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Analysis of risk factors for delayed postoperative discharge of patients with pulmonary nodules after surgery

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Abstract: Objective To investigate the influencing factors of delayed postoperative discharge in patients with pulmonary nodules. **Methods** Electronic medical records of 223 patients, 91 males and 132 females, who underwent thoracoscopic/Da Vinci robotic surgery for pulmonary nodules under general anesthesia in Eastern Theater General Hospital, from June to August 2021 were analyzed retrospectively. Univariate analysis and binary logistic regression analysis were used to screen the risk factors for delayed postoperative discharge in patients with pulmonary nodules. **Results** One hundred and fifty-nine patients (71.3%) with a postoperative hospital stay of ⩾3 days were considered the delayed discharge group, and the 64 patients (28.7%) with < 3 days were considered the normal discharge group. The age, proportion of males, proportion of smoking history, proportion of thoracoscopic surgery, operation duration, intraoperative fluid volume, intraoperative loss, propofol consumption, incidence of postoperative complications, duration of thoracic drainage tube retention, and drainage volume of patients in the delayed discharge group were significantly higher than those in the normal discharge group (P<0.05). Binary logistic regression analysis showed that older age [OR=1.063, 95% CI (1.016-1.111), P=0.008], longer duration of thoracic drainage tube retention [OR=8.743, 95%CI (4.144-18.445), P<0.01] and use of conventional analgesic pump [OR=3.759, 95%CI (1.232-11.468), P=0.020] were independent risk factors for the duration of postoperative hospitalization ⩾3 days. **Conclusion** Older age, longer duration of thoracic drainage tube retention and use of conventional analgesic pump can affect the length of postoperative hospitalization in patients undergoing lung nodule surgery.

Keywords: Thoracic surgery; Pulmonary nodules; Thoracoscope; Da Vinci robotics; Delayed discharge; Risk factors; Opioids

The incidence of pulmonary nodules (small round or oval lesions in the lung) is increasing year by year [1]. With widespread screening of lung nodules and advances in detection techniques, more and more patients require surgical treatment. Pulmonary nodule surgery is a common type of thoracic surgery in which lung lesions are removed to prevent malignant transformation and further spread.

However, the length of stay after pulmonary nodule surgery has always been a clinical concern [2]. Delayed discharge after surgery may increase the hospitalization cost and infection risk of patients, and also affect the quality of life and rehabilitation process of patients [3-4]. Therefore, it is important to analyze the risk factors for delayed discharge after surgery to optimize patient management and improve surgical outcomes. There have been extensive studies on the risk factors of delayed discharge after surgery. For example, factors such as age, gender, co-morbidities, operation method, and preoperative lung function are considered to be closely related to postoperative length of stay [5-6]. In addition, postoperative complications are also one of the important factors affecting the length of hospitalization [7]. Therefore, there is an urgent need to further study and analyze these risk factors in order to provide clinicians with more accurate prediction and intervention means to optimize the therapeutic effect of pulmonary nodule surgery. Through in-depth understanding of the risk factors of delayed discharge after surgery, we can better guide the postoperative management and rehabilitation of patients, reduce the length of hospital stay of patients, and improve their quality of life.

1 Data and methods

1.1 General data

The electronic medical records of patients received pulmonary nodule surgery under general anesthesia in Eastern Theater General Hospital from June to August 2021 were retrospectively analyzed.

Inclusion criteria:

(1) Preoperative diagnosis of pulmonary nodule or lesion;

(2) Patients received thoracoscopic/Da Vinci robotic pulmonary nodule surgery under general anesthesia.

Exclusion criteria:

(1) American Society of Anesthesiologists (ASA) grade III or above;

(2) Patients with severe cardiopulmonary function disease before surgery, or within 6 months after myocardial infarction, or within 1 month after cerebral infarction;

(3) Medical record data was incomplete, and relevant data required in this study was missing.

