Work in progress report - Thoracic general

Management of complicated postoperative air-leak – a new indication for the Asherman chest seal

Sridhar Rathinam*, Richard S. Steyn

Regional Department of Thoracic Surgery, Birmingham Heartlands Hospital, Bordesley Green East, Birmingham B9 5SS, UK

Received 20 June 2007; received in revised form 28 August 2007; accepted 29 August 2007

Abstract

Postoperative air-leak is a problem which is frequently encountered in thoracic surgery. We describe the utility of the Asherman chest seal, a device used in primary trauma care in the successful management of a complicated postoperative air-leak. The Asherman Chest Seal is a sterile occlusive dressing with a one-way Heimlich valve for treating open pneumothorax in acute settings. We used the Asherman chest seal in six patients from July 2001–June 2006 for management of persistent air-leak following thoracic surgical procedures. It was used in three decortication and three pleurectomy patients. There was an equal sex distribution with an age range of 24–67 years. The chest seal was used when drains fell out in the presence of air-leak or wound infection resulting in pneumothorax. All six patients had satisfactory expansion of the lungs with cessation of the air-leak. This was achieved without the pain and morbidity of a chest drain and inpatient stay. The Asherman chest seal is a simple but very useful device that has a role in management of complex air-leaks.

Keywords: Asherman chest seal; Air-leak; Decortication; Empyema

1. Background

Postoperative air-leak is a common problem encountered in thoracic surgery [1]. Persistent air-leaks prolong chest tube duration and hospital stay and increase the liability to infections. The best treatment for air-leak complications is by prevention. Various methods are described to manage persistent air-leak [2–6]. We describe the successful utilization of the Asherman Chest Seal [ACS] (Vernon-Carus Ltd, Preston, Lancs, UK) in the management of complex air-leak. The Asherman chest seal is a device used in the management of an open pneumothorax and stab wounds at the primary level after accidents or in the battlefield (Fig. 1). There are no published reports of the usage of the Asherman chest seal in elective hospital settings. Its utility and simplicity is emphasized in this article.

2. Objective

To review the utility and results of the Asherman chest seal in postoperative air-leak following thoracic surgical procedures.

3. Methods

A retrospective review of the prospectively collected data from July 2001 to June 2006 was performed on patients who had the Asherman chest seal for postoperative air-leak

*Corresponding author. Tel.: +44 121 424 2562; fax: +44 121 424 0562. E-mail address: srathinam@rcsed.ac.uk. (S. Rathinam).

© 2007 Published by European Association for Cardio-Thoracic Surgery in our regional center. All the patients had undergone thoracic surgical procedures and had prolonged air-leak. The chest seal was used when the drains fell out in the presence of an air-leak. Our standard policy is reinsertion of another chest drain if the patient is compromised or if there is no resolution with conservative measures. However, in patients with adhesions and pleurectomy a chest drain reinsertion might be tricky. All the patients were counseled about the ACS option as we use the ACS in pre-hospital care for open pneumothorax in our center.

All the patients with empyema had a preoperative CT-scan, which confirmed them to be Grade III empyema. The choice of the chest seal over chest drain was made when it was difficult to reposition a further drain, due to previous pleurodesis or due to the patient’s reluctance in having one. The chest seal was given a trial before any further intervention in these patients. The presence of incomplete expansion of the lung was confirmed radiologically where appropriate. The ACS was only used in patients who were not clinically compromised and who had a definite track for the air to drain from the pleural space as was evident by visible air-leak on cough. The chest seal was used when drains fell out in the presence of an air-leak in five patients and wound infection resulted in wound dehiscence leading to sucking wound and pneumothorax in one patient.

The chest seal was placed at the drain site and the self-adherent dressing around the seal was fixed to the skin (Fig. 2). The device has a circular flange which is self-adhesive; in the center of the device there is an opening to which the Heimlich valve is attached. The drain site is
Fig. 1. Asherman chest seal.

Fig. 2. Asherman chest seal attached to a patient.

first cleaned and dried with sterile gauze, which comes with the device. The best fit is achieved by having the drain site corresponding to the valve. It is imperative to check that the valve is working before application. The protective cover is peeled off the flange to expose the adhesive as the device is applied firmly onto the skin. It is important to ensure that the drain site corresponds to the valve. In the event of a wound with combined air-leak and drainage a stoma bag can be fitted onto the chest seal. In a patient with port dehiscence leading to sucking wounds causing an air-leak, the ACS was placed on the inferior port and the anterior port, which was dehisced, was sutured.

All the patients were followed-up with regular radiographs to check for satisfactory expansion of the lungs. The patients who were still having pleural drainage at the time of losing the chest drain were supplemented with a stoma bag to collect the pleural contents. Cessation of the air-leak and satisfactory expansion of the lungs without the need for a further chest drain were taken as end points.

4. Results

Six patients were managed during this period with ACS for persistent air-leak following thoracic surgical procedures (Table 1). It was used in three decortication and three pleurectomy patients. There was an equal sex distribution with an age range of 24–67 years. None of these patients needed intensive care admission and there were no mortalities in this series. The median length of air-leak was 14.5 days (range 3–27 days) and the median length of ACS usage was six days (range 2–8 days). Two patients had it placed in the hospital and had it removed after satisfactory expansion prior to discharge. Three patients were discharged home with the ACS and one patient had it used as an outpatient. Patient 2 was readmitted after initial successful VATS bullectomy with pleurectomy and satisfactory expansion after drain removal. He developed an air-leak and small pneumothorax due to drain site infections, which were sucking air. One site was closed and the chest seal was used on the other drain hole, and the air-leak stopped and lung expanded completely.

