Safety of Next Day Discharge After Lobectomy: Have We Broken the Speed Limit?

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Background. **Utilizing our standardized approach to air leak reduction (STAR) protocol has led to a continual decrease in the need for inpatient recovery after lobectomy. Although next-day discharges do occur, the current literature, to our knowledge, has not addressed their safety. We analyzed our STAR data set to study this group and their outcomes.**

Methods. **A retrospective review of prospectively collected data from the STAR data set was performed. Characteristics were compared between patients discharged on postoperative day (POD) 1 and those with longer admissions. Outcome data was analyzed.**

Results. **From June 2010 through June 2017, 390 patients underwent lobectomy and met study criteria. Of these, 150 (38%) were discharged on POD 1 versus 240 (62%) who were discharged later (mean length of stay, 3.9 days). There was no increase in morbidity, mortality, or 30-day readmission between the 2 groups. Distinguishing characteristics of the POD 1 group included more nonsmokers, use of a minimally invasive technique, and a lower incidence of prolonged air leak. FEV_1 (forced expiratory volume in 1 second) and DLCO (diffusing capacity of the lung for carbon monoxide) data were also favorable in the POD 1 group. The percentage of patients sent home POD 1 increased from an average of 23% over the first 3 years of the study to 63% over the last 3 years.**

Conclusions. **Appropriately identified patients can safely go home on POD 1 after lobectomy without an increase in 30-day readmission, morbidity, or mortality. A continued focus on lobectomy length of stay reduction has the capacity to increase patient satisfaction and lead to reduction in health care costs.**

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Postoperative care after pulmonary resection has seen a marked evolution in the era of minimally invasive techniques. In addition to improved surgical technique, fast tracking, enhanced recovery after surgery, and outpatient chest tube management have all helped reduce the postoperative length of stay (LOS) after a lobectomy [1–7]. Currently, the STS Thoracic Surgery Database reports the mean hospital LOS after a lobectomy to be 5.3 days, yet some programs are reporting much lower LOS.

We set out to devise a system, the Standardized Approach to Air Leak Reduction (STAR) as a way to reduce prolonged air leaks (PAL) in our pulmonary resection patients [8, 9]. PAL is defined as any air leak lasting more than 5 days per the STS Thoracic Surgery Database. The end result has been a steady decrease in hospital LOS such that many patients are being discharged within 24 hours of their admission. Although air leaks and postoperative pain may be improved, there are still significant physiologic effects occurring in post-lobectomy patients such that early discharge could compromise their overall morbidity and mortality. Many colleagues have been critical of next-day discharges, believing that these may lead to higher readmission rates, negating cost savings and negatively impacting patient satisfaction scores [10]. Currently, to our knowledge, the literature does not address the safety or value of next-day discharges after lobectomy.

In this study, we analyzed our STAR database comparing outcomes of patients who underwent a lobectomy and were discharged on postoperative day (POD) 1 to the outcomes of lobectomy patients with longer admissions. Specifically, we were interested in the impact that next-day discharges might have on morbidity, mortality, and readmission rates.

Patients and Methods

A retrospective review was conducted of our previously published prospective STAR database [8, 9]. All patients are from a single surgeon applying STAR as standard of care in pulmonary resections. This is from a regional practice, with patients living within a 150-mile radius of the hospital. STAR incorporates three basic principles: a

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fissureless operative technique, staple line buttressing, and protocol-driven chest tube management regardless of the approach. For consistency purposes, thoracoscopy was our preferred approach to minimally invasive surgery. Any robotic lobectomies, patients who had a sublobar or more than an anatomical lobe resected, and any patient who received neoadjuvant therapy were excluded from the study. Robotic lobectomies were excluded given that the numbers were small, we were early in the learning curve, and the patients were highly selected for that procedure. The protocol was approved by the institutional review board of the University of Tennessee College of Medicine at Chattanooga. All patients who met the given criteria were included in the study.

The STAR technique involves a standardized approach to all pulmonary resections. Adherence to a standardized surgical and postoperative pathway has been shown to expedite recovery [3]. The STAR technique first addresses the resection itself, with the main goal simply keeping the dissection outside the fissure. All upper lobes are approached by ligation of the corresponding pulmonary vein and then arterial branches to the lobe in question in a superior to inferior order before final ligation of the bronchus. Lower lobectomies are performed by first dividing the inferior pulmonary ligament then the bronchus. In patients with complete fissures, the arterial branches are ligated with the fissure. Right middle lobes are taken by dividing the vein, bronchus, and arterial branches in this order.