The postoperative discharge time of all cases was divided according to the quartile, and considering the left-skewed distribution of the data, 25% was finally

selected as the cutting point, and the patients discharged 1 day after surgery were taken as the first day after surgery, 1-2 days after surgery were classified as the normal group, and the patients discharged 3 days or more after surgery were classified as the delayed group [8]. This study was approved by the hospital Ethics Committee (2022DZKY-042-01).

1.2 Observation indicators

The patients' clinical data were retrospectively collected by consulting the inpatient electronic medical record system, electronic anesthesia record sheet and Ruimei Laboratory Information System. The data were collected by two researchers at the same time, and the data were proofread after collection, and the data found to be different were retrieved and entered again by another researcher.

(1) Patient's general clinical data: age, gender, body mass index (BMI), ASA grade, underlying diseases (diabetes, coronary heart disease), smoking history;

(2) Perioperative indicators: Surgical time, extubation time, surgical type (thoracoscopic surgery, Da Vinci robot surgery), surgical site (upper lobe of left lung, lower lobe of left lung, upper lobe of right lung, middle lobe of right lung, lower lobe of right lung, both lung lobes and above), resection scope (wedge resection, segmental resection, lobectomy, whole lung resection), intraoperative hypotension, intraoperative fluid rehydration, intraoperative fluid loss, intraoperative drug use (midazolam, propofol, etomidate, dexmedetomidine, rocuronium, cisatracurium, sufentanil, reifentanil, flurbiprofen axetil, 0.75% ropivacaine, 2% lidocaine), Postoperative complications, type of postoperative analgesic pump (conventional analgesic pump, subcutaneous analgesic pump), retention time and drainage flow of thoracic drainage tube.

1.3 Statistics Methods

SPSS 27.0 software was used to analyze the data. The measurement data of normal distribution are expressed as $\bar{x} \pm s$, and the comparison between groups was conducted by t test. Measures of non-normal distribution were presented with $M(P_{25}, P_{75})$. Inter-group comparisons were conducted by Mann-Whitney U test. Counting data were expressed as example (%) using chi-square test or its modified method or Fisher exact probability method. Variables with $P < 0.05$ in univariate analysis were included in multivariate logistic regression analysis to evaluate the risk factors of delayed discharge after surgery. $P < 0.05$ was considered statistically significant.

2 Results

2.1 General data

A total of 223 patients were included in the study, and the postoperative hospital stay data showed a left-skewed distribution. There were 64 patients (28.7%) of normal discharge and 159 patients (71.3%) of delayed discharge. Univariate analysis showed that the age, male proportion and smoking history of patients in the delayed group were significantly higher than those in the normal group, with statistical significance ($P < 0.01$). **[Table 1]**

Tab.1 Comparison of general clinical data between two groups

Indicators	Normal group (n=64)	Delayed group (n=159)	t/χ^2 value	P value
Age (years,$\bar{x}$±s)	53.55±10.91	58.03±12.34	2.533	0.012
Male/Female (case)	17/47	74/85	7.540	0.006
BMI (kg/m^2,$\bar{x}$±s)	22.95±3.13	22.94±3.02	0.022	0.982
ASA grade II/III(case)	60/4	152/7	0.055	0.815
Smoking [case (%)]	12(12.5)	52(32.7)	4.342	0.037
coronary disease [case (%)]	1(1.6)	6(3.8)	0.187	0.666
Diabetes [case (%)]	5(7.8)	10(6.3)	0.013	0.908

2.2 Perioperative indicators

Compared with the normal discharge group, the proportion of thoracoscopic surgery, operation duration, intraoperative fluid rehydration, intraoperative fluid loss, and the use of propofol were significantly increased in the delayed discharge group ($P < 0.05$). In addition, the incidence of postoperative complications, retention time of thoracic drainage tube and drainage flow in the delayed discharge group were significantly higher than those in the normal discharge group ($P < 0.05$).**[Table 2]**

2.3 Multivariate regression analysis of influencing length of postoperative hospitalization in patients with pulmonary nodules

