Original article

Influence of timing of chest tube removal on early outcome of patients underwent lung resection

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Available online 16 June 2016

Abstract

Objective: The presence of a chest tube is a factor significantly associated with postoperative pain and functional limitation in patients submitted to pulmonary resection. Our aim was to study if early removal of the chest tube is the better way that can effectively release pain, and improve pulmonary functions without increasing the risk of postoperative complications.

Methods: A prospective observational study was carried out on 88 patients who underwent lung resection by posterolateral thoracotomy. A single chest tube was inserted. Criteria for chest tubes removal were when air leak resolved and the fluid drainage was 350 ml/day or less provided that the drained fluid was macroscopically non-chylous and non-hemorrhagic. Static and dynamic pain scores and forced expiratory volume in the first second (FEV1) were assessed 2 h before and after the chest tube removal. The pain level was assessed by the numeric rating scale (NRS). Two measurements for FEV1 were performed both before and after the chest tube removal, and the best value measured at each time was recorded and used for the analysis. Postoperative complications were reported.

Results: The mean static and dynamic pain scores were decreased significantly after chest tube removal. The mean value of FEV1/Liters and FEV1% of predicted also showed statistically significant improvement after chest tube removal. 8 (9%) of patients developed pleural effusion. 5 (5.7%) of patients developed pneumothorax. Empyema was reported in 3 (3.4%) of patients.

Conclusion: Early removal of chest tube may have beneficial effect on control of post-thoracotomy pain, improvement of pulmonary functions and decreasing the risk of complications after lung resection.

1. Introduction

Chest tube placement following pulmonary lobectomy is common modality. Postoperative pleural effusion is drained and in case of an air leak, development of tension pneumothorax is prevented. Still much controversy exists about management of chest tubes in postoperative period [1].

Fast recovery after operation has been the hotspot of recent researches. Postoperative pain not only increases patient suffering, but also increases the risk of infection and prolongs the length in hospital. The pain is usually caused by incision and irritation of chest tube [2].

The aim of this study was to evaluate the effect of early removal of chest drains after lung resection on early postoperative outcome including pain pulmonary functions, and incidence of postoperative complications.

2. Patients and methods

2.1. Study design

Between June 2012 to May 2015, and after approval of Menoufia Ethic's committee and a signed informed consent by all patents for the study protocol, we conducted a prospective longitudinal study on 88 patients who underwent lung resections for both neoplastic and non-neoplastic lung diseases in Menoufia University hospital.

Patients excluded from the study were with: (a) double chest tubes (b) prolonged air leak >7 days, (c) patients needing post-operative mechanical ventilation, (d) patients reopened for bleeding, (e) surgery on chest wall or diaphragm, (f) Patients with a non-functioning epidural catheter and (g) Patients lost to follow-up. None of them underwent VATS resection.

All patients had a thoracic epidural catheter, which was inserted just prior to induction of general anesthesia and removed on the third postoperative day.

All patients had the standard posterolateral thoracotomy with division of the latissimus dorsi muscle and preservation of the serratus anterior muscle by the same surgical team. All intraoperative measures were done to prevent air leak including stapling or manual suturing and meticulous hemostasis was done to decrease the amount of blood loss. All patients were extubated in the operating theatre after completion of the surgery. We left a single chest tube (30 French) with the tip positioned mid-posteriorly and connected to the underwater seal. A chest roentgenogram (CXR) was performed one to 2 h after the procedure.

Criteria for chest tubes removal are when air leak resolved (air leakage was evaluated as no bubbles were seen in the water seal when the patient coughs) and the fluid drainage was 350 ml/day or less provided that the drained fluid was macroscopically non-chylous and non-hemorrhagic. One post-removal CXR was performed before discharge.

Postoperative analgesic protocol was similar in all patients. It consisted of intravenous infusion of 1 g of paracetamol every 8 h in the first two days then oral paracetamol during the following five days in addition to non-steroidal anti-inflammatory drug (Ketorolac 30 mg IM twice daily) and on demand doses in the epidural catheter (10 ml of 0.25% bupivacaine).

Static and dynamic pain and FEV1 were assessed in the same patients 2 h before and after the chest tube removal by the same operator for each of them and in the same conditions.

No analgesics were administered before or after the chest tube removal that could have potentially affect the analysis. All patients were seated in bed in a semi sitting position. The pain level was assessed by the numeric rating scale [range 0: no pain, range 10: severe pain]. This scale uses a 10-cm horizontal line whose left extremity indicates the absence of pain and whose right extremity indicates the worst pain ever experienced [3].

FEV1 was measured by using spirometry (Cosmed®). A spirometer connected to a rigid plastic mouthpiece, was used to measure FEV1. The operator was responsible for preventing any type of leaks, optimizing the fitting of the mouthpiece to the lips of the patients. A nose clip was used to avoid air leaks through the nose of the patients.

Two measurements were performed both before and after the chest tube removal, and the best value measured at each time was recorded and used for the analysis. Bronchodilators were not used in these patients.

The primary outcome of this study was pain, which was measured by a well-trained physician using the numeric rating scale from 0 to 10 which was explained to all patients preoperatively and was recorded 2 h before and after Chest tube removal. Also FEV1 is one of the primary outcomes included in the study.

The secondary outcomes include postoperative complications before and after discharge for one month.

2.2. Statistical analysis

Based on the total number of patients received thoracotomy and the prevalence rate of post-thoracotomy pain reported in previous studies [4], sample size was calculated to be 83 patients with 95% confidence interval. Two types of statistics were done: descriptive: e.g. percentage (%), mean and standard deviation (SD), and analytic statistics: e.g. The Wilcoxon signed rank test for measuring pre-removal and post-removal pain and FEV1 changes. Comparisons of data were made with the overall α error set at 0.05 (two-tailed). Analyses were conducted with the SPSS version 20 software (SPSS, IBM. Chicago, IL, USA).

3. Results

Patients prospectively allocated to this study were 110 patients. We excluded 22 patients either because they didn't met the inclusion criteria, (n = 9) or refused to participate, (n = 5), or lost to follow-up, (n = 6) and prolonged air