All parenchymal staple lines are reinforced utilizing Biodesign Staple Line Reinforcement strips (Cook Medical, Inc, Bloomington, IN). These are made of a thin, noncross-linked biologic material that acts as a scaffold for native tissue to remodel. Stapler and cartridge sizes are chosen at the surgeon's discretion. The surgeon uses between 2 and 4 strips per lobectomy, at a cost of $150 per strip.

Chest tubes are placed on 10 cm of suction until 7:00 AM on POD 1, at which point they are converted to water seal. We utilized traditional dry seal chest drains (Atrium USA, Hudson, NH). Chest roentgenograms on POD 1 are obtained while on water seal and the surgical team evaluates each patient for chest tube removal that morning. If a pneumothorax causing dyspnea or significant subcutaneous emphysema occurs, the chest tube is returned to 10 cm of suction. If no air leak is present and the total chest tube output is less than 450 mL, the tube is removed. If the patient has a persistent air leak, but is otherwise medically ready for discharge, they are sent home with the chest tube to water seal using the Atrium Express Mini 500 Dry Seal Chest Drain (Atrium USA). These patients are seen in the office within 72 hours of discharge for reevaluation of their air leak. If the leak is resolved, the chest tube is removed. Otherwise the patient will be seen at 72-hour intervals for reevaluation until the chest tube is removed. All patients receive written instructions on what to expect after being discharged home with a chest tube, and have the contact information of the thoracic team. Home health care is utilized at the patient's discretion based on their comfort level. No prophylactic antibiotics are given.

Discharge planning begins preoperatively during the surgeon's initial visit with the patient. All patients are given perioperative instructions and anticipate a postoperative LOS of 1 day. Patients are instructed to have family or friend support in their home at discharge. All anticoagulants or antiplatelets are resumed after removal of the epidural. Patients are maintained on their aspirin therapy throughout their episode of care. Thoracic epidurals are utilized for perioperative pain control when appropriate in addition to intercostal nerve bocks with a combination of dexmedetomidine, ropivacaine, and dexamethasone. All patients are discharged home with a prescription for an oral analgesic, which is typically oxycodone if there is no contraindication.

Patient characteristics including demographics; smoking status; and comorbidities such as chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), diabetes mellitus (DM), hypertension (HTN), and body mass index were collected. Patients were evaluated for postoperative LOS, 30-day mortality, prolonged air leak, and 30-day readmission rates. Postoperative complications were only tracked if they required readmission. Pulmonary function data including FEV_1 (forced expiratory volume in 1 second) and DLCO (diffusing capacity of the lung for carbon monoxide) were also tracked. Additionally, the lobe resected and pathologic stage were recorded.

Results

From June 2010 through June 2017, 390 patients underwent lobectomy and met study criteria. Of the 390 study patients who met criteria, 150 (38%) were discharged on POD 1 versus 240 (62%) who were discharged later than POD 1 (mean LOS, 3.9 days). The demographics were similar in both groups; specifically, there was no difference in age and sex between the two groups. All patients discharged on POD 1 were discharged to their homes; none required rehab or specialized nursing facility placement. Comorbidities including smoking status and the presence of COPD, CAD, DM, or HTN were similar between the two groups. Distinguishing characteristics of the POD 1 group included more patients who never used tobacco, increased utilization of thoracoscopy, right middle lobectomy, and a lower incidence of PAL. Patients discharged on POD 1 were less likely to be discharged home with a chest tube (7% versus 21%; $p = 0.0001$) and had statistically fewer PAL (1% versus 9%; $p = 0.0016$). FEV_1 and DLCO data were also favorable in the POD 1 group (Table 1).

There was no difference in pathologic stage resected between the two groups. Twenty-one of the 390 lobectomy patients underwent lobectomy for nonpulmonary stage IV disease (melanoma 4, colo-rectal 12, sarcoma 4, renal cell 1). There were 2 patients resected with stage IV lung cancer. One was a planned resection after treatment of an isolated brain metastasis. The other was an unexpected positive cytology on pleural fluid sent at the time