With postoperative length of stay (transformed into categorical variable) as the dependent variable, variables with statistical differences, such as age, operation time, operation type, drainage tube retention time, drainage volume, intraoperative fluid rehydration, intraoperative fluid loss, propofol dosage, gender, smoking, postoperative complications, postoperative analgesia pump and other independent variables, were incorporated into binary logistic regression analysis. Older age, long retention time of drainage tube and use of conventional analgesic pump were independent risk factors for postoperative hospital stay ≥3 days. **[Table 3]**

Tab.2 Comparison of perioperative indexes between two groups

Indicators	Normal group (*n*=64)	Delayed group (*n*=159)	$t/Z/\chi^2$ value	*P* value
Surgical type [case (%)]				
Thoracoscopic surgery	44(68.8)	151(95.0)	28.570	<0.001
Da Vinci robot	20(31.2)	8(5.0)		
Surgical site [case (%)]				
Left upper lobe	12(18.8)	39(24.5)		
Left lower lobe	15(23.4)	23(14.5)		
Right upper lobe	14(21.9)	44(27.7)	3.818	0.576
Right middle lobe	4(6.2)	12(7.5)		
Right lower lobe	13(20.3)	27(17.0)		
Two lobes or more	6(9.4)	14(8.8)		
Resection scope [case (%)]				
Wedge resection	20(31.3)	41(25.8)		
Segmentectomy	15(23.4)	37(23.3)	1.839	0.606
Lobectomy	29(45.3)	78(49.0)		
Whole lung resection	0	3(1.9)		
Postoperative complication [case (%)]	8(12.5)	53(33.3)	9.967	0.002
Hypotension [case (%)]	2(3.1)	3(1.9)	0.002	0.964
Postoperative analgesic pump [case (%)]				
Not used	17(26.6)	44(27.7)	0.050	0.975
Conventional	43(67.2)	106(66.6)		
Subcutaneous	4(6.2)	9(5.7)		
Intraoperative fluid rehydration (mL)[b]	1143.75±251.27	1279.03±380.01	3.089	0.002
Intraoperative fluid loss (mL)[b]	355.47±154.38	447.08±232.71	2.897	0.004
Operation time (h)[c]	2(1.5,2.5)	2.5(1.8,3)	2.238	0.026
Extubating time (h)[b]	2.52±1.39	2.59±1.37	0.346	0.732
Drainage tube retention time (d)[b]	1.80±0.41	3.02±1.28	10.729	<0.001
Drainage volume (mL)[c]	240(166.25,375)	490(300,740)	6.638	<0.001
Midazolam (mg)[c]	2(2,2)	2(2,2)	0.352	0.725
Propofol (mg)[c]	700(680,777.5)	900(700,1 280)	3.143	0.002
Etomidate (mg)[c]	12(0,50)	12(0,57.5)	0.007	0.994
Dexmedetomidine (μg)[c]	200(37.5,230)	200(50,230)	0.396	0.692
Rocuronium [case (%)]				
Used	11(17.2)	24(15.1)	0.151	0.680
Unused	53(82.8)	135(84.9)		
Cisatracurium (mg)[c]	36(35,41.5)	35(35,40)	0.479	0.632
Sufentanil (μg)[c]	90(72.5,100)	90(50,100)	0.510	0.610

Remifentanil (mg)[c]	1(1,1)	1(1,1)	0.259	0.796
Flurbiprofen axetil (mg)[c]	100(100,100)	100(100,100)	0.041	0.967
0.75% Ropivacaine [case (%)]				
Used	5(7.8)	11(6.9)	0.055	0.815
Unused	59(92.2)	148(93.1)		
2% Lidocaine [case (%)]				
Used	5(7.8)	11(6.9)	0.055	0.815
Unused	59(92.2)	148(93.1)		

Note: [a] indicates the data were expressed as case (%); [b] indicates the data were expressed as $\bar{x} \pm s$; [b] indicates the data were expressed as $M(P_{25}, P_{75})$.

