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Outpatient air leak management after lobectomy: a CMS cost analysis



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ABSTRACT

Background: Air leaks after lobectomy are associated with increased length of stay (LOS) and protracted resource utilization. Portable drainage systems (PDS) allow for outpatient management of air leaks in patients otherwise meeting discharge criteria. We evaluated the safety and cost efficiency of a protocol for outpatient management of air leaks with a PDS. **Methods:** We retrospectively assessed patients who underwent lobectomy for non–small-cell lung cancer at our institution between 2004 and 2014. All patients discharged with a PDS for air leak were included in the analysis. The study group was compared to an internally matched cohort of patients undergoing lobectomy for non–small-cell lung cancer managed without the need for outpatient PDS. Study end points included resource utilization, postoperative complications, and readmission.

Results: A total of 739 lobectomies were performed during the study period, 73 (10%) patients with air leaks were discharged with a PDS after fulfilling postoperative milestones. Shorter LOS was observed in the study group (3.88 ± 2.4 versus 5.68 ± 5.7 d, $P = 0.014$) without significant differences in 30-d readmission (11.7% versus 9.0%, $P = 0.615$). PDS-related complications occurred in 6.8% of study patients (5/73), and 2.7% (2/73) required overnight readmission. PDSs were used for 8.30 ± 4.5 outpatient days. A CMS-based cost analysis predicted an overall savings of \$686.72/patient (4.9% of Medicare reimbursement for a major thoracic procedure), associated with significantly fewer hospital days and resources used. **Conclusions:** In patients otherwise meeting discharge criteria, outpatient management of air leaks is safe and effective. This strategy is associated with improved efficiency of postoperative care and a modest reduction in hospital costs. This model may be applicable to other thoracic procedures associated with protracted LOS.

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Introduction

Given the increased emphasis placed on cost containment and efficient delivery of patient care, recent investigational studies have focused on treatment strategies aimed at

reducing health care–associated costs and length of stay (LOS) after major thoracic procedures.^{1,2} Fast-track protocols for early discharge have successfully reduced LOS without increasing risk for readmission, demonstrating safety and cost-efficiency.³ After major pulmonary resection, the

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presence of an air leak is a common finding. In addition, extended LOS from a prolonged air leak, defined by the Society of Thoracic Surgeons as an air leak lasting greater than 5 d after surgery, occurs in 5%-26% of cases.⁴⁻¹⁰ Previous studies have identified air leaks as a primary driver for increased LOS and hospital costs for both open and video-assisted thoracoscopic surgery lobectomy.^{4,7,10-13}

Published data supporting portable drainage systems (PDSs) have demonstrated efficacy for outpatient management of air leaks.^{8,14-20} However, most studies are comprised of heterogeneous patient populations, combining data from multiple operative procedures and for a variety of indications.^{20,21} In addition, few have examined the associated cost savings for early discharge with a chest tube (CT) and PDS, with estimates based loosely on billing and institution-specific charges rather than actual cost to the hospital.^{10,19}

In the present study, we sought to evaluate the safety, feasibility, and economic impact of an outpatient management strategy consisting of early discharge with a PDS for air leak after lobectomy for non-small-cell lung cancer (NSCLC). Our hypothesis is that outpatient management of an air leak with a PDS is a safe protocol for patients who meet traditional discharge milestones, and that earlier transition of care to the outpatient setting is significantly more efficient and cost-effective, particularly for an integrated health care network. To date, no air leak study has sought to determine the actual hospital cost, particularly via a generalizable metric such as Centers for Medicare and Medicaid Services (CMS) reimbursement, to evaluate the efficiency associated with early transition of patient care to the outpatient setting.

Material and methods

Patient population

We performed a retrospective evaluation of patients at the University of Wisconsin Hospital and Clinics who underwent lobectomy or bilobectomy for NSCLC between 2004 and 2014. Data were collected in a prospective manner. Patients aged greater than 50 with a diagnosis of NSCLC, retrievable preoperative computed tomography and positron-emission tomography scans, pulmonary function tests, and follow-up within our health system with accessible pathologic reports, operative dictation, clinic notes, 30-d follow-up, and record of death were evaluated. Patients treated with neoadjuvant therapy and those who underwent sublobar resection, pneumonectomy, or additional pleural-based procedures (decortication, washout of empyema, pleurodesis) were excluded. To identify the association between air leak, early discharge, and resource utilization with minimal confounding, patients discharged with a CT and PDS for ongoing CT drainage were also excluded. The remaining patients discharged with a PDS for air leak were identified as the primary study group ($n = 73$). All patients undergoing lobectomy during the study period without PDS at discharge were considered for inclusion in the control group ($n = 666$). The Institutional Review Board at the University of Wisconsin approved this study including a waiver for patient consent due to the retrospective and de-identified nature of the data.

In both groups, we performed an extensive chart review from patient electronic medical records to determine clinical and pathologic characteristics for matching. Propensity score matching (1:1) using patient characteristics (age, gender, race, smoking history and status, comorbidities, pulmonary function tests), surgical characteristics associated with air leak (stage, histology, surgical approach, extent of resection), and postoperative complications before discharge (acute respiratory failure, cardiac arrhythmia, surgical site infection, transfusions, myocardial infarction, atelectasis/pneumonia, deep vein thrombosis/pulmonary embolism, stroke) was performed. Details regarding inpatient LOS, imaging and laboratory evaluations, discharge details, emergency room (ER) visits, readmissions, and outpatient clinic evaluations were captured for both groups to evaluate the cost savings associated with early discharge.

Operative technique/postoperative care

Patients in study and control groups underwent lobectomy or bilobectomy and mediastinal lymph node dissection in all cases. Patients were uniformly managed with a single 28-French CT after resection. Tubes were placed to suction postoperatively using an Oasis Dry Suction Water Seal Drain (Atrium Medical Corporation, Hudson, NH) and evaluated the evening of POD #0 for the presence of an air leak and each morning thereafter. Chest roentgenograms (CXRs) were performed each morning and repeated when transitioning to water seal, for clinical changes mandating imaging evaluation, or after transition to a PDS. Pleurevac systems were placed to water seal with cessation of an air leak or when deemed appropriate by the operating surgeon. No patients required resumption of pleurevac suction due to CXR changes or clinical symptoms after transition to water seal.

At the time of discharge, study patients were required to fulfill predetermined discharge milestones including: (1) tolerance of regular diet, (2) pain control on oral medication, (3) stable CXR on water seal, (4) CT drainage less than 250 cc/24 h, (5) performance of adequate pulmonary toilet and regular use of an incentive spirometer, (6) completion of nursing education including demonstration of competency to manage the PDS, and (7) family support at the discharge residence to help manage the PDS and observe the patient. Study patients were discharged home with an Atrium Express Mini 500 Mobile Dry Seal Drain (Atrium Medical Corporation, Hudson, NH). We performed a 6-h-interval CXR after PDS placement to demonstrate lung expansion in all patients.

Outpatient management

Study patients returned to clinic 4-5 d after discharge, with variation based on distance of travel to our institution and clinical judgment regarding anticipated duration for PDS. A CXR was performed at each clinic visit and compared to discharge imaging to ensure appropriate lung expansion. The PDS was evaluated for air leak, and if resolved, the CT was removed. Persistent air leak with a stable CXR, and in the absence of symptoms, was managed with short interval follow-up, typically between 2 and 3 d after the initial clinic

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