

Incidence and risk factors of unplanned emergency department visits following thoracic surgery



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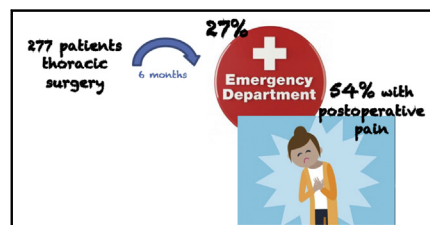
ABSTRACT

Background: Unplanned visits for care following a surgical procedure can represent a lapse in quality of care. The purpose of this study was to define the proportion of patients undergoing thoracic surgery who return to the emergency department (ED) within 6 months after discharge and the reasons for the returns. In addition, the risk factors for ED visits after thoracic surgery were identified.

Methods: All adult patients undergoing thoracic surgery at the Leiden University Medical Center between January 1, 2016, and December 31, 2017, were reviewed. To identify potential risk factors for ED return visits, a multivariate regression analysis was performed. A subgroup analysis of patients who reported pain during the ED visit was performed to identify the risk factors for pain-related return to the ED.

Results: Of 277 patients who underwent thoracic surgery, 27.4% ($n = 76$) returned to the ED within 6 months after discharge. Among these patients, 41 (53.9%) presented with postoperative pain. Younger patients (odds ratio [OR], 0.98; $P = .04$), those who were operated on through a thoracotomy (OR, 2.92; $P = .04$), and those reporting a high pain score on the ward (OR, 1.98; $P < .001$) were at increased risk of returning to the ED.

Conclusions: The rate of patients returning to the ED after thoracic surgery was high. Pain was the most frequently reported reason for unplanned ED visits. The results of this study highlight the need to optimize the postoperative care and the follow-up of patients undergoing thoracic surgery. (JTCVS Open 2021;8:668-76)



More than one-half (54%) of the patients returned to the emergency department with postoperative pain.

CENTRAL MESSAGE

The rate of patients returning to the emergency department with postoperative pain after thoracic surgery is high.

PERSPECTIVE

The results of this study highlight the need to optimize postoperative care and follow-up of patients undergoing thoracic surgery. Health care providers and policy makers should integrate this evidence into clinical and outpatient care to reduce avoidable emergency department visits.

See Commentary on page 677.

▶ Video clip is available online.

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Unplanned visits for care following a surgical procedure are perceived as undesired. They can represent a lapse in quality of care and carry high financial costs for the health care system.¹ The 30-day readmission rate is a widely accepted indicator of quality of care.² In 2012, the Centers for Medicare & Medicaid Services implemented a financial penalty for US hospitals with a 30-day readmission rate above the national average.³

However, according to Nasser and colleagues,⁴ the true incidence of unplanned postoperative hospital visits may be underestimated by considering only readmission rates, and emergency department (ED) visits must be considered as a complementary measure of the quality of care. Only a few studies have reported the incidence of ED visits after discharge. The incidence varies between 5.8% after total hip and knee replacement and 7.5% after head and neck surgery.^{5,6} A substantial percentage of these ED visits after discharge might be avoided by providing better quality of

Abbreviations and Acronyms

ED	= emergency department
LOS	= length of stay
LUMC	= Leiden University Medical Center
PACU	= postanesthesia care unit
VATS	= video-assisted thoracoscopic surgery
VAS	= visual analog scale

care.⁷ In one study, 23.0% of the patients who experienced an unplanned return to the ED presented with a pain-related diagnosis.⁴ Almost all these visits could have been prevented by better pain management. To our knowledge, only 1 study has described ED visits after thoracic surgery, reporting an ED return rate of 6.3% after a follow-up of 30 days⁸; however, that study was limited to patients who underwent surgery through a thoracotomy.

The present study aimed to define the proportion of patients undergoing thoracic surgery who return to the ED within 6 months after discharge. In addition, the reason and the risk factors for ED visits after thoracic surgery were identified, with an extra focus on return encounters for pain (Video 1).

METHODS

Ethical Approval

The Ethics Committee of Leiden University Medical Center (LUMC) approved the study protocol and publication of data. The requirement for patient written consent for the publication of the study data was waived by the Ethics Committee because of the large number of patients. All patients received standard care according to protocol. No additional procedures were performed, and no additional material was taken from the patient.

Conduct of Study

This retrospective observational cohort study included all adult patients who underwent thoracic surgery at LUMC over a 2-year period between January 1, 2016, and December 31, 2017.

