisbane, Australia.
- Dept of Paediatrics and Child Health, University of Queensland, Brisbane, Australia.
- Dept of Neonatology, Mater Mother's Hospital, Brisbane, Australia.
- Cochrane Perinatal Team, Brisbane, Australia.
- Centre for Clinical Studies, Mater Hospital, Brisbane, Australia.

External sources
- No sources of support supplied

INDEX TERMS

Medical Subject Headings (MeSH)
*Anesthesia, General; Gastrochisis [*surgery]; Infant, Newborn
MeSH check words

Humans