CRD summary
This review evaluated the effectiveness of interventions to manage the pain experienced upon chest drain removal. The authors concluded that analgesic protocols for this procedure need revision and that further research is required. The review appears to support the authors' conclusions, but poor reporting of the review methods make it difficult to confirm the robustness of the conclusions.

Authors' objectives
To evaluate the effectiveness of interventions to manage chest drain removal pain in adults and children.

The review also assessed the amount of pain experienced on chest drain removal but this abstract only refers to the effects of interventions.

Searching
The British Nursing Index, CINAHL, EMBASE, MEDLINE and PsycINFO were searched from inception to February 2004 using the reported search terms. In addition, the Cochrane Library and the Internet were searched and related articles were traced using PubMed. The reference lists of reviews were screened. Non-English language publications were not excluded.

Study selection
Study designs of evaluations included in the review
Clinical trials were eligible for inclusion.

Specific interventions included in the review
Studies of analgesic and non-pharmacological interventions for chest drain removal pain in acute hospital care settings were eligible for inclusion. The included studies evaluated non-pharmacological interventions and analgesic interventions. The former (non-pharmacologics) were white noise versus patient's choice of music versus no music, relaxation versus no relaxation, and ice versus tepid water. The latter (analgesics) were morphine versus local anaesthetic, local anaesthetics versus placebo, and nitrous oxide versus isoflurane and desflurane. The cointerventions included morphine, codeine plus paracetamol and pethidine.

Participants included in the review
Studies of adult and paediatric participants having chest drains removed were eligible for inclusion. Most of the included studies were in adults; two studies included only children (age range: 1 month to 18 years).

Outcomes assessed in the review
Studies that evaluated analgesic efficacy were eligible for inclusion. Studies that did not assess patient outcomes were excluded. The included studies assessed pain using patient-rated visual analogue scales (VAS), patient-rated numeric scales, the Short Form or a modified McGill Pain Questionnaire, patients' verbal comments and observer-rated scales.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
Studies of interventions were assessed for randomisation, allocation concealment, loss to follow-up, integrity of the intervention, and the reliability and validity of the methods used to assess outcomes. The authors of the review independently assessed validity and resolved any disagreements through consensus.
**Data extraction**
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction. For each study, the main findings were extracted and summarised.

**Methods of synthesis**
*How were the studies combined?*
The studies were grouped by intervention and combined in a narrative.

*How were differences between studies investigated?*
Differences between the studies were discussed with respect to the interventions and study quality.

**Results of the review**
Nine studies (n=614) evaluated interventions: eight randomised controlled trials (RCTs; n=590) and one non-randomised controlled clinical trial (CCT; n=24).

Seven of the eight RCTs used blinding.

Non-pharmacological interventions (two RCTs and one CCT).

One RCT (156 adults; 72% given morphine or codeine plus paracetamol within 4 hours of drain removal) reported no difference in pain scores between white noise, patient's choice of music and no music. All patients reported significantly increased pain during chest drain removal. The other RCT (50 adults) reported no difference in pain scores between ice and placebo. One CCT (24 adults given intramuscular pethidine 40 to 60 minutes before drain removal) reported no difference in VAS pain scores between relaxation and no relaxation.

Analgesic interventions.

**Morphine versus local anaesthetic (three RCTs).**

One RCT (80 adults) reported no difference in pain intensity between 4 mg intravenous (i.v.) morphine, 10 mL subfascial 1% lidocaine, i.v. morphine plus subfascial lidocaine, and i.v. morphine plus subfascial saline given 5 to 15 minutes before drain removal. One RCT (52 adults) reported that patients given 0.1 mg/kg i.v. morphine 30 minutes before the procedure had significantly greater increases (p<0.01) in observer-rated VAS scores during drain removal than those given topical anaesthetic cream (EMLA) 3 hours before. Patients treated with EMLA cream reported moderate pain during the procedure (modified McGill pain questionnaire score 4.4). The third RCT (118 children) reported that children given i.v. morphine (0.1 mg/kg) 30 minutes before had significantly greater increases in observer-rated pain (p<0.01) during drain removal than those given EMLA cream 3 hours before.

Local anaesthetic versus placebo (one RCT).

The RCT (41 adults) reported no difference in pain scores during drain removal between 30 mL saline and 30 mL 0.25% bupivacaine given through the chest drain. Both treatment groups reported moderate to severe pain during the procedure.

**Nitrous oxide versus isoflurane and desflurane (two RCTs briefly described).**

One crossover RCT (35 adults, each having two drains removed) reported significantly higher VAS pain scores during the procedure for patients using Entonox plus isoflurane for the first drain and Entonox only for the second drain (p=0.021). The other RCT (56 adults) reported no difference in VAS pain scores between Entonox and IsoDes (a mixture of isoflurane plus desflurane).

**Authors' conclusions**
Since patients given morphine or local anaesthetics still experience moderate to severe pain during the removal of chest drains, analgesic protocols for this procedure need to be revised. Further research is required.

**CRD commentary**

The review addressed a clear question that was defined in terms of the participants, interventions and outcomes; inclusion criteria for the study design were broad. Several relevant sources were searched and no language restrictions were applied, thus minimising the potential for language bias. No attempts were made to minimise publication bias. Methods were used to minimise reviewer errors and bias in the assessment of validity, but it was unclear whether similar steps were taken in the study selection and data extraction processes. Validity was assessed using relevant criteria and the results of this assessment were reported. Combining the studies in a narrative was appropriate given the diversity of the studies, and the synthesis took study quality into account. The review appeared to support the authors’ conclusions, but incomplete reporting of the review methods made it difficult to confirm the robustness of the conclusions.

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

Practice: The authors stated that since patients given morphine or local anaesthetics can still experience moderate to severe pain during the removal of chest drains, analgesic protocols for this and other painful procedures need to be revised and should involve combinations of agents rather than single agents.

Research: The authors stated that further research into the effectiveness of interventions for chest drain removal pain is required, especially combinations of classes of drugs, non-steroidal anti-inflammatory drugs, local anaesthetics and inhalational agents, particularly Entonox. Future studies should evaluate pain and psychological distress using validated instruments. The authors also stated that since chest drain removal can be very painful, future studies that provide no pain relief to some patients should be considered unethical.

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