Patient Population

All patients age >18 years who underwent thoracic surgery at LUMC during the study period were screened for eligibility. Only patients who underwent pulmonary, pleural, or mediastinal resections were included; patients who were operated on for other types of thoracic resection, such as those of the upper gastrointestinal tract, were excluded. Patients who were not operated on using video-assisted thoracoscopic surgery (VATS) or thoracotomy were excluded, as were patients who died during the index visit. Patients who did not receive follow-up at LUMC or Alrijne Hospital were excluded, owing to the lack of information on their postoperative care. Standard postoperative pain management consisted of epidural analgesia with bupivacaine and sufentanyl or intravenously administered morphine. In addition, awake patients received a combination of paracetamol and oxycodone, with oxycodone as an escape medication. If the VAS was <4, epidural analgesia or intravenously administered morphine was terminated.

Follow-up Protocol

The protocol for follow-up after discharge consisted of an outpatient clinic visit with the pulmonologist at 10 to 14 days after discharge. If



VIDEO 1. Incidence and risk factors of unplanned emergency department (ED) visits following thoracic surgery. More than one-quarter of patients returned to the ED after 6 months. Among these patients, more than one-half presented with postoperative pain. Factors associated with a 6-month ED visits were younger age, thoracotomy, and worse pain relief on the ward. Video available at: [https://www.jtcvs.org/article/S2666-2736\(21\)00249-7/fulltext](https://www.jtcvs.org/article/S2666-2736(21)00249-7/fulltext).

morphine was used, pills were prescribed for 7 to 10 days, based on the patient's need as judged by the physician on the ward. In the time between discharge and outpatient clinic visit, patients were instructed to call the thoracic surgeon or pulmonologist. If these specialists were not able to address the complaint over the phone, the patient was instructed to visit the outpatient clinic or report at the ED. If the complaint was significant or occurred when the outpatient clinic was closed, the patient was instructed to visit the ED. Further follow-up was left to the referring pulmonologist.

For patients who revisited the ED multiple times, each visit was analyzed. A chart review was conducted using the electronic medical record system to obtain data from each patient, including demographic information; type of surgery; use of epidural anesthesia; length of stay (LOS) after surgery; pain scores on a visual analog scale (VAS) during admission,

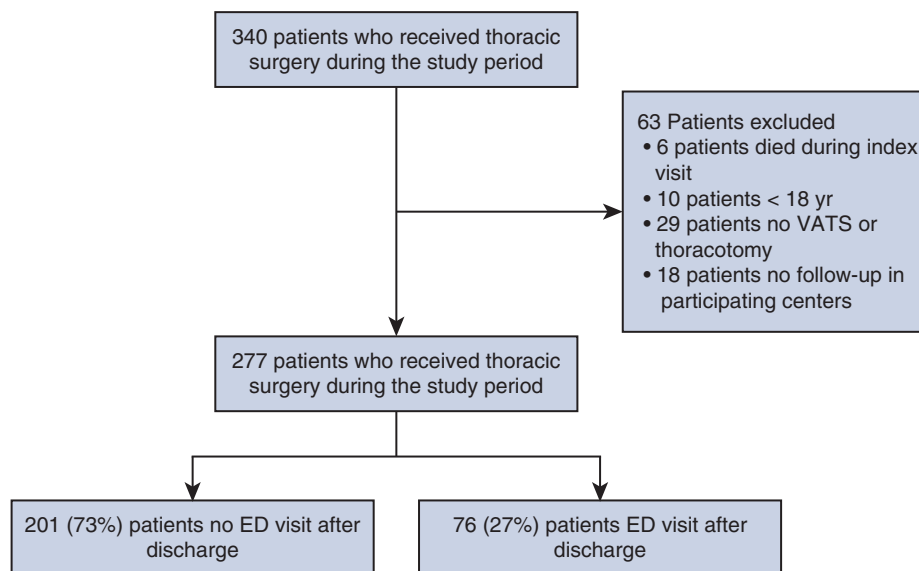


FIGURE 1. Flow chart of patient inclusion. Among the 277 patients who underwent thoracic surgery, 76 patients returned to the emergency department (ED). VATS, Video-assisted thoracoscopic surgery.

at discharge, and in the ED; complications during the index visit; clinical data at discharge; pain medication received at discharge; date of and reason for ED visit; and treatment received at the ED. These parameters were compared between the patients who visited the ED after discharge and those who did not.

Outcomes

The primary study outcome was the incidence of ED visits for patients within 6 months after undergoing thoracic surgery. The secondary outcomes were the reasons and risk factors for ED visits after discharge.