Tab.3 Binary logistic regression analysis of postoperative length of hospital stay

Indicators	*β*	*S.E.*	*Wald*	*P* value	*OR*	95%*CI*
Age	0.061	0.023	7.122	0.008	1.063	1.016-1.111
Drainage volume	0.000	0.001	0.002	0.968	1.000	0.998-1.002
Drainage tube retention time	2.168	0.381	32.407	0.000	8.743	4.144-18.445
Intraoperative fluid loss	0.000	0.001	0.000	0.992	1.000	0.997-1.003
Intraoperative fluid intake	0.000	0.001	0.007	0.934	1.000	0.999-1.002
Male	0.502	0.547	0.841	0.359	1.651	0.565-4.825
Smoking	0.130	0.577	0.050	0.822	1.138	0.367-3.528
Da Vinci robot	-0.015	0.925	0.000	0.987	0.985	0.161-6.039
Postoperative complication	0.963	0.541	3.174	0.075	2.620	0.908-7.557
Propofol	0.000	0.001	0.159	0.690	1.000	0.999-1.001
Conventional analgesic pump	1.324	0.569	5.412	0.020	3.759	1.232-11.468
Subcutaneous analgesic pump	0.706	1.064	0.440	0.507	2.025	0.252-16.302

3 Discussion

Postoperative hospital stay is one of the main indicators to evaluate postoperative recovery. Perioperative treatment includes promoting the best postoperative recovery of patients, so that patients can return home safely and resume daily activities as soon as possible [9]. Complications, readmissions and economic costs of patients with delayed discharge have increased significantly. Therefore, a large number of studies have built prediction models to analyze the risk factors of delayed discharge [10], so as to make targeted diagnosis and treatment plans. Previous studies have suggested that the length of hospital stay after thoracic surgery is related to the patients' age, gender, smoking history, presence of comorbidities, surgical indicators and anesthesia indicators, etc. Therefore, this study retrospectively analyzed the correlation between the patients' general data, surgical methods, drainage tube retention time, drainage volume, anesthetics, postoperative analgesia and length of hospital stay [11-12].

The results of univariate analysis in this study showed that age, drainage tube retention time, postoperative complications and conventional analgesic pump were significantly correlated with the length of hospital stay of patients after pulmonary nodule surgery, which was consistent with the studies of Greer et al. [13] and Rogers et al. [14]. Age was a predictor of delayed hospitalization after pulmonary nodule surgery. In addition, the length of postoperative hospital stay was divided into two categorical variables based on the median, and binary logistic regression was performed. The results showed that age, drainage tube retention time and use of conventional analgesic pump were independent risk factors for postoperative hospital stay $\geqslant$ 3 days. Hyer et al. [15] found that the age of spinal surgery patients did increase the length of hospital stay, independent of opioid dependence status. Older adults stay longer in the hospital for a variety of reasons that may be related to comorbidities. The results of this study are consistent with them.

We found a significant positive correlation between the use of conventional intravenous analgesia pumps and delayed discharge after surgery. Previously, Pizzi et al. [16] found that adverse reactions related to patients receiving opioid therapy after orthopedic surgery were associated with increased length of hospital stay. In the field of thoracic surgery, D'Amico et al. [17] found that compared with opioid-based anesthesia, opioid-free anesthesia in thoracic surgery was associated with lower postoperative complications, less opioid demand, better analgesia within 48 h after operation, and reduced patient length of hospital stay. Therefore, it is reasonable to speculate that, increased risk of patients staying in hospital with the use of an analgesic pump is partly due to opioid use. Recently, the concept of enhance recovery after surgery (ERAS) has been widely proposed at home and abroad. Based on multidisciplinary cooperation,

clinical anesthesia plays an important role in preventing delayed postoperative recovery and reducing length of hospital stay. A large number of studies recommend epidural analgesia, regional analgesia and multimodal analgesia for relieving acute pain after thoracic surgery, reducing the use of opioids and promoting rapid recovery after surgery, and this study is consistent with the results of relevant studies [18]. However, there is no consensus on whether the best analgesic technique is intravenous analgesia or epidural analgesia after thoracic surgery, which needs further study.

