

## A New Conveyable Device for Electro-drainage of Thorax

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### ABSTRACT

Chest tube is a flexible plastic tube used to discharge secretion in the cavity between the lungs and chest named pleural cavity. Normally, there is a small amount of fluid in the cavity between the lungs and chest; This fluid helps the movement of lungs during breathing without abrasion. Entrance of bit of air, blood or pus because injury in the pleural cavity can prevent the lungs from fully opening. Full or partial collapse of the lungs makes breathing difficult and can lead to respiratory arrest; putting chest tube in the pleural cavity causes the discharge of secretion and helps patients comfort.

Chest Electro-Drainage mobile system is designed to drain air, blood, water and pus accumulated in the space between the visceral and parietal pleural cavity. Based on low volume and weight, this system can be used to treat Pneumothorax, Hemothorax and Hydrothorax and so forth, both in the emergency state and treatment centers. Obviously, this system will be an action to reduce deaths especially in the case of Pneumothorax.

### Keywords

Chest Tube, Lungs, Electro-drainage, Pneumothorax, Hemothorax, Hydrothorax

### Introduction

Chest tube is a flexible plastic tube connected to a bottle through a set equipped with clamps, there is no connection between the inside of the tube and the outside air [1]. Distilled water or normal Saline should be poured to the bottle so that the distal or end of the tube is placed 2cm below water level. There is another connection to the outside in the bottle so that while breathing bubbles go out through this way. Following heart surgery and chest, some drains are implanted inside the patient's chest variably. In open heart surgery, drainage and pressure reduction in the mediastinum, the pericardium and sometimes the pleural cavity (in the case of air entry to this cavity) are required. Primary goals involve removing blood and fluid of these spaces to prevent cardiac tamponade (short-time) or pericarditis (long-term) and prevent pleural effusion clinically.

Applications of Chest Tube:

1. Pneumothorax: accumulation of air in the pleural cavity
2. Hemothorax: accumulation of blood in the pleural cavity.
3. Pneumopyothorax or Empyema: accumulation of pus in the pleural cavity
4. Cholothorax: accumulation of lymph due to thoracic duct

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5. Hydrothorax: accumulation of non-inflammatory serous fluid

6. Pleural effusion: accumulation of other types of fluid in pleural cavity [2].

Previous existing drainage systems for air or liquid (blood, water, pus and ...) from visceral and parietal pleural cavity are large in size, and there is no capability to use them as mobile systems (especially in cases where the patient is unconscious).

Besides, none of them has the capability to page physicians at the time of need. There is a compact mobile system to page physicians when it is necessary and the patient can use it (even in the absence of consciousness) it would be important to reduce mortality (especially in cases of Pneumothorax).

## Material and Methods

Chest electro-drainage with a unidirectional discharge system drains material (air and liquid) from target space and collects them in a graded bag. This system has the capability of adjusting drainage power (according to the patient's condition) with regard to storing air and liquid and the determination of their amounts is diagnostic as well as treatment aspects. Due to one-way flow throughout this system, the creation of a new Pneumothorax is prevented in case of system shutdown for any reasons. It also features a physician's pager system (wirelessly) in the case of drainage system shutdown or patient requirement. Chest electro-drainage mobile system in terms of size, weight, performance and the current price is much more efficient than previous systems.

Central system (in the size of a fist) which hangs on the patient's neck has the input and the output. Input is attached to IV or chest tube by the interface, and output is connected to a graded bag. System power on (with the capability of adjusting drainage power) drainage of air and liquid (blood, water, pus and ...) would be possible. In order to increase security, in the case of device accidental shutdown, the physician would be paged wirelessly. Due to

the one-way flow throughout the system, the creation of renewed Pneumothorax in case of shutdown for any reasons is prevented. In the case of Hemothorax associated with Pneumothorax, special thrombus filter of this system also can be used, and a graded bag could be embedded before entering the system. With regard to the supply of air and liquid and their amount of determination, it has diagnostic aspects in addition to treatment aspects. It also has the capability of battery charging.