Statistical Analysis

Statistical analysis was conducted with SPSS version 23 (IBM, Armonk, NY). Baseline characteristics were described using descriptive analysis. Comparisons between normally distributed data were performed using Student's unpaired *t* test, whereas nonnormally distributed data were compared using the Mann-Whitney *U* test. Categorical variables were compared using the χ^2 test. The reasons for ED visits were classified in 5 categories: postoperative pain, dyspnea, malaise, wound problems, and other (all symptoms that did not fall into one of the other specified categories and that have little clinical relevance for the operation of interest). We evaluated whether a patient reported 1 or more of these symptoms during an ED visit.

To identify potential risk factors for an ED return, a multivariate regression analysis was performed using a backward stepwise process. The significance level was set at $P < .05$.

A subgroup analysis of patients who reported pain during the ED visit was performed to identify risk factors for pain-related return to the ED.

RESULTS

Demographic Characteristics

After screening for eligibility (Figure 1), 277 patients who underwent thoracic surgery during the study period were enrolled, including 175 patients operated on through thoracotomy and 102 patients operated on through VATS. The mean patient age was 59.6 years, and 58.5% of the patients

were male. The mean length of stay was 11.5 days (Table 1). The most frequently performed procedure was lobectomy (46.2%), followed by segmental resection (21.1%), pleurectomy (5.8%), and pneumonectomy (4.7%).

Characteristics of ED Visit Rates

The overall 6-month ED return was 27.4% ($n = 76$), as depicted in Table 1 and Figure 1. The mean age of the patients returning to the ED was 57.0 years, with a male predominance of 57.9%, both similar to the patient group not returning to the ED. Among the patients who returned to the ED, 72.4% were operated on through a thoracotomy, a significantly higher rate than the 59.7% of those not returning to the ED ($P < .05$). The lowest reported VAS on the ward was significantly higher among patients who returned to the ED ($P < .05$). The temperature, oxygen saturation, and pulse rate at discharge were similar in the 2 groups, as were the number of patients with complications and the LOS. Among the patients who returned to the ED, 19 (25.0%) needed to be readmitted subsequently. This results in a readmission rate of 6.9%. None of the patients that returned to the ED subsequently died.

Reasons for ED Visit

The distribution of the symptoms reported by patients who returned to the ED is illustrated in Figure 2. Among these patients, 41 (53.9%) presented with postoperative pain as 1 of their symptoms. In 13 patients (17.1%), pain was reported as their only symptom. More often, pain was accompanied by dyspnea (46.2%), malaise (43.4%), and wound problems (11.6%). Thirty patients (39.5%) reported dyspnea, 21 (27.6%) reported malaise, 5 (6.6%) reported a

TABLE 1. Factors associated with ED visits

Factor	All patients (N = 277)	Patients not returning to ED (N = 201)	Patients returning to ED (N = 76)	P value
Age, y, mean ± SD	59.6 ± 16.1	60.6 ± 15.2	57.0 ± 18.2	.09
Sex, n (%)				.50
Male	162 (58.5)	118 (58.7)	44 (57.9)	
Female	115 (41.5)	83 (41.3)	32 (42.1)	
Surgical access, n (%)				<.05*
Thoracotomy	175 (63.2)	120 (59.7)	55 (72.4)	
VATS	102 (36.8)	81 (40.3)	21 (27.6)	
Epidural analgesia, n (%)				.74
Yes	233 (80.5)	163 (81.1)	60 (78.9)	
No	54 (19.5)	38 (18.9%)	16 (21.1)	
Hospital LOS, d, mean ± SD	11.5 ± 10.3	11.2 ± 7.9	12.0 ± 15.0	.58
Clinical data at discharge				
Temperature, °C, mean ± SD	37.0 ± 0.4	37.0 ± 0.5	37.0 ± 0.3	.77
Saturation, %, mean ± SD	97.2 ± 3.4	97.2 ± 3.1	97.2 ± 4.0	.89
Pulse, bpm, mean ± SD	83.6 ± 13.6	83.3 ± 13.4	83.2 ± 14.0	.73
Complication during index visit, n (%)				.80
No complication	121 (43.7)	87 (43.3)	34 (44.7)	
Complication	156 (56.3)	114 (56.7)	42 (55.3)	
VAS, mean ± SD				
Preoperative	0.4 ± 1.2	0.4 ± 1.1	0.5 ± 1.2	.32
Postoperative	2.6 ± 3.0	2.8 ± 3.1	2.7 ± 3.4	.90
At discharge	1.5 ± 1.7	1.5 ± 1.7	1.7 ± 1.6	.43
Highest VAS PACU	3.8 ± 2.8	3.9 ± 2.8	4.1 ± 3.1	.68
Lowest VAS PACU	1.0 ± 1.4	1.2 ± 1.5	1.1 ± 1.5	.65
Highest VAS ward	5.0 ± 2.2	4.7 ± 2.2	5.0 ± 2.5	.42
Lowest VAS ward	0.2 ± 0.7	0.3 ± 0.8	1.0 ± 1.5	<.05*
Pain medication at discharge, n (%)				
Paracetamol	244 (88.1)	175 (88.4)	69 (92.0)	.38
Oxycodone	156 (56.3)	113 (57.1)	43 (57.3)	.97
Naproxen	50 (18.1)	40 (19.6)	10 (13.2)	.40
Diclofenac	6 (2.2)	4 (2.0)	2 (2.6)	.95
Fentanyl	5 (1.8)	3 (1.5)	2 (2.6)	.83
Morphine	3 (1.1)	1 (0.5)	2 (2.6)	.36
No pain medication	20 (7.25)	16 (8.0)	4 (5.3)	.72