The results of univariate analysis in this study showed that there were statistically significant differences between the two groups in terms of the type of surgery and the amount of intraoperative fluid rehydration and intraoperative fluid loss. However, in subsequent regression analyses, these differences did not reach a significant level. This may be due to the existence of other confounding factors. In multi-factor analysis, the influence of other confounding factors can be adjusted by establishing a regression model, so as to reveal the true effect of the independent variable on the dependent variable.

There are still some limitations in this study. First, as a retrospective study, data collection may be biased. Secondly, due to the imperfection of electronic information systems, retrospective studies rely on existing medical records and data, and there is a risk of information bias. Thirdly, data quality may be affected by the accuracy and completeness of medical records, there may be missing or erroneous data, and in addition, there may be limitations in data availability and availability, certain important variables or indicators may not be recorded or measured, limiting the depth and breadth of the study.

To sum up, this study found that age, long retention time of drainage tube and use of conventional analgesic pump were independent risk factors for postoperative hospitalization ≥3 days, and targeted and active preoperative intervention should be performed to reduce postoperative complications. Although the dosage of opioids and the rate of adverse reactions are typical, the need to balance pain management and event risk should also be emphasized.

Conflict of Interest None

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·论　著·

肺结节患者术后延迟出院的危险因素分析

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摘要：目的　探讨肺结节手术患者术后延迟出院的影响因素。**方法**　回顾性分析 2021 年 6 月至 8 月东部战区总医院因肺结节全麻下行胸腔镜/达芬奇机器人手术患者 223 例的电子病历资料，其中男 91 例，女 132 例。采用单因素分析和二元 logistic 回归分析筛选肺结节患者术后延迟出院的危险因素。**结果**　以术后住院时间≥3 d 的 159 例（71.3%）患者为延迟出院组，<3 d 的 64 例（28.7%）为正常出院组。延迟组患者的年龄、男性比例、吸烟史比例、胸腔镜手术占比、手术时长、术中补液量、术中失液量、丙泊酚使用量、术后并发症发生率、胸腔引流管留置时间及引流量明显高于正常出院组（$P<0.05$）。二元 logistic 回归分析显示，年龄大［$OR=1.063$，95% CI（1.016～1.111），$P=0.008$］、引流管留置时间长［$OR=8.743$，95% CI（4.144～18.445），$P<0.01$］以及使用常规静脉镇痛泵［$OR=3.759$，95% CI（1.232～11.468），$P=0.020$］是术后住院时长≥3 d 的独立危险因素。**结论**　年龄大、引流管留置时间长以及使用常规静脉镇痛泵可影响肺结节手术患者术后住院时间。

关键词：胸外科手术；肺结节；胸腔镜；达芬奇机器人；延迟出院；危险因素；阿片类药物

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Analysis of risk factors for delayed postoperative discharge of patients with pulmonary nodules

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Abstract: Objective　To investigate the influencing factors of delayed postoperative discharge in patients with pulmonary nodules. **Methods**　Electronic medical records of 223 patients, 91 males and 132 females, who underwent thoracoscopic/Da Vinci robotic surgery for pulmonary nodules under general anesthesia in Eastern Theater General Hospital, from June to August 2021 were analyzed retrospectively. Univariate analysis and binary logistic regression analysis were used to screen the risk factors for delayed postoperative discharge in patients with pulmonary nodules. **Results**　One hundred and fifty-nine patients (71.3%) with a postoperative hospital stay of ≥3 days were considered the delayed discharge group, and the 64 patients (28.7%) with <3 days were considered the normal discharge group. The age, proportion of males, proportion of smoking history, proportion of thoracoscopic surgery, operation duration, intraoperative fluid supplement and fluid loss volume, propofol consumption, incidence of postoperative complications, duration of thoracic drainage tube retention, and drainage volume of patients in the delayed discharge group were significantly higher than those in the normal discharge group ($P<0.05$). Binary logistic regression analysis showed that older age [$OR=1.063$, 95% CI (1.016-1.111), $P=0.008$], longer duration of thoracic drainage tube retention [$OR=8.743$, 95% CI (4.144-18.445), $P<0.01$] and use of conventional intravenous analgesic pump [$OR=3.759$, 95% CI (1.232-11.468), $P=0.020$] were independent risk factors for the postoperative hospital stay ≥3 days. **Conclusion**　Older age, longer duration of thoracic drainage tube retention and use of conventional intravenous analgesic pump can affect the length of postoperative hospitalization in patients undergoing lung nodule surgery.

