Successful use of a single chest drain postlobectomy instead of two classical drains: a randomized study

Abel Gómez-Caro a,*, Maria J. Roca a, Juan Torres a, Pedro Cascales b, Emilio Terol b, Juan Castañer b, Antonio Piñero b, Pascual Parrilla b

a Thoracic Surgery Department, Hospital Universitario Virgen de Arrixaca, Autovía Murcia-Cartagena s/n, CP 30120 Murcia, Spain
b General Surgery Department, Hospital Universitario Virgen de Arrixaca, Autovía Murcia-Cartagena s/n, Murcia, Spain

Received 5 December 2005; received in revised form 5 January 2006; accepted 10 January 2006

Abstract

Objective: To compare surgical results and complications in the immediate postoperative course between the use of a single drain and two-drain post-anatomical pulmonary resections. Patients and methods: Between January 2004 and September 2005, 143 patients were scheduled for pulmonary lobectomy or bilobectomy for non-small cell lung cancer (NSCLC) in our department. Pneumonectomies, wedge resection, and nonresectable thoracotomies were excluded from the study. Hundred and nineteen patients were enrolled in this study. Clinical and surgical variables were collected prospectively. Lobectomy or bilobectomy and systematic mediastinal node dissection were performed in all cases. The patients were randomly assigned to receive single (group A) or two (group B) drains, independent of any preoperative or intraoperative variables. Group A consisted of 60 patients who had one single drain sited in the midposition and group B consisted of 59 patients who had two classical drains (apical and basal). There were no surgical, oncological, or physiological differences between the groups (p = NS). Results: There were no statistically significant differences detected between the groups in relation to postsurgical morbidity or mortality and other issues studied, except in analgesia requirements (group A less than group B, p < 0.05). After drain removal there were no significant differences between the groups in terms of subcutaneous emphysema, new drains needed, residual pleural effusion, or residual space (p > 0.05). Conclusions: In our study, we did not find significant differences between the use of one or two drains after lobectomy or bilobectomy in relation to early postoperative outcome. However, the use of only one drain is more economical and is less painful for patients, without any additional adverse consequences.

Keywords: Drains; Outcome; Lobectomy; Pain; Complications

1. Introduction

Inadequate re-expansion of residual lung is one of the most important causes of morbidity following lung resection and may instigate postsurgical hemothorax, persistent air leak, or atelectasis. It is widely accepted practice to use two drains — one apical and anterior and the other posterior and basal — as classically described in the textbooks [1]. The use of a single drain after lobectomy has been reported in the literature, in this nonrandomized study, the authors cited similar results and postoperative complications with the use of either single or two drains [2].

Theoretically, the use of a single drain is likely to result in less postoperative pain, and is more economical in terms of time and costs more than the classical two-drain approach. Less pain during the postoperative course improves patient’s ability for respiratory exercise, aids bronchial toilet, and decreases the risk of respiratory complications [3]. The aim of this study was to compare surgical results and complications in the immediate postoperative course between the use of one single drain and two drains postlobectomy or bilobectomy.

2. Patients and methods

Between January 2004 and September 2005, 143 patients were scheduled for pulmonary lobectomy or bilobectomy for non-small cell lung cancer (NSCLC) in our department. Pneumonectomies, wedge resection, and nonresectable thoracotomies were excluded from the study. Hundred and nineteen patients were enrolled in this study. Clinical and surgical variables were collected prospectively. The pre- and postoperative variables are shown in Table 1. For all patients included in the study, surgery was performed by three consultant thoracic surgeons. The approach was posterolateral thoracotomy through the fifth intercostal space with sparing of serratus anterior. Lobectomy or bilobectomy and...
systematic mediastinal node dissection were performed in all cases. For nonfused fissures we divided the pulmonary artery branches first before stapling the fissure and dividing the lobar bronchus. We divided all fused fissures with mechanical staples. When performing upper lobectomies, we divided the superior lobe artery branches first followed by the upper lobe bronchus, which was approached from above. This technique allows good exposure of the posterior recurrent arteries or the lingular arteries on the left side, which were divided next. Finally, the fused fissure was separated with mechanical staples in order to avoid persistent air leak. Pleural tent or biological sealants were not used. Drains were inserted two intercostal spaces below the incision. The patients were randomly assigned, to receive single (group A) or two drains (group B), independent of any preoperative or intraoperative variables. Randomization was conducted preoperatively by computer (on-line web www.randomizer.org (©1997–2005 by Geoffrey C. Urbaniak and S. Plous)).