1. Central system (Drainage and pager): includes input (A), output (B), patient necklace (C)
2. IVC (to connect to the entrance of central system)
3. Chest tube (to connect to the drainage bag and central system)
4. The blood or tissue thrombus filter
5. A drainage bag
6. Pager receiver systems (capable of supporting at least 4 patients simultaneously). (Figure 1)

## Results

After the clinical use of this system by experts in thoracotomy surgery, these results were obtained.

- Mobility of system (much less size and weight than previous systems)
- Low price compared to previous systems
- No need for a one-way valve
- The capability of use in the emergency situations outside medical centers
- The ability for domestic production

## Discussion

The existence of a compact mobile system to page physicians when required, and for the patients to use it (even in the absence of consciousness) It would be important to reduce mortality (especially in cases of Pneumothorax). Chest electro-drainage mobile system is designed to drain air, blood, water and pus accumulated in the space between the visceral and parietal pleural cavity (Figure 2). Due to

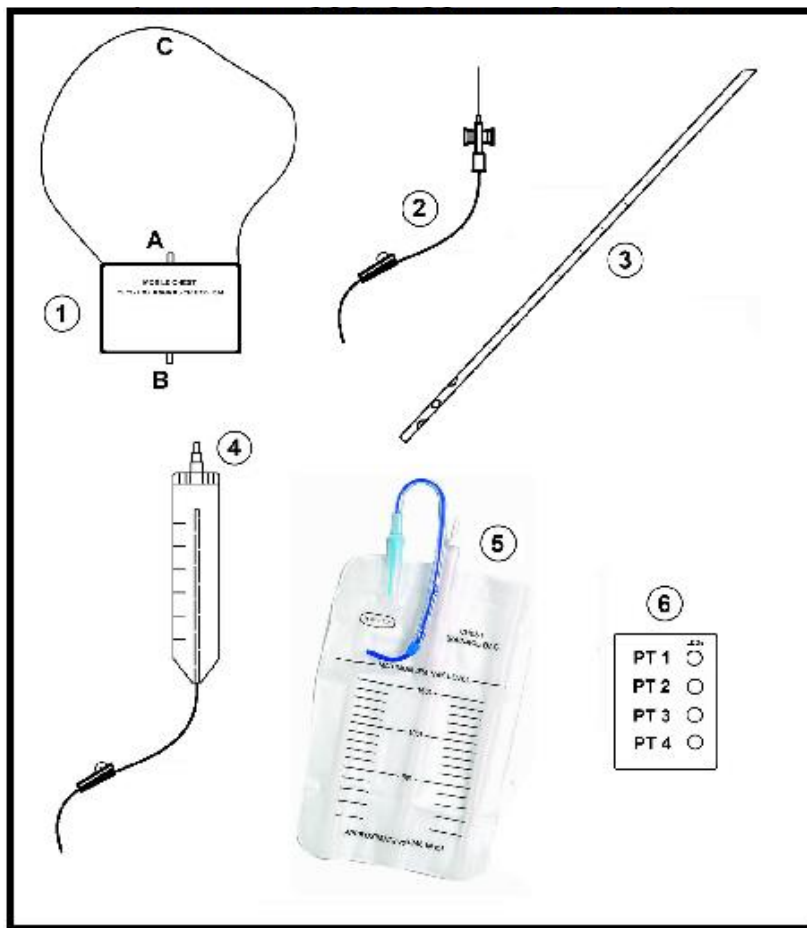


Figure 1: Chest electro-drainage mobile system



Figure 2: Chest electro-drainage after practical use

low volume and weight, this system can be used to treat Pneumothorax, Hemothorax and Hydrothorax and so forth, both in the emergency state and treatment centers. Obviously, this system will be an action to reduce death (especially in case of Pneumothorax). This system has solved all the problems mentioned above.

### Conflict of Interest

None

### References

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