Keywords: Thoracic surgery; Pulmonary nodules; Thoracoscope; Da Vinci robotics; Delayed discharge; Risk factors; Opioids

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肺结节,即肺内小的圆形或者卵圆形的病变,其发生率逐年增加[1]。随着肺结节的广泛筛查和检测技术的进步,越来越多的患者需要进行手术治疗。肺结节手术是一种常见的胸外科手术,通过切除肺部病变来防止恶性转化和进一步扩散。

然而,肺结节手术后的住院时长一直是临床上的一个关注点[2]。术后延迟出院可能会增加患者的住院费用和感染风险,也会影响患者的生活质量和康复进程[3-4]。因此,分析术后延迟出院的危险因素对于优化患者管理和提高手术效果至关重要。已有学者对术后延迟出院的危险因素进行了广泛的探讨。例如,年龄、性别、合并疾病、手术方式和术前肺功能等因素被认为与术后住院时长密切相关[5-6]。此外,术后并发症也是影响住院时长的重要因素之一[7]。因此,迫切需要进一步研究和分析这些危险因素,以便为临床医生提供更准确的预测和干预手段,从而优化肺结节手术的治疗效果。通过深入了解术后延迟出院的危险因素,可以更好地指导患者的术后管理和康复,减少患者住院时长,提高其生活质量。

1　资料与方法

1.1　一般资料　回顾性分析 2021 年 6 月至 8 月东部战区总医院全麻下肺结节手术患者的电子病历资料。纳入标准:(1) 术前诊断为肺部结节或占位;(2) 于全麻下行胸腔镜/达芬奇机器人肺结节手术的患者。排除标准:(1) 麻醉分级Ⅲ级以上;(2) 术前患有严重心肺功能疾病,或处于心肌梗死后 6 月内,脑梗死后 1 月内;(3) 病案数据不全,缺失研究所需相关数据。将所有病例术后出院时间按四分位数进行分割,参考文献资料,考虑数据呈左偏态分布,最终选用 25%作为切割点,将从手术日后 1 d 作为术后第 1 天,术后 1~2 d 出院病例划作正常出院组,将术后 3 d 及以上出院病例划作延迟出院组[8]。本研究获得医院伦理委员会批准(2022DZKY-042-01)

1.2　观察指标　查阅住院电子病历系统、电子麻醉记录单和瑞美实验室管理系统,回顾性收集患者临床资料,数据收集由两名研究人员同时进行,收集完成后对数据进行校对,发现存在差异的数据由另一名研究人员再次检索录入。(1) 患者一般临床资料:年龄、性别、身体质量指数(BMI)、美国麻醉师学会(ASA)分级、基础疾病(糖尿病、冠心病)、吸烟史;(2) 围术期指标:手术时间、拔管时间、手术类型(胸腔镜手术、达芬奇手术),手术部位(左肺上叶、左肺下叶、右肺上叶、右肺中叶、右肺下叶、两肺叶及以上),切除范围(楔形切除术、段切除术、肺叶切除术、整肺切除),术中低血压、术中补液量、术中失液量、术中药物使用(咪达唑仑、丙泊酚、依托咪酯、右美托咪定、罗库溴铵、顺阿曲库铵、舒芬太尼、瑞芬太尼、氟比洛芬酯、0.75%罗哌卡因、2%利多卡因),术后并发症、术后镇痛泵类型(常规镇痛泵、皮下镇痛泵)、胸腔引流管留置时间及引流量。