Group A (Fig. 1) consisted of 60 patients who had one single drain sited laterally, directed from the base towards the mid-cavity, ensuring adequate drainage of the costophrenic angle. Group B consisted of 59 patients who had two drains: one apical and anterior and the other posterior and basal. There were no surgical, oncological, and physiological differences between the groups (Table 1, p = NS). The drains were classical Argyle® 28 Fr tubes (Sherwood Services AG, TYCO Healthcare, Ireland) in both groups. The drains were connected to a thoracic drain unit (SENTINEL SEAL, Sherwood Services AG, TYCO Healthcare, Ireland), using a Y-connector for patients receiving two drains. All drains were connected to suction in theatre and kept on low suction (15–20 mmHg) until removed. If after 5 days a persistent air leak was detected suction would be removed and the algorithm of Cerfolio et al. [4] was followed. Daily drainage volumes and air leak were registered by a consultant surgeon.

Epidural thoracic catheter was inserted in all the patients preoperatively in theatre. During the first 48 h, patients received epidural infusion (Bupivacaine 0.125 mg and fentanyl 2 μg/ml h)) and intravenous non-steroidal anti-inflammatory drugs (Ketorolaco Trometamol). After extubation in theatre, patients enrolled in this study spent the first 12–24 h in ICU where chest drainage and air leak were reviewed hourly. Chest X-rays were performed at 3 and 24 h after the procedure. The importance of physiotherapy had been emphasized to the patients preoperatively and these exercises were commenced in ICU. All the patients returned to the thoracic surgery unit as soon as possible where they received intravenous analgesia (Ketorolaco trometamol 30 mg/21 ml h)). All patients were asked to complete questionnaires collecting information in relation to pain control and a pain score was registered twice daily (numerical verbal pain score, Table 2). Additional analgesia (morphine 0.5 mg/kg 24 h infusion) was administrated if the verbal pain score was 3 or greater and this was registered as nonstandard analgesia in both groups. All patients deemed suitable for discharge were commenced on oral analgesics in
Table 2
The numeric verbal pain score

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No pain at rest or on movement</td>
</tr>
<tr>
<td>1</td>
<td>Mild pain at rest, mild pain on movement</td>
</tr>
<tr>
<td>2</td>
<td>Moderate pain at rest, moderate pain on movement</td>
</tr>
<tr>
<td>3</td>
<td>Severe continuous pain</td>
</tr>
</tbody>
</table>

the morning and if pain was well controlled they were allowed home in the same evening.

Each patient was clinically examined every morning and evening and the decision to remove the drains was based on the lack of air leak on coughing, a drainage of less than 150 ml in the previous 24 h, and the absence of a hemothorax or a pneumothorax bigger than 10% on chest films. In group B, both drains were removed on the same day unless an air leak was detected whilst removing one of the drains, in which case one drain was left in situ. Patient discharge was encouraged after drain removal and satisfactory chest film.

Postoperative complications, length of stay, time to drain removal, number of chest X-rays, the requirement for repeat chest drain insertion, subcutaneous emphysema which needed a intervention, residual space, or residual pleural effusion were collected prospectively until the 30th post-operative day.

Statistical analyses were carried out with the computer program package SPSS v.11 (SPSS Inc., Chicago, IL, USA). Qualitative variables were compared with the χ² statistical test or Fisher’s exact test as appropriate, with a significance level accepted when p < 0.05. Total costs are expressed in euros.

3. Results

Table 3 shows the complications in our series. In group A, three patients died due to pneumonia (n = 2) and myocardial infarction (n = 1). In group B, only one patient died due to pneumonia. There was no mortality in patients who underwent extended or sleeve procedures. There were no significant differences in complications between both groups (p > 0.05). None of these postoperative complications has been related to the use of a single drain instead of two drains.

Table 4 shows hospital stay, drainage characteristics, analgesia requirements, and residual space assessment. Patients in group B required significantly more nonstandard analgesia than patients in group A (p < 0.05). There were no other statistically significant differences detected between the groups in relation to postsurgical morbidity and the other issues studied.

