A Prospective Trial Comparing Pain and Quality of Life Measures After Anatomic Lung Resection Using Thoracoscopy or Thoracotomy

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Background. **Minimally invasive lung lobectomy and segmentectomy by video-assisted thoracic surgery (VATS) are assumed to result in better quality of life and less postoperative pain compared with standard open approaches. To date, few prospective studies have compared the two approaches. We performed a prospective cohort study to compare quality of life and pain scores during the first 12 months after VATS or open anatomic resection.**

Methods. **Patients were prospectively enrolled from May 2009 to April 2012. Patients with clinical stage I lung cancer who were scheduled to undergo anatomic lung resection were eligible. The Brief Pain Index and Medical Outcomes Study 36-Item Short Form Health Survey were conducted perioperatively and at four assessments during the first 12 months after the operation. Intent-to-treat analyses using mixed-effects models were used to longitudinally assess the effect of treatment on quality of life components (physical component summary and mental component summary) and pain.**

Results. **In total, 74 patients underwent thoracotomy, and 132 underwent VATS (including 19 patients who were converted to thoracotomy); 40 and 80 patients, respectively, completed the 12-month surveys. Baseline characteristics were similar between the two groups. Physical component summary and Brief Pain Index scores were similar between the two groups throughout the 12 months of follow-up. The mental component summary score, however, was consistently worse in the VATS group.**

Conclusions. **Patient-reported physical component summary and pain scores after VATS and thoracotomy were similar during the first 12 months after surgical resection.**

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Video-assisted thoracic surgery (VATS) for anatomic resection of lung cancer has gained wide acceptance in the thoracic surgery community. After some initial concerns regarding the oncologic soundness of the approach compared with open thoracotomy—concerns that have since been mostly dispelled [1–4]—the technique has been enthusiastically adopted, owing to the perceived advantages of minimally invasive approaches. Indeed, studies (primarily retrospective ones) suggest that the VATS approach has certain physiologic advantages, including less postoperative pain [5, 6], shorter hospitalization [7], better tolerability in older patients [8, 9], and even lower costs [10, 11].

A significant limitation of most of these studies, however, is their retrospective design, which can introduce significant recollection bias [12]. Furthermore, many of these studies are not analyzed as intent-to-treat, and conversions from VATS to thoracotomy are often inappropriately included in the thoracotomy arm.

Last, and perhaps most important, the focus of many studies assessing the benefits of VATS has been "objective" measures of quality of life (QOL) after the operation, with the implication that these serve as a more accurate reflection of the effect of the operation on patients [13]. However, with the mandate for patient-reported measures as a component of quality care and with future reimbursement of care linked to quality, patient-reported measures of pain and QOL, once marginalized, have gained significantly in

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importance. We performed a prospective cohort study to compare QOL and pain scores during the first 12 months after VATS or open anatomic resection for early-stage non-small cell lung cancer (NSCLC).

Material and Methods

The Memorial Sloan Kettering Cancer Center Institutional Review Board approved this study. All patients gave consent for participation in the study.

Eligibility

Patients were eligible for this study if they had histologically confirmed or suspected clinical stage I [14] NSCLC (as determined by positron emission tomography, computed tomography, and nonroutine invasive mediastinal or hilar staging, or both) and were deemed medically fit for anatomic lung resection (segmentectomy or lobectomy). Patients were excluded if they had undergone a previous lung resection or had received preoperative chemotherapy or radiotherapy, or both. Patients who had disease of a more advanced stage or who did not have NSCLC after the operation were removed from the study.

Patients were invited to participate in the study after consenting to their surgical procedure. The choice of surgical approach (thoracotomy vs VATS and lobectomy vs segmentectomy) was determined by surgeon preference (thoracotomy is the standard preference for 3 surgeons in the group; VATS, for 5).

Thoracotomy was defined as a procedure that included any rib spreading, including standard posterolateral thoracotomy and muscle-sparing axillary thoracotomy. VATS was performed through 3 incisions, with the largest (utility) incision approximately 4 cm in size. Some VATS cases included robotic assistance with the da Vinci Surgical System (Intuitive Surgical, Sunnyvale, CA).

Operations were considered conversions if the initial attempt at resection was performed using VATS but was aborted due to technical difficulties such as bleeding or adhesions. If the VATS procedure was primarily used for staging, with no true intent to resect, the operation was considered a thoracotomy. Because more surgeons in our group typically perform VATS resections in this cohort of patients, rather than thoracotomies, our accrual target was 80 VATS patients and 40 thoracotomy patients who completed the 12-month follow-up evaluations.

Demographic Data Collected

We prospectively collected data from all patients, including demographic characteristics, comorbidities, lung function test results, pathologic stage, tumor type, any postoperative morbidity, hospital length of stay, and disease status during the 12 months of follow-up.

QOL Measures

We obtained data on health-related QOL using the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36). The SF-36 taps 8 health domains: physical functioning, role limitations due to physical problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health. Each of the 8 domains is scored on a Likert-like scale (1 to 5), with higher scores indicating better QOL. Factor analyses of the SF-36 provide strong support for a two-factor model of health, with one factor encompassing aspects of physical health and the second encompassing aspects of emotional health. Physical component summary (PCS) and mental component summary (MCS) scales from the SF-36 have been standardized to national norms [15]. Reliability estimates for the PCS and MCS exceeded 0.90 [16], and internal consistency reliability estimates for all scales were 0.78 or higher.

After registration and enrollment, patients completed the SF-36 survey preoperatively, at the first postoperative visit (~2 weeks after discharge), and at the 4-month, 8-month, and 12-month postoperative visits. If a documented recurrence developed during follow-up, no additional QOL surveys were collected from the patient.

Pain Measures

Pain was measured using the Brief Pain Inventory (BPI). The BPI is a pain assessment tool used to measure pain intensity and pain interference in cancer patients [17, 18]. Patients rate the severity of their pain at its worst and least during the previous week, on average, and "right now" [18]. Patients rate their level of pain interference in 7 contexts: (1) work, (2) activity, (3) mood, (4) enjoyment, (5) sleep, (6) walking, and (7) relationships [19]. The BPI also assesses the patient's pain intervention, pain quality, and perception of the cause of pain. Other BPI items include (1) a shade-in of the patient's area of pain on a front and back view of a human figure; (2) rating the amount of relief the patient feels that the current pain treatments provide; (3) rating the duration of the patient's pain relief after taking prescribed pain medications; and (4) assessing the patient's attribution of pain to the disease, the treatment of the disease, or conditions unrelated to the disease. The scale does not have a scoring algorithm, but "worst pain" or the arithmetic mean of the 4 severity items can be used as measures of pain severity, and the arithmetic mean of the 7 interference items can be used as a measure of pain interference [18].

After registration and enrollment, patients completed the BPI preoperatively, on postoperative days 2 to 4 (while still hospitalized), at the initial postoperative visit (~2 weeks after discharge), and at the 4-month, 8-month, and 12-month postoperative visits. If a documented recurrence developed during follow-up, no additional BPI surveys were collected from the patient.

Pain Management

All patients received an epidural catheter before their operation. Most commonly, the epidural infusion was begun in the operating room, using bupivacaine only, followed postoperatively by an infusion of hydromorphone (8 mg/mL) and bupivacaine (0.05%) at 6 mL/h, with a 6-mL bolus. Toradol (Roche, Basel Switzerland) was also used when not contraindicated by renal function. The Anesthesia Pain Service, which is present in the hospital 24 hours a day, managed the epidural catheters.