1.3　统计学方法　采用 SPSS 27.0 软件对数据进行分析。正态分布计量资料以 $\bar{x}\pm s$ 表示,组间比较采用两独立样本 t 检验;非正态分布计量资料以中位数(第 25 百分位数,第 75 百分位数)[M (P_{25},P_{75})]表示,组间比较采用 Mann-Whitney U 检验;计数资料以例(%)表示,采用 χ^2 检验或校正 χ^2 检验或 Fisher 确切概率法。将单因素分析中 $P<0.05$ 的变量纳入多因素 logistic 回归分析,评估术后延迟出院的危险因素。$P<0.05$ 为差异有统计学意义。

2　结　果

2.1　一般资料　本研究共纳入 223 例患者,术后住院时长数据呈左偏态分布,最终选用 25%作为切割点,64 例(28.7%)正常出院,159 例(71.3%)延迟出院。单因素分析显示,延迟出院组患者的年龄、男性比例以及吸烟史比例明显高于正常出院组,差异有统计学意义($P<0.05$)。见表 1。

表 1　两组一般资料的比较

Tab. 1　Comparison of general data between two groups

指标	正常出院组($n=64$)	延迟出院组($n=159$)	t/χ^2 值	P 值
年龄(岁,$\bar{x}\pm s$)	53.6±10.9	58.0±12.3	2.533	0.012
男/女(例)	17/47	74/85	7.540	0.006
BMI(kg/m^2,$\bar{x}\pm s$)	22.9±3.1	22.9±3.0	0.022	0.982
ASA 分级Ⅱ/Ⅲ(例)	60/4	152/7	0.055	0.815
吸烟[例(%)]	12(18.8)	52(32.7)	4.342	0.037
冠心病[例(%)]	1(1.6)	6(3.8)	0.187	0.666
糖尿病[例(%)]	5(7.8)	10(6.3)	0.013	0.908

2.2　围术期指标　与正常出院组相比,延迟出院组胸腔镜手术占比、手术时长、术中补液量以及术中失液量、丙泊酚的使用量均明显增高,差异有统计学意义($P<0.05$)。此外,延迟出院组术后并发症发生率、胸腔引流管留置时间及引流量明显高于正常出院组,差异有统计学意义($P<0.01$)。见表 2。

2.3　影响肺结节患者术后住院时长的多因素回归分析　以术后住院时长(转化为分类变量)为因变量,将有统计学差异的变量以及临床常有意义的术

后镇痛泵纳入二元 logistic 回归分析,结果显示,年龄大[OR = 1.063, 95% CI(1.016 ~ 1.111), P = 0.008]、引流管留置时间长[OR = 8.743, 95% CI(4.144 ~ 18.445), P<0.01]和使用常规镇痛泵[OR=3.759, 95%CI(1.232 ~ 11.468), P=0.020]是术后住院时长≥3 d 的独立危险因素。见表 3。