ED, Emergency department; SD, standard deviation; VATS, video-assisted thoracoscopic surgery; LOS, length of stay; VAS, visual analog scale; PACU, postanesthesia care unit. *Indicates a significant difference between individuals who returned to the ED and those who did not.

wound problem, and 17 (22.4%) reported other complaints. Among these, 5 patients reported complaints related to chemotherapy, 4 reported complaints related to trauma, and 2 reported complaints related to metastases.

Time to ED Visit After Discharge

Figure 3 presents the Kaplan–Meier curve of time to ED visits after discharge. Among the patients who returned to the ED, 40.0% presented to the ED within 14 days and 50.0% presented to the ED within 30 days.

Estimating the Risk of ED Visit

Odds ratio estimates of factors associated with 6 months ED visits following thoracic surgery are presented in Table 2 and Figure 4. In general, younger patients were at

increased risk for an ED visit, with a 2.0% increased risk for each year of younger age (P = .04). In addition, patients with a high VAS on the ward had a significantly higher risk of returning to the ED after thoracic surgery (P = .00). For example, the likelihood of returning to the ED was almost doubled for each 1-point increase in reported lowest VAS on the ward. Moreover, patients who were operated on through a thoracotomy had a 2.4-fold increased risk of an ED visit (P = .02).

Characteristics of the Patients With Postoperative Pain

Univariate comparisons of patients who returned to the ED with and without pain resulted in a correlation with pain scores on the ward (Table 3). Patients returning to

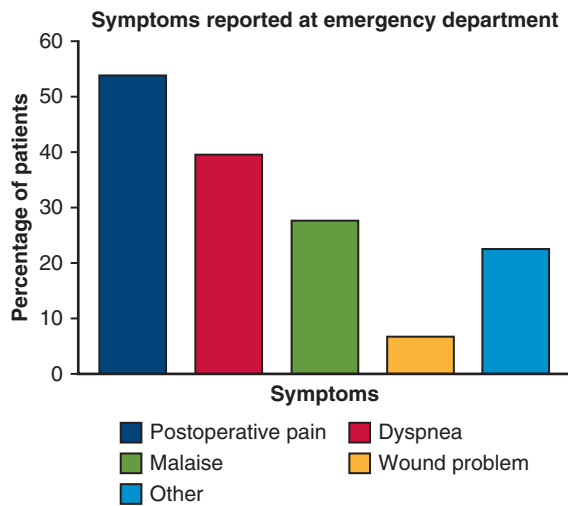


FIGURE 2. Distribution of symptoms reported in the emergency department. Forty-one patients presented with postoperative pain, 30 reported dyspnea, 21 reported malaise, 5 reported a wound problem, and 17 reported other complaints.

the ED with pain had significantly higher VAS scores during the hospital stay and at discharge compared with those returning to the ED without pain ($P < .05$). In addition, younger patients were at an increased risk for returning to the ED with pain ($P < .05$).

Estimating the Risk of a Postoperative Pain-Related ED Visit

Odds ratio estimates of factors associated with postoperative pain-related ED visits are listed in Table 4. In general, younger patients were at increased risk for a postoperative pain-related ED visit, with a 4.0% increased risk with each year of younger age ($P = .03$). Patients who were operated through a thoracotomy had a 2.9-fold increased risk of a postoperative pain-related ED visit ($P = .04$). In addition, patients with worse pain relief

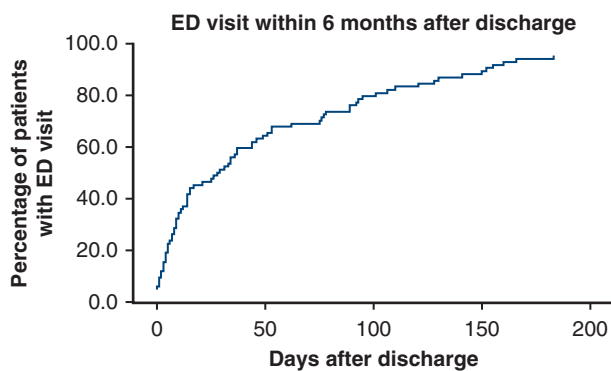


FIGURE 3. Kaplan–Meier curve of the time to emergency department (ED) visits after discharge. Among the patients who returned to the ED, 40.0% presented within 14 days and 50.0% presented within 30 days.

