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Association of postoperative pulmonary complications with delayed mobilisation following major abdominal surgery: an observational cohort study

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Abstract

Objectives Previous Australian studies reported that postoperative pulmonary complications affect 13% of patients undergoing upper abdominal laparotomy. This study measured the incidence of postoperative pulmonary complications, risk factors for the diagnosis of postoperative pulmonary complications and barriers to physiotherapy mobilisation in a cohort of patients undergoing high-risk abdominal surgery.
Design Prospective, observational cohort study.
Setting Two surgical wards in a tertiary Australian hospital.
Participants Seventy-two patients undergoing high-risk abdominal surgery (participants in a larger trial evaluating a novel model of medical co-management).
Main outcome measures Incidence of, and risk factors for, postoperative pulmonary complications, barriers to mobilisation and length of stay.
Results The incidence of postoperative pulmonary complications was 39%. Incision type and time to mobilise away from the bed were independently associated with a diagnosis of postoperative pulmonary complications. Patients were 3.0 (95% confidence interval 1.2 to 8.0) times more likely to develop a postoperative pulmonary complication for each postoperative day they did not mobilise away from the bed. Fifty-two percent of patients had a barrier to mobilisation away from the bed on the first postoperative day, with the most common barrier being hypotension, although cessation criteria were not defined objectively by physiotherapists. Development of a postoperative pulmonary complication increased median hospital length of stay (16 vs 13 days; $P = 0.046$).
Conclusions This study demonstrated an association between delayed postoperative mobilisation and postoperative pulmonary complications. Randomised controlled trials are required to test the role of early mobilisation in preventing postoperative pulmonary complications in patients undergoing high-risk upper abdominal surgery.

Keywords: Postoperative complications; Early ambulation; Physical therapy (specialty); Pneumonia; Laparotomy; Surgery

Introduction

Postoperative pulmonary complications following major upper abdominal surgery increase morbidity [1,2], mortality [3], hospital length of stay and costs [2,4]. However, the lack of a consistent definition for postoperative pulmonary complications has resulted in various rates reported in the literature [5]. A recent Australian study reported an incidence of postoperative pulmonary complications of 13%, with an associated significant increase in hospital length of stay [6].

Strategies to prevent postoperative pulmonary complications remain poorly defined. A recent systematic review questioned the utility of routine postoperative respiratory physiotherapy following upper abdominal surgery [7]. In contrast, other evidence suggests that postoperative mobilisation may reduce the incidence of pulmonary complications [8], although the quantity and intensity of mobilisation to achieve this outcome is unknown.

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A recent pilot study performed at the authors' institution involved a postoperative surveillance team (POST) to provide medical co-management of a selected high-risk surgical patient population on two inpatient wards [9]. As part of the pilot study, a physiotherapy sub-study was conducted in the POST cohort who underwent upper abdominal surgery. The objectives of the sub-study were to record the incidence of pulmonary complications and test whether clinical variables were risk factors for the diagnosis of postoperative pulmonary complications. In addition, the project aimed to document the nature and timing of the physiotherapy intervention provided to the POST abdominal surgery cohort, and identify barriers that delayed or prevented mobilisation of patients in the early (Day 1 to 7) postoperative period.

Methods

The Austin Health Human Research Ethics Committee approved the POST project and waived the requirement for informed patient consent. This study was part of the POST pilot study, which analysed the effectiveness of a new model of postoperative medical co-management for patients undergoing high-risk abdominal surgery, including upper oesophageal surgery with a thoracic incision. The pilot study was conducted between 1 March 2010 and 30 June 2010 at a tertiary teaching hospital in Melbourne, Australia and has been detailed elsewhere [9].

At the authors' institution, patients undergoing upper abdominal surgery are not provided with pre-operative physiotherapy assessment or treatment. They are assessed routinely on the first postoperative day with an emphasis on early mobilisation. Additional treatment is provided if patients are assessed to have clinically significant respiratory signs, such as atelectasis or sputum retention. Weekend physiotherapy treatment is reserved for patients who have not been mobilised previously or who require specific respiratory intervention.

Patients who were admitted to the two surgical wards or intensive care unit (ICU)/high dependency unit were included in the study on the day they were first seen by a physiotherapist following surgery. Patients who underwent laparoscopic, lower abdominal, minimally invasive, endoscopic or non-surgical procedures were excluded.

Demographic and clinical information including premorbid respiratory and functional status were recorded for each patient. Daily physiotherapy assessment, treatment and the presence of predefined barriers to physiotherapy were recorded on a standardised case report form. Predefined barriers included: low blood pressure, severe premorbid debility, patient refusal, pain, atrial fibrillation or other cardiac arrhythmia, nausea and vomiting, motor block from epidural, nurse concerned, low haemoglobin or other. Patients received physiotherapy (early mobilisation, deep breathing, +/− periodic non-invasive ventilation and supported cough) based on individual patient assessments by the treating physiotherapist, as would be provided routinely. Data were collected daily by the treating physiotherapist on each review until the patient was discharged from physiotherapy or the seventh postoperative day, whichever came first. Time (in hours) from the end of theatre time to first sitting out of bed, and time from the end of theatre time to mobilising >10 m from the bed were also recorded.

Box 1: Criteria for postoperative pulmonary complications [6].

1. Chest radiograph report of collapse/consolidation.
2. Raised maximal oral temperature >38 °C on more than one consecutive postoperative day.
3. Pulse oximetry oxygen saturation (SpO_2) < 90% on more than one consecutive postoperative day.
4. Production of yellow or green sputum different to pre-operative assessment.
5. Presence of infection on sputum culture report.
6. An otherwise unexplained white cell count greater than 11×10^9/l or prescription of an antibiotic specific for respiratory infection.
7. New abnormal breath sounds on auscultation different to preoperative assessment.
8. Physician diagnosis of post-operative pulmonary complication.

Postoperative pulmonary complications were diagnosed when four or more of the eight criteria of Scholes *et al.* [6] were present (Box 1). While there is no consensus about the best tool to use in diagnosing postoperative pulmonary complications in upper abdominal surgery, these criteria were selected on the basis that they were the most recently described and have been used in previous Australian studies in a similar population.

All criteria for pulmonary complications were verified against the patient's medical history. For the purposes of this study, mobilisation was defined as the ability to walk >10 m from the bed [10]. Parameters for hypotension were not predefined *a priori*, but were clinically determined by the treating nurse and/or therapist at the bedside.

Data analysis was performed using PASW Statistics Version 18.0.0 (SPSS Inc., Chicago, IL, USA) and $P < 0.05$ was taken to indicate statistical significance. Descriptive data are presented as median [interquartile range (IQR)] unless otherwise specified. Categorical differences between groups were analysed using chi-squared test, with Yates' continuity correction used for 2 × 2 tables. Independent samples *t*-test was used for normally distributed independent group analysis, and Mann–Whitney *U*-test was used for non-normally distributed independent group analysis. The difference in the median estimates was calculated using the independent samples Hodges–Lehman test.

Multiple variable logistic regression analysis was performed to investigate the factors associated with the diagnosis