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Respositionable Chest Tube for Pleural Drainage

To the Editor:

Patients can develop pleural effusions for multiple reasons to includes: infection, trauma, malignancy, and heart failure. Placement of a thoracostomy tube for drainage is a common management strategy. However, the fluid is not always free flowing in the pleural space and may be loculated. One of the drawbacks of the standard chest tube is that it remains stationary in the chest after being placed. This may prevent maximum pleural fluid drainage from a standard chest tube. Often, only fluid in the general vicinity of the tube is drained, while fluid farther away is unaffected. When the pleural space is infected, it is more likely to be loculated and maximum pleural fluid drainage, which is desired to clear the space of the infection, is less likely with a single tube.

An innovative tube has been developed which can be repositioned within the pleural space readily from exterior to the thorax. We hypothesize that a chest tube which can be repositioned after placement in the pleural space should eliminate inadequate drainage, speed the patient's recovery, and reduce the cost of

FIGURE 1. Chest tube straight.

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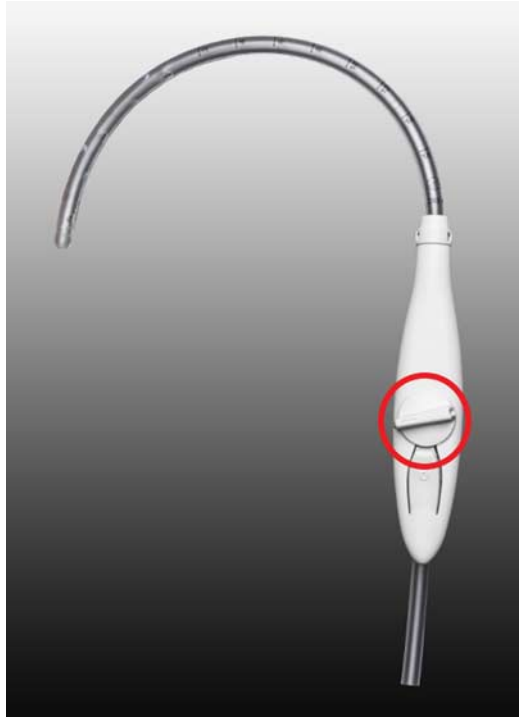

FIGURE 2. Chest tube actuated: red circle is around the dial for the actuator to allow adjustment of the tube. Please note the arrow on the dial that provides a relative estimation of the amount the tube is curved.

hospitalization via a reduction in hospital length of stay. As it can be repositioned, it may reduce the need for additional chest tubes or surgical interventions. If any or all of these occur, the overall cost of treatment may be significantly reduced. The repositionable chest tube (RCT) is substantially similar in other aspects to chest tubes in current use including common radiographic markings and number and size of drainage holes. It is a 510(k) exempt item with the FDA and is approved for use in humans. However, the main difference of the RCT compared with a standard chest tubes is the ability to adjust its position in the thorax cavity after placement. This can aide with evacuation of unwanted or loculated fluid after initial drainage. These repositionable tubes allow the intrathoracic portion to be moved in a symmetric 135 degree arc from midline to both sides for a total 270-degree arc. Two control wires within the tubing connected to a mechanical actuator outside the chest that can then adjust the tube inside the pleural space.

With standard chest tubes, a second or third thoracostomy tube often needs to be placed either when new pockets of fluid accumulate in the thorax which are not drained by the initial thoracotomy tube or after surgery to ensure complete management and control of the pleural space. This novel RCT can be adjusted in the thorax allowing the tip and adjacent drainage holes to manage undrained pockets of fluid. Figure 1 shows the RCT in the straight position. Figure 2 shows the RCT in a curved position.

FIGURE 3. The repositionable chest tube loaded on the placement tool. This is needed as using a clamp to grasp and insert the tube may damage the wires.

CASE STUDIES

Case 1

The patient, a 65-year-old female, had a retained massive hemothorax secondary to trauma that occurred days earlier. The initial chest tube placement resulted in minimal drainage. It was elected to proceed to surgery where a thoracoscopic approach was taken for evacuation of the hemothorax. The 28 French RCT was chosen for drainage to

potentially eliminate the need for multiple tubes to be placed during the patient's hospital stay. The tube was able to be adjusted easily at the bedside with little to no discomfort from the patient. After repositioning an additional 350 ml was drained from the thorax. On the fifth postoperative day the tube was again repositioned without any discomfort.

Case 2

The patient had a large pneumothorax and received a RCT upon admission. The RCT was placed utilizing the supplied placement tool (Fig. 3), which facilitated introduction and initial positioning of the RCT. The placement tool has a lower profile than a clamp grasping the end of the tube. After placement of the tube, with it on suction, a repeat radiograph continued to show a large pneumothorax. The tube was repositioned using the tubes repositioning ability without discomfort for the patient. Repeat radiograph demonstrated complete resolution of the pneumothorax.

CONCLUSION

The RCT being developed is a proprietary leading edge chest drainage system. The technology is highly differentiated relative to currently available chest tubes and it is expected to be superior in removing unwanted fluid from the thorax in terms of efficiency with reduced hospital stay and mortality. Today's chest drainage systems are stationary, and essentially the same, going back to their introduction in 1875.[1] Incomplete removal of a hemothorax[2] or complex pleural effusion[3] can lead to significant increases in morbidity and mortality. The inefficiency of standard chest tubes can result in prolonged hospitalization, need for additional tubes or procedures, and increased costs. A single RCT can be repositioned within the pleural space, which, in theory and shown in these 2 cases, increases the likelihood of only 1 tube being sufficient. This may result in both faster treatment and reduced hospitalization.

Despite the potential benefits, there are some possible drawbacks to consider. First, as in case 1, the RCT was placed at the time of a thoracoscopic decortication. This ensured that there were no adhesions in the chest that if torn could result in bleeding. While this tube was adjusted postoperatively, it was done just a few days after surgery which is prior to reformation of dense adhesions and scar tissue. Placing the tube and adjusting it prior to decortication may result in tearing of adhesions and visceral pleura. This may result in bleeding and additional complications. In the second case, the large pneumothorax occurred due to a paucity of adhesions in the chest and adjusting the RCT could be done safely.

The feasibility of using a repositionable chest tube has been demonstrated in these cases mentioned. While this is a very limited experience, we look forward to more broad use in the future and additional studies to see if our hypotheses are supported by larger series.

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Was it Really a Leiomyoma?

Revisiting a Peripheral Bronchoscopic Diagnosis

To the Editor:

In the October issue of this journal, we published what we believed to be the first reported case of a primary pulmonary leiomyoma (PPL) diagnosed by peripheral bronchoscopy.[1] Presciently, we subtitled our report with a question: "A First for Peripheral Diagnostic Bronchoscopy?" After our manuscript was accepted for publication, the subject of our report—a healthy 29-year-old man—underwent repeat computed tomography of the chest in preparation for surgical resection. Much to our surprise, the lesion was noted to have spontaneously decreased in size in the course of one year (Fig. 1). This observation forced us to consider the possibility of a pathological misdiagnosis because, unlike hormonally driven leiomyoma of uterine origin,[2] a PPL would not be expected to regress

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