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## Best evidence topic - Cardiac general

# Is manipulation of mediastinal chest drains useful or harmful after cardiac surgery?

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### Summary

A best evidence topic in cardiac surgery was written according to a structured protocol. The question addressed was: in patients who have undergone cardiothoracic surgery does manipulation of drainage tubes affect drainage volumes or post-surgical outcome? Altogether 681 papers were found using the reported search, of which four represented the best evidence to answer the clinical question. Duncan and Erickson in 1982 found that chest tube stripping can lead to very low negative intrathoracic pressures. The authors report that this has the potential to cause tissue injury. Issacson et al. in 1986 compared two different methods of drain manipulation. They found no significant differences in the milking and stripping methods, suggesting that they are of similar efficacy in enhancing drainage. Lim-Levy et al. in 1986 also compared milking vs. stripping, with a control group that received no manipulation. They found no significant differences between the three groups in drainage volume. Furthermore, they recorded no incidences of tube occlusion in any of the three groups, implying that leaving the drains free of manipulation is acceptable in terms of clot clearance in the majority of patients. The milking and stripping methods were also compared by Pierce et al. in 1991. They also found no significant differences between the two manipulation methods. The studies by Issacson et al., Lim-Levy et al., and Pierce et al. were included in a Cochrane systematic review by Wallen et al. in 2002. No other relevant studies other than the three mentioned above were found after an extensive search of the literature. Overall, the authors concluded that there was insufficient evidence to recommend one type of drain manipulation technique over another, or to support or refute the need for drain manipulation at all. In our paper the authors, journal, date and country of publication, patient group studied, study type, relevant outcomes and results of these papers are tabulated. We conclude that due to possible tissue damage and lack of demonstrable benefit, in most patients drainage tube manipulation should not be performed. No differences in either safety or efficacy have been demonstrated between the milking and stripping methods of manipulation.

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**Keywords:** Thoracic surgery; Cardiac surgical procedures; Chest drain; Drainage

### 1. Introduction

A best evidence topic was constructed according to a structured protocol. This is fully described in the ICVTS [1].

### 2. Three-part question

In [patients who have undergone cardiothoracic surgery] does [manipulation of drainage tubes] affect [drainage volumes or post-surgical outcome]?

### 3. Clinical scenario

You are on the intensive care unit reviewing a patient with your consultant, 4 h after you performed a CABG × 4. The drain output has fallen from 200 ml/h to 150 ml/h, then to 50 ml/h. You arrive to find the nurse milking the

drains. Your consultant reprimands her, saying that milking can pull clots off the heart and cause further bleeding. After he leaves the nurse tells you that the last patient she looked after like this whose drainage suddenly dropped off then developed a tamponade, and needed urgent reopening. She thinks milking would at least stop this from happening. You realise that you have never read any papers on this subject and you are confident that neither of these clinicians had either, so you resolve to review the literature.

### 4. Search strategy

Medline 1950 to September 2007 using OVID interface [exp. Thoracic Surgery OR exp. Cardiac Surgical Procedures OR heart surgery.mp] AND [exp. Chest Tubes OR exp. Drainage OR mediastinal drain.mp OR chest drain.mp] AND [exp. Hemorrhage OR exp. Postoperative Complications OR exp. Postoperative Hemorrhage OR bleeding.mp OR exp. Cardiac tamponade OR exp. Drainage].

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Table 1  
Best evidence papers

| Author, date and country<br>Study type<br>(level of evidence)  | Patient group   | Outcomes  | Key results  | Comments  |
|--|---|---|--|---|
| Duncan and Erickson, (1982) Heart and Lung, UK, [2]<br><br>Prospective case series (level 2b)              | 20 male patients undergoing closed chest tube drainage  | Negative pressure levels caused by drain stripping  | Pressure of up to –408 cm H <sub>2</sub> O were recorded during manual tube stripping  | This study demonstrates the very low negative pressure exerted on the mediastinum by drain stripping, that may have the potential to cause tissue damage  |
| Isaacson et al., (1986) Heart and Lung, UK, [3]<br><br>Prospective randomised controlled study (level 1b)  | 211 consecutive post-operative cardiac patients, alternately allocated into stripping or milking drain manipulation groups  | Mean drainage output at 8 and 12 h  | 0–8 h (–20 cm suction)<br>Milking 467 ml vs. stripping 433 ml<br><br>8–12 (–20 cm suction)<br>Milking 96 ml vs. stripping 93 ml<br><br>No significant differences  | This study demonstrates that milking and stripping result in equivalent drainage outputs  |
| Lim-Levy et al., (1986) Ann Thorac Surg, UK, [4]<br><br>Prospective randomised controlled study (level 1b) | 60 male patients following CABG, randomly allocated into 3 groups: milking ( <i>n</i> = 18), stripping ( <i>n</i> = 16), or no manipulation (control <i>n</i> = 15) | Mean total drainage volume<br><br>Frequency of tube occlusion<br><br>Incidence of arrhythmias<br><br>Average heart rate         | Milking 756.38 ml; stripping 869.87 ml; control 883.33 ml<br><i>P</i> = 0.4597<br><br>No occlusions detected in any patient<br><br>16 subjects had arrhythmias (group not stated)<br><br>No significant difference between among the 3 groups<br><br>Milking 90 BPM; stripping 95 BPM; control 92 BMP<br><br>No significant difference between among the 3 groups  | This study shows that no advantage can be demonstrated by either method of drain manipulation compared to controls. The lack of occlusion in the control group implies that drain manipulation is not required in the majority of patients. |
| Pierce et al., (1991) Heart and Lung, UK, [5]<br><br>Prospective randomised controlled study (level 1b)    | 200 adults following myocardial revascularisation surgery randomly allocated into 2 groups: milking ( <i>n</i> = 100) or stripping ( <i>n</i> = 100)                | Mean total drainage volume<br><br>Mean number of manipulation episodes<br><br>Chest X-ray for tamponade<br><br>Surgery re-entry | Milking 541.6 ml vs. stripping 515.8 ml<br><br>No significant differences between the 2 groups<br><br>Milking 3.1 vs. stripping 2.7<br><br>No significant differences between the 2 groups<br><br>1 tamponade in milking group; 0 in stripping group<br><br>No significant differences between the 2 groups<br><br>3 occurrences of surgical re-entry in each group<br><br>No significant differences between the 2 groups | This study shows that both milking and stripping have similar drainage outputs, and incidence of manipulation episodes, tamponade, and surgical re-entry  |
| Wallen et al., (2002) Cochrane Database of Systematic Reviews, [6]   | Review of the literature, comparing drain manipulation methods in efficacy of preventing tamponade  | Chest tube blockage<br><br>Tamponade  | No differences in any variable observed between any groups   | This systematic review includes three of the papers included in this paper. The authors   |