Postoperative outcome regarding drainage of the pleural cavity (residual space, residual pleural effusion, or reoperation for hemothorax) after a single drain or two drains were of very low rates in both groups, and did not show any significant difference (p > 0.05). After drain removal there were no significant differences between the groups in terms of subcutaneous emphysema, new drains needed, residual pleural effusion, or pneumothorax (p = NS). In group B, one patient developed subcutaneous emphysema and pneumothorax bigger than 20% which required the insertion of a new drain.

There was no difference between the two groups in terms of length of hospital stay, amount of drainage, and number of days till chest drain removal (p = NS). Indeed, we did not find any differences between the two groups in terms of pain score registered (group A 2.3 ± 1.2 (mean ± SD) and group B 2.2 ± 0.9 (mean ± SD), p > 0.005) and in both groups the most painful day was the second day after surgery.
The amount of cost-saving in group A was 212.67 ± 7.60€ (mean ± SD) compared to group B (additional sutures, dressing pads, stitch cutters, removal packs, gloves).

4. Comment

Inadequate re-expansion of residual lung is one of the most important causes of morbidity following lung resection. This re-expansion is essential to avoid atelectasis, acute respiratory insufficiency, postoperative bleeding, and re-operation due to clots inside the cavity [2]. The classical practice is to use two drains after pulmonary resections. These drains are positioned in different directions according to different schools. The most popular practice is one anterior and apical, and the other posterior and basal [1,2]. Most of the thoracic surgeons in Spain and the United Kingdom leave two drains in the thoracic cavity, one in the costo-phrenic angle to remove blood and pleural effusion [1], and the other at the apex. These drain positions were classically thought to be important, and surgeons usually fix the drains internally with pleural loops or stitches [5]. Emerging data, and our own experience, led us to question the validity of this concept. Alex et al. [2] have recently reported no differences in complication rate or intermediate outcome between two non-randomized groups with one single or two rigid drains after lobectomy. These authors found significantly less pain and better cost-savings in the single drain group [2]. The results from our own randomized prospective study support the findings of Alex et al. [2], since we also showed no significant differences in terms of postoperative morbidity with the use of single instead of double drains.

We only performed six extended resections (five extended to the chest wall and one extended to the diaphragm) and 13 bronchial and/or arterial sleeve resections during the time period of this study. As we have performed very few of these cases, it would be meaningless to draw any solid conclusions about the use a single drain instead of the two drains in this cohort. Nonetheless, we did not detect any complications in these patients in our series regarding adequate drainage of the pleural cavity. In the opinion of the authors, the use of a single drain in extended resections is likely to be suitable but due to the small numbers in our study it is difficult to draw firm conclusions regarding this.

In our series, patients with two drains needed more analgesia; however, we believe it is difficult to attribute this extra analgesia solely to the use of one or two drains, since the patients underwent a thoracotomy. However, large bore chest drains can impinge on the lung and, passing through the intercostal space, create great discomfort for the patient whom often experiences pain due to the restriction of deep breathing, sputum retention, and atelectasis [6].

Undoubtedly, effective pain control is of fundamental importance if one is to avoid respiratory complications such as sputum retention [7] and it allows patients to undergo their respiratory rehabilitation more comfortably [3].

It is therefore mandatory in our opinion that patients are kept as comfortable as possible during the postoperative course [8]. Early mobilization and less oxygen support are likely to accelerate the recovery of patients undergoing a thoracic procedure [9] and reduce the incidence of sputum retention [7].

According to a recent British survey of thoracic surgery guidelines and procedures, more than 90% of thoracic surgeons in the United Kingdom leave two drains after anatomical or non-anatomical pulmonary resection [10]. Watanabe et al. [11] have recently published a series of cases in which the authors avoided the use of drains after minor thoracic surgery; however, none of the patients in their series underwent an anatomical pulmonary resection.

In Spain, most of the thoracic surgery departments tend to leave two drains after anatomical pulmonary resections except in pneumonectomy which follows a different protocol. Only two departments in Spain routinely leave one drain after anatomical pulmonary resection as far as the authors are aware from a telephone survey. Recently, Terzi et al. [6] have published the successful use of two new silastic, non-rigid drains after lobectomy with similar complication rates.


Acknowledgements

The authors are indebted to Mr. R. Chau and Mr. B. Choudhary from the Freeman Hospital (Newcastle Upon Tyne, UK) for their contribution in the translation and arrangement of this manuscript.

References


