

# A new specifically designed forceps for chest drain insertion<sup>☆</sup>

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## Abstract

Insertion of a chest drain can be associated with serious complications. It is recommended that the drain is inserted with blunt dissection through the chest wall but there is no specific instrument to aid this task. We describe a new reusable forceps that has been designed specifically to facilitate the insertion of chest drains.

A feasibility study of its use in patients who required a chest drain as part of elective cardiothoracic operations was undertaken. The primary end-point was successful and accurate placement of the drain. The operators also completed a questionnaire rating defined aspects of the procedure.

The new instrument was used to insert the chest drain in 30 patients (19 male, 11 female; median age 61.5 years (range 16–81 years)). The drain was inserted successfully without the trocar in all cases and there were no complications. Use of the instrument rated as significantly easier relative to experience of previous techniques in all specified aspects.

The new device can be used to insert intercostal chest drains safely and efficiently without using the trocar or any other instrument.

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## 1. Introduction

Insertion of a chest drain into the thoracic cavity is a potentially life-saving procedure that is used by many clinicians, often in emergency situations, to remove pathological collections of air or fluid. Use of the trocar provided to insert the drain is dangerous and is associated with significant complications [9]. Most intrathoracic and upper abdominal organs have been penetrated at some time [5,7,8,10].

Due to these complications, it is recommended that the open technique be used to insert the chest drain [1]. It involves the use of a Robert's or artery forceps to separate the intercostal muscle fibres to create a channel for the drain [12] through which the drain is then passed without the trocar and without force.

While this method is safer than the use of a trocar, it also carries a high complication rate [2–4] as well as several practical limitations. Creation of the channel through the intercostal muscle requires a separating or spreading action

but the forceps currently employed is designed for gripping rather than separating tissue and therefore does not provide optimum power or control for this task. Alignment of the drain to the channel is also troublesome, as the drain becomes difficult to manipulate once the trocar is removed, and the forceps holding the channel open obstructs insertion of the drain. Finally, positioning the drain appropriately within the chest cavity is awkward due to the limitations of the forceps to direct the drain within the chest cavity.

A new instrument was developed to overcome these problems. Local Ethics Committee and Government approval for use of the instrument in a clinical study was granted. The aim of this study was to determine whether the new forceps could be used to insert chest drains effectively and safely without the trocar. All patients gave verbal consent for participation in the trial after they had received appropriate information.

## 2. Materials and methods

The instrument is shown in Fig. 1. It has three major features:

1. A pivot joint at the fulcrum provides a spreading or separating action at the tips using the stronger gripping action of the hand. The extent to which the tips open has been

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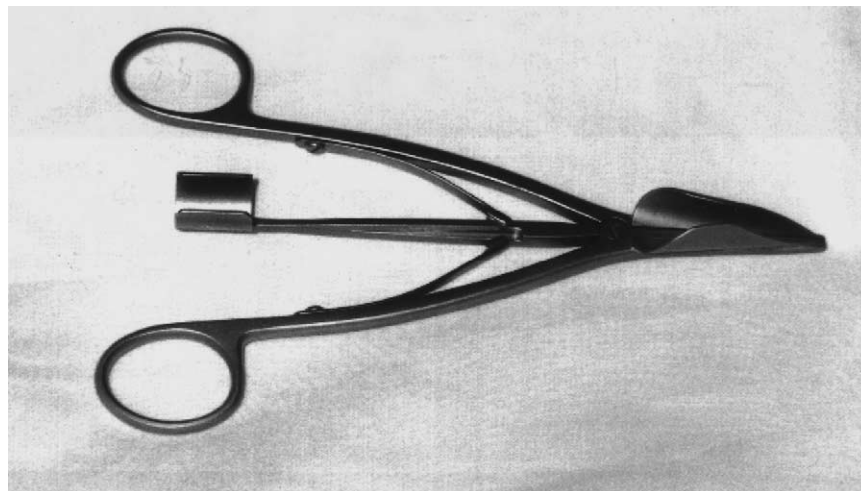


Fig. 1. The new instrument.