TABLE 2. Estimating the risk of ED visit after thoracic surgery

Variable	Adjusted OR (95% CI)	P value
Age	0.98 (0.96-1.00)	.04
Thoracotomy	2.41 (1.15-5.06)	.02
Lowest VAS ward	1.98 (1.24-3.17)	.00

OR, Odds ratio; CI, confidence interval; VAS, visual analog scale.

(as assessed by lowest pain score on the ward) had a significantly higher risk of returning to the ED with postoperative pain ($P = .01$). For example, for every point on the VAS scale reported on the ward, patients had an 88.0% increase in the likelihood of returning to the ED for a postoperative pain-related event. In Figure 5, the Kaplan–Meier curve of time to pain-related ED visits after discharge is presented. Among the patients who returned to the ED with postoperative pain, 43.0% presented to the ED within 14 days and 59.0% presented to the ED within 30 days. The pain treatment regimen was changed for all patients returning to the ED for a pain-related event. To effectuate this, 15 patients with postoperative pain (36.5%) required readmission.

DISCUSSION

This analysis of patients who underwent thoracic surgery found that a large percentage of patients (27.4%) returned to the ED within 6 months after surgery. Among those patients, 53.9% ($n = 41$) presented with postoperative pain, 39.5% with dyspnea, 27.6% with malaise, and 6.6% with wound problems as one of their symptoms.

In multivariable analysis, younger patients, those who were operated on through a thoracotomy, and those with worse pain relief on the ward were at increased risk of returning to the ED for any reason. The same risk factors were found for patients who returned to the ED with postoperative pain. The explanation for this is that more than one-half of the patients who returned to the ED reported postoperative pain. More than one-third of this group needed subsequent readmission.

Thoracotomy is associated with more postoperative pain compared with VATS, as many studies have shown.^{9,10} These findings indicate that pain management during postoperative care is crucial, and that adequate pain management during the postoperative care period may help prevent a visit to the ED. This applies to the period on the ward but is also likely true for the time after discharge.

Patients with worse pain relief on the ward (as assessed by the lowest pain score on the ward) had a significantly higher risk of returning to the ED with postoperative pain. Based on the results of this series, patients with high pain scores on the ward should be counseled accordingly before being discharged. The Kaplan–Meier curve of time to pain-related ED visits after discharge shows that 43.0% of the patients returned to the ED within 14 days after discharge.