The chest seal was removed in all the patients and they were followed-up without any problems and discharged to their primary physician.

5. Discussion

Postoperative air-leak is a common problem encountered in thoracic surgery [1]. Persistent air-leaks prolong chest tube duration and hospital stay, and increase the liability to infections. The best treatment for air-leak complications is by prevention. An air-leak can be prevented by meticulous dissection, and careful closure of parenchyma and bronchus [2, 3]. Care should be taken during the operation to check for air-leaks at the end of the procedure by inflating the lung and checking for the air-leak underwater. Reinforcements to staple lines bronchial and parenchyma with pleura, muscle flaps, prevent air-leaks [4]. Tissue sealants are useful tools that can be used in parenchymal air-leaks [5]. Pleural tenting is known to decrease the air-leak after lung resections [6]. Most air-leaks generally stop spontaneously within the first few days. However, the air-leak may persist when further treatment options need to be considered.

Continuous low-pressure suction helps expansion of the lung and promotes adhesions to the chest wall, which stops the air-leak [7]. If the lung collapses on discontinuation of suction, then pleurodesis is performed with chemicals or blood.

Chemical pleurodesis with tetracycline and talc are very useful in the management of an air-leak [8–10]. The chemical solution or slurry is injected through the chest drain into the pleural cavity and clamped with the patient nursed in different postures to promote coating of the different areas of the pleura. Care is taken not to leave the drain clamped for long periods and is used only to promote uniform distribution of the pleurodesing material. Once the
pleurodesing agent is distributed then the drain is unclamped. The alternative method is instilling the pleurodesis material into the chest and looping the chest drain in a non-dependent position to prevent rapid efflux of the material. The chemicals induce an inflammatory reaction following which there are adhesions and pleurodesis.

Autologous blood pleurodesis is another proven method in dealing with this problem, where the patient’s own blood is collected and instilled into the pleural cavity [11, 12]. The blood promotes pleurodesis by fibrinous adhesions. If the lungs stay inflated after discontinuation of suction the drains can be removed, or if the air-leak persists in the absence of pneumothorax then the drains can be connected to flutter bags, in which there are drains connected to bags with a one-way Heimlich valve [13]. The patient can be discharged home with a periodic review until the lungs expand and air-leak settles.

Rarely when all these measures fail and there is still a significant air-leak, the patient needs a re-operation to look for the air-leak and seal it appropriately with glue, sutures, pleural or pedicled muscle flap and finally surgical pleurodesis. Each method has its advantages and disadvantages.

We describe the successful utilization of the Asherman chest seal in the management of persistent air-leak complicated by loss of the chest drains. There are no published reports of the usage of the Asherman chest seal in elective hospital settings. Its utility and simplicity is emphasized in this article.

The Asherman Chest Seal® is a sterile occlusive dressing for treating open pneumothorax and preventing tension pneumothorax in chest injuries from gunshots, stab wounds, or other penetrating chest trauma. The Asherman chest seal is 5.5 cm in diameter, includes a gauze pad (4" × 4") to clean and dry the wound, and is clear so that the wound can be observed. The unique one-way Heimlich valve is designed to let air and blood escape while preventing re-entry of either. The ACS is standard issue for the US Army, the British Army and the US Navy for emergencies in the battlefronts for air-leaks in the chest. It is also used frequently by the paramedics and ambulance crews in acute management of stab wounds and pneumothorax [14]. The drain site is cleaned and dried; the seal has an adhesive which can be best fitted in the wounds ensuring that the drain site corresponds to the valve. It is imperative to check that the valve is working before application. The adhesive is peeled off the fixing dressing and the device is applied onto the skin ensuring the drain site corresponds to the valve. Though in principle it is similar to a Heimlich valve on a flutter bag, the significant difference is that there is no intra-thoracic component to this device and it is just adherent to the chest wall.

The advantages are that the patient is ambulant and can be treated as an outpatient. The discomfort of the chest drain is not present hence is patient friendly. The risk of infection, which is associated with chronic indwelling chest drain, is also avoided. The patient can be taught how to change the seal if need be. ACS has a proven role as a very useful tool in an emergency setting and has a definite role in an elective setting as well. We emphasize that its utility in a hospital setting has been tested only in stable patients without clinical compromise and further evaluation is needed with larger numbers. We feel ACS is not an alternative for an intercostal chest drain but an option in complicated states where a chest drain reinsertion might be difficult due to adhesions.

6. Conclusion

The Asherman chest seal is a simple but very useful device that has a role in management of persistent air-leaks complicated by loss of chest drains.

References


Table 1
Procedures and duration of air-leak

<table>
<thead>
<tr>
<th>Serial no.</th>
<th>Age/sex</th>
<th>Diagnosis</th>
<th>Procedure</th>
<th>Reason for use</th>
<th>Duration of air-leak (days)</th>
<th>Duration of chest seal (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28/F</td>
<td>Empyema</td>
<td>VATS decortication</td>
<td>Slipped drain</td>
<td>27</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>24/M</td>
<td>Pneumothorax</td>
<td>VATS bullectomy/pleurectomy</td>
<td>Slipped drain</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>61/M</td>
<td>Empyema</td>
<td>Decortication</td>
<td>Drain site infection and slipped drain</td>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>46/M</td>
<td>Empyema</td>
<td>VATS bullectomy/pleurectomy</td>
<td>Drain site infection and air-leak</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>32/F</td>
<td>Pneumothorax</td>
<td>VATS effusion drainage</td>
<td>Slipped drain</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>67/F</td>
<td>Pleural effusion</td>
<td>VATS effusion drainage</td>
<td></td>
<td>14</td>
<td>6</td>
</tr>
</tbody>
</table>