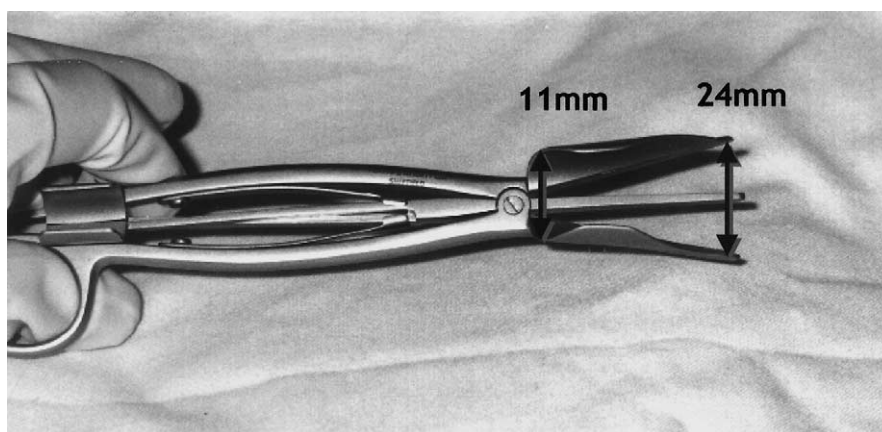


Fig. 2. The distance between the vertical blades at the fulcrum is 11 mm, sufficient to accommodate the diameter of the most commonly used 32 gauge chest drain, expanding to 24 mm at the tips to provide sufficient leverage to separate the muscle fibres.

limited (Fig. 2) so as to reduce the trauma to the intercostal muscle and create a tighter seal around the drain.

2. The second feature is a vertical extension on each blade. These create a circular channel that is more appropriately shaped to allow easy passage of the drain.
3. The problems of aligning and positioning the drain were resolved using a third limb, which is held equidistant from the main limbs by two leaf springs. It carries a grip to hold the drain on the instrument, and facilitates alignment of the drain to the channel and manipulation of the drain into the correct position in the pleural space.

Consecutive patients, who required a chest drain as a routine part of their treatment following elective cardiothoracic surgery, were prospectively entered into the evaluation. The drain was inserted in theatre at the end of the procedure by one of the cardiothoracic surgical team after the chest had been closed while the patient was under general anaesthesia. The drain was sited in the fifth intercostal space in the mid-axillary line on the appropriate side. After incising the skin, the new instrument was used to dissect a channel

through the chest wall and to place the drain in the pleural cavity. The drain is usually inserted by the open technique with the aid of a Roberts' forceps.

The primary endpoint of the study was successful and accurate placement of the drain. The operator also completed a questionnaire recording any difficulties encountered and rating three specified aspects of the procedure, creation of the muscle channel, alignment of the drain to the channel, and positioning of the drain in the pleural cavity, on a 10 cm Visual Analogue Scale relative to experience of previous techniques. The scale allowed a rating from 0 to 10, where 0 meant easier than current techniques and 10 was more difficult. The patients were followed until discharge to ensure that delayed complications were noted.

### 3. Results

The study group consisted of 30 patients (19 men and 11 women) with a mean age of 61.5 years (range 16–81 years).

There were three different operators of varying experience. All 30 drains (size 32FG in all cases) were successfully introduced with the new instrument without the trocar or any other instrument. There were no procedure related or subsequent complications. The mean rating scores for all parameters were low (<2/10) indicating high user satisfaction with the new instrument in all rated aspects.

#### 4. Discussion

Chest drain insertion remains a common procedure, and although atraumatic insertion with blunt dissection is safer than use of the trocar [1,9,12], it is also inadequate in a number of respects [2–4]. Considerable variation from recommended practice has been identified [11] and it has been recognised that the standard of equipment with which medical staff are expected to insert chest drains is a major subject of concern and that this is a correctable contributor to the morbidity associated with the procedure [6].

Our study demonstrates that this new instrument can be used to insert chest drains effectively and safely without the use of the trocar or any other instrument. The ratings of its effectiveness in performing the procedure indicate that it makes this task significantly easier than current techniques. It facilitates creation of the intercostal channel, alignment of the drain to the channel and positioning of the drain in the pleural cavity.

In conclusion, this study demonstrates that this new instrument is of significant benefit in eliminating some of the hazards and difficulties encountered during insertion of chest drains. As the majority of chest drains in the emergency

setting are inserted in more difficult circumstances and by less experienced staff [12], the use of this instrument warrants further research in that environment.

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