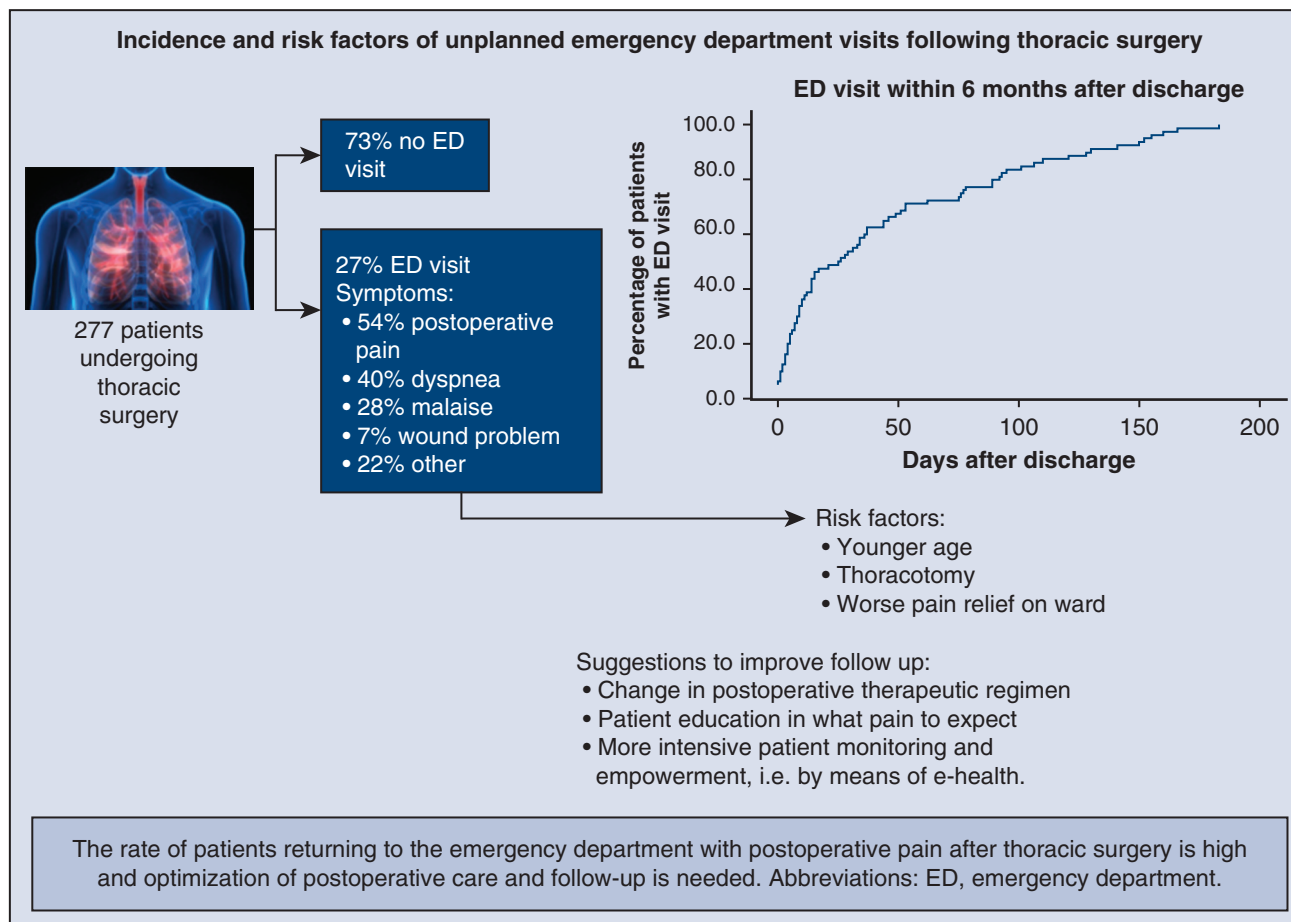


FIGURE 4. Incidence and risk factors of unplanned emergency department (ED) visits following thoracic surgery. 27% of the patients returned to the ED after 6 months. Factors associated with the 6-month ED visits were younger age, thoracotomy, and worse pain relief on the ward.

There is a possibility that the patients who returned for pain did not receive sufficient pain medication at or after discharge. In our study, it appears that patients returning to the ED used less opioids at discharge compared with those not returning to the ED, which also suggests a deficiency of pain medication owing to lack of prescriptions, inadequate pain management education, or poor patient compliance. This is important because pain intensity in the first postoperative days after thoracic surgery predicts the occurrence of pain at 6 months after surgery, which is also reflected by our results (Table 3).¹¹ The outpatient care protocol dictates that patients visit the outpatient clinic at 10 to 14 days after discharge. Remarkably, 43% of the patients returning to the ED for pain did so within the first 2 weeks and felt that their burden was so strong that they could not wait until their visit, nor could it be handled over the phone by the surgeon, pulmonologist, or primary care physician. Notably, 57.0% of the patients returned after their outpatient clinic appointment, suggesting a major challenge regarding more effective pain relief regimens after the first 2 weeks. However, given recent studies on the

problem of pain medication addiction, pain relief strategies should be tailored with great care.¹² Nonetheless, those visits related to pain probably could have been avoided with more adequate pain control strategies.

More aggressive treatment of acute postoperative pain possibly could result in a reduction of chronic pain. The use of epidural anesthesia had no influence on the incidence of pain-related visits to the ED, in accordance with other studies.¹³ The apparent lack of influence of epidural analgesia on the occurrence of chronic pain may be related to the high frequency of technical failures and possible rebound pain after stopping treatment with epidural analgesia. In addition, education of patients regarding pain expectations is relevant and can possibly reduce perceived pain intensity.¹⁴ Assessment of pain and other postoperative complaints and their impact on daily life should improve. A possible tool for this is the international quality of life questionnaire for patients with lung cancer (QLQ-LC29), which was recently validated.¹⁵ A second option to improve postoperative pain control is to manage pain medications after discharge