(Continued on next page)

Table 1 (Continued)

| Author, date and country<br>Study type<br>(level of evidence) | Patient group | Outcomes                        | Key results | Comments   |
|---|---------------|---------------------------------|-------------|--|
| Cochrane systematic review<br>(level?)                        |               | Heart rate<br>Surgical re-entry |             | conclude that a lack of evidence means that no particular method of manipulation can be recommended, nor can the use of manipulation at all be supported or refuted. |

## 5. Search outcome

Six hundred and eight-one papers were found using the reported search. From these, four papers were identified that provided the best evidence to answer the question. These are presented in Table 1.

## 6. Results

Duncan and Erickson [2] in 1982 performed a prospective case series examining the pressures associated with chest tube stripping. They found that negative pressures of up to  $-408$  cm H<sub>2</sub>O were measured, significantly lower than the  $-15$  to  $-20$  cm H<sub>2</sub>O commonly applied to chest drainage systems. The amount of negative pressure was directly related to the length of tubing stripped. The authors report that complications such as tissue entrapment have been reported with as little as  $-15$  cm H<sub>2</sub>O, and that the pressures exerted by stripping, therefore, have the potential to cause tissue injury.

Issacson et al. [3] in 1986 performed an alternate allocation trial comparing the effect of milking and stripping on mean drainage output at eight and 12 h. They found no significant differences between the groups at either time point, suggesting that the two methods are of similar efficacy in enhancing drainage. In addition, they noted that the two groups did not differ in their packed red cell requirements, implying a similar clinical outcome as well.

Lim-Levy et al. [4] in 1986 performed a randomised controlled trial comparing milking and stripping with a control group that had no manipulation. They found no significant differences between the three groups in mean total drainage volume. They also found no differences between the three groups in incidence of arrhythmias or average heart rate, showing that not manipulating tubes appears to have no adverse clinical consequences. In addition, they recorded no incidences of tube occlusion in any of the three groups, implying that leaving the drains free of manipulation is acceptable in terms of clot clearance in the majority of patients.

Pierce et al. [5] in 1991 performed a randomised controlled study comparing the effects of milking and stripping on mean total drainage volume, manipulation events, and incidence of tamponade and surgical re-entry. Like Isaacson et al. and Lim-Levy et al., they found no significant differences between the two manipulation methods. In this study, manipulation was not carried out on a routine basis, but instead was only performed when a clot was evident.

Interestingly, 73 out of 200 patients required no manipulation episodes and a further 30 had only one episode.

The previous three studies were included in a Cochrane systematic review by Wallen et al. in 2002 [6]. This review compared the efficacy of different methods of drain clearance (e.g. varying levels of suction or suction in combination with milking or stripping etc.) in preventing cardiac tamponade. No other relevant studies other than the three mentioned above were found after an extensive search of the literature. The three studies could not be included in a meta-analysis due to incomplete data provision. Overall, the authors concluded that there was insufficient evidence to recommend one type of drain manipulation technique over another, or to support or refute the need for drain manipulation at all.

## 7. Clinical bottom line

Manual manipulation of drainage tubes after surgery exerts very low negative pressures on intrathoracic structures, with the subsequent possibility of causing tissue damage. No clinical or physiological advantages have been demonstrated in the use of manipulation compared to no manipulation, so therefore, in the majority of cases, manipulation should not be carried out. If manipulation is carried out, no differences in efficacy or safety have been demonstrated between milking and stripping, so the choice of method should be made based on practicability and personal preference.

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