TABLE 3. Factors associated with postoperative pain-related ED visit

Patient variable	No pain at ED or no ED visit (N = 236)	Pain at ED (N = 41)	P value
Age, y, mean \pm SD	61.1 \pm 15.4	51.4 \pm 18.1	<.05*
Sex, n (%)			.99
Male	138 (58.5)	24 (58.5)	
Female	98 (41.5)	17 (41.5)	
Surgical access, n (%)			.07
Thoracotomy	144 (61.0)	31 (75.6)	
VATS	92 (39.0)	10 (24.4)	
Epidural analgesia, n (%)			.83
Yes	189 (80.1)	34 (82.9)	
No	47 (19.9)	7 (17.1)	
Hospital LOS, d, mean \pm SD	11.3 \pm 7.9	12.4 \pm 19.0	.38
Clinical data at discharge, mean \pm SD			
Temperature, $^{\circ}$ C	37.0 \pm 0.5	37.0 \pm 0.3	.40
Saturation, %	97.3 \pm 3.0	96.9 \pm 5.1	.54
Pulse, bpm	83.7 \pm 14.4	83.0 \pm 14.5	.76
Complication during index visit, n (%)			.71
No complication	102 (43.2)	19 (46.3)	
Complication	134 (56.8)	22 (53.7)	
VAS, mean \pm SD			
Preoperative	0.4 \pm 1.1	0.6 \pm 1.3	.23
Postoperative	2.8 \pm 3.1	2.5 \pm 3.1	.60
At discharge	1.4 \pm 1.7	2.1 \pm 1.7	<.05*
Highest VAS in PACU	3.9 \pm 2.9	4.0 \pm 3.0	.92
Lowest VAS in PACU	1.1 \pm 1.5	1.3 \pm 1.6	.41
Highest VAS on ward	4.7 \pm 2.3	5.5 \pm 2.3	<.05*
Lowest VAS on ward	0.4 \pm 0.9	1.2 \pm 1.6	<.05*
Pain medication at discharge, n (%)			
Paracetamol	205 (88.4)	39 (95.1)	.20
Oxycodone	128 (55.2)	28 (68.3)	.12
Naproxen	47 (19.9)	3 (7.3)	.10
Diclofenac	4 (1.7)	2 (4.9)	.30
Fentanyl	5 (2.1)	0	.23
Morphine	3 (1.3)	0	.32
No pain medication	19 (8.1)	1 (2.4)	.18

ED, Emergency department; SD, standard deviation; VATS, video-assisted thoracoscopic surgery; LOS, length of stay; VAS, visual analog scale; PACU, postanesthesia care unit. *Indicates a significant difference between individuals who returned to the ED for pain and those who did not.

with e-health. This way, the patient is empowered to participate in his or her own treatment. Several studies on e-health interventions have been published, and the majority of these conclude that e-health leads to improved clinical patient-related outcomes compared with only face-to-face perioperative care.¹⁶ Underscoring this point, Shargall and colleagues¹⁷ evaluated an integrated comprehensive care program that coordinates home care and

TABLE 4. Estimating risk of postoperative pain-related ED visit after thoracic surgery

Variable	Adjusted OR (95% CI)	P value
Age	0.96 (0.94-0.99)	.03
Thoracotomy	2.92 (1.04-8.23)	.04
Lowest VAS ward	1.88 (1.18-3.00)	.01

OR, Odds ratio; CI, confidence interval; VAS, visual analog scale.

hospital-based clinical services for patients undergoing major thoracic surgery. Although hospital LOS appeared to be shorter than that in our study, the readmission rates was comparably high, indicating the need for more drastic measures than intensive patient monitoring by setting up a robust health care network after discharge. These findings argue for better home monitoring and avenues for patient-doctor communication, which could be provided by e-health initiatives.¹⁷ Younger patients were at increased risk of returning to the ED with postoperative pain. The association between younger age and high postoperative pain scores has been well described in the literature.¹⁸⁻²¹ Behman and colleagues²² found that younger patients who underwent open liver resection were more likely to report higher postoperative pain. A similar finding was reported by Berglund and colleagues,²³ with a significantly

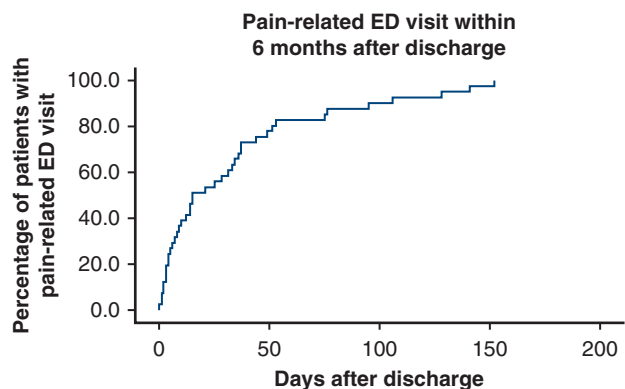


FIGURE 5. Kaplan–Meier curve of time to postoperative pain-related emergency department (ED) visit after discharge. Among the patients who returned to the ED with postoperative pain, 43.0% presented within 14 days and 59.0% presented within 30 days.

higher frequency of postoperative pain after arthroscopic knee surgery among younger patients. This is relevant because younger age is also associated with an increased risk of persistent opioid use after lung resection.²⁴

Although postoperative pain rates in the ED appear to be high, the results in our study are consistent with current literature. Numerous studies have shown that pain is a very common diagnosis for ED visits after other types of surgery.^{4-6,8,25} For example, Finnegan and colleagues⁶ reported that 5.8% of patients who underwent total hip and knee replacement surgery returned to the ED, and among those patients, 25.8% reported pain.

Among the patients who returned to the ED, 19 (25.0%) had a subsequent readmission. This suggests that the true incidence of unplanned postoperative hospital visits may be underestimated by considering only readmission rates. Currently, only the 30-day readmission rate is used as an outcome measure for quality of care.²⁶ The findings of this study show that policy makers should consider the rate of ED visits, along with readmission rates, as an indicator of quality of care.

To date, only 1 study has been published reporting the incidence and risk factors of ED visits following thoracotomy. Shaffer and colleagues⁸ reported an incidence of 6.3% after a follow-up of 30 days, lower than the incidence reported in our study. An explanation for this may be that our cohort is younger, which is a factor associated with ED visits. Considering that VATS is a commonly used technique, limiting the surgical access to thoracotomy will not report the true incidence in a thoracic surgery clinic.²⁷ In addition, Shaffer and colleagues evaluated a time window of 30 days after discharge. It has been estimated that 30% to 50% of the patients who undergo thoracotomy experience post-thoracotomy pain syndrome.^{28,29} Because thoracic surgery has long-term effects, limiting the follow-up to 30 days will underestimate the true incidence.³⁰ This is reflected by our finding that among the

patients returning to the ED, 43% did so within 14 days and 59% did so within 30 days. This finding could argue for a second visit at 30 to 40 days targeted at surgery-related issues. The scarcity of studies addressing unplanned ED visits after thoracic surgery warrants further research into this topic. These studies could provide insight into how to improve postoperative patient care after thoracic surgery and reduce financial costs for health care.

Some limitations of this study should be noted. First, 18 patients (5.3%) who did not receive follow-up at the 2 participating hospitals were excluded owing to a lack of information on their care or release from the facility. This exclusion could have skewed our results slightly. There is a slight possibility that some patients returned to a different ED at a remote location but were still followed up at 1 of the 2 participating hospitals. However, we theorize that this is a very small number of patients, given that the patients were instructed to return to the ED at the hospital where they were followed up. A second limitation of this study is its retrospective nature, which might have affected the accuracy of the data. However, we would expect this effect to be limited. In addition, the indications for thoracic surgery were not specified, and we did not exclude any patients based on their indication for surgery.

In The Netherlands, patients are referred to a tertiary referral center by either a general practitioner or a secondary referral center. Interpreting the findings of this study should be done taking into account specific features of the Dutch health care system, and translation of the results into other systems should be done with caution. Moreover, interpretation should be done considering the population of secondary and tertiary referral centers, with a significant proportion of procedures performed through a thoracotomy. This was appreciated as a risk factor for ED visits and corrected for by multivariate analysis. Finally, further research is needed to evaluate how the social behavior of patients and the accessibility to primary care influences the number of ED visits.

Despite these limitations, this study contributes to our knowledge of the rate of ED visits after thoracic surgery, as well as the reasons for these visits and factors associated with them.

CONCLUSIONS

This study found that 27.4% of patients who underwent thoracic surgery returned to the ED, with more than one-half of them due to pain. Subsequently, 25.0% of these patients had to be readmitted. Younger patients, patients operated on through thoracotomy and those with worse pain relief on the ward were more likely to return to the ED with pain. Given the increasing rate of ED visits, it is becoming increasingly important to identify factors that make patients more likely to return to the ED after discharge. In the era of value-driven health care and patient-related outcome measures, 3 out of 10 patients

returning to the ED after thoracic surgery is not an acceptable outcome. The results of this study highlight the need to optimize the postoperative care and follow-up of patients undergoing thoracic surgery. Health care providers and policy makers should integrate this evidence into clinical care to help reduce avoidable ED visits.

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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Key Words: postoperative pain, thoracic surgery, unplanned emergency department visit