表 2　两组患者围术期指标对比

Tab. 2　Comparison of perioperative indexes between two groups

指标	正常出院组(n=64)	延迟出院组(n=159)	$\chi^2/t/Z$ 值	P 值
手术类型[a]				
胸腔镜手术	44(68.8)	151(95.0)	28.570	<0.001
达芬奇机器人	20(31.2)	8(5.0)		
手术部位[a]				
左肺上叶	12(18.8)	39(24.5)		
左肺下叶	15(23.4)	23(14.5)		
右肺上叶	14(21.9)	44(27.7)	3.818	0.576
右肺中叶	4(6.2)	12(7.5)		
右肺下叶	13(20.3)	27(17.0)		
两肺叶及以上	6(9.4)	14(8.8)		
切除范围[a]				
楔形切除术	20(31.3)	41(25.8)		
段切除术	15(23.4)	37(23.3)	1.839	0.606
肺叶切除术	29(45.3)	78(49.0)		
整肺切除	0	3(1.9)		
术后并发症[a]	8(12.5)	53(33.3)	9.967	0.002
低血压[a]	2(3.1)	3(1.9)	0.002	0.964
术后镇痛泵[a]				
未使用镇痛泵	17(26.6)	44(27.7)		
常规镇痛泵	43(67.2)	106(66.6)	0.050	0.975
皮下镇痛泵	4(6.2)	9(5.7)		
术中补液量(mL)[b]	1 143.8±251.3	1 279.0±380.0	3.089	0.002
术中失液量(mL)[b]	355.5±154.4	447.1±232.7	2.897	0.004
手术时间(h)[c]	2(1.5,2.5)	2.5(1.8,3)	2.238	0.026
拔管时间 (h)[b]	2.52±1.39	2.59±1.37	0.346	0.732
引流管留置时间(d)[b]	1.80±0.41	3.02±1.28	10.729	<0.001
引流量(mL)[c]	240(166.25,375)	490(300,740)	6.638	<0.001
咪达唑仑(mg)[c]	2(2,2)	2(2,2)	0.352	0.725
丙泊酚(mg)[c]	700(680,777.5)	900(700,1 280)	3.143	0.002
依托咪酯(mg)[c]	12(0,50)	12(0,57.5)	0.007	0.994
右美托咪定(μg)[c]	200(37.5,230)	200(50,230)	0.396	0.692
罗库溴铵[a]				
使用	11(17.2)	24(15.1)	0.151	0.680
未使用	53(82.8)	135(84.9)		
顺阿曲库铵(mg)[c]	36(35,41.5)	35(35,40)	0.479	0.632
舒芬太尼(μg)[c]	90(72.5,100)	90(50,100)	0.510	0.610
瑞芬太尼(mg)[c]	1(1,1)	1(1,1)	0.259	0.796
氟比洛芬酯(mg)[c]	100(100,100)	100(100,100)	0.041	0.967
0.75%罗哌卡因[a]				
使用	5(7.8)	11(6.9)	0.055	0.815
未使用	59(92.2)	148(93.1)		
2%利多卡因[a]				
使用	5(7.8)	11(6.9)	0.055	0.815
未使用	59(92.2)	148(93.1)		

注:[a] 表示数据为例(%);[b] 表示数据为 $\bar{x}\pm s$;[c] 表示数据为$M(P_{25},P_{75})$。

表 3　术后延迟出院的二元 logistic 回归分析

Tab. 3　Binary logistic regression analysis of delayed postoperative discharge

变量	β	标准误差	瓦尔德	自由度	P 值	OR 值	95%CI
年龄	0.061	0.023	7.122	1	0.008	1.063	1.016~1.111
引流量	0.000	0.001	0.002	1	0.968	1.000	0.998~1.002
引流管留置时间	2.168	0.381	32.407	1	<0.001	8.743	4.144~18.445
术中失液量	0.000	0.001	0.000	1	0.992	1.000	0.997~1.003
术中补液量	0.000	0.001	0.007	1	0.934	1.000	0.999~1.002
性别(1)	0.502	0.547	0.841	1	0.359	1.651	0.565~4.825
吸烟史	0.130	0.577	0.050	1	0.822	1.138	0.367~3.528
手术类型(1)	−0.015	0.925	0.000	1	0.987	0.985	0.161~6.039
术后并发症	0.963	0.541	3.174	1	0.075	2.620	0.908~7.557
丙泊酚	0.000	0.001	0.159	1	0.690	1.000	0.999~1.001
镇痛泵(1)	1.324	0.569	5.412	1	0.020	3.759	1.232~11.468
镇痛泵(2)	0.706	1.064	0.440	1	0.507	2.025	0.252~16.302

注:(1) 表示分类变量编码;性别(1)表示男性,手术类型(1)是达芬奇机器人,镇痛泵(1)表示常规镇痛泵,镇痛泵(2)表示皮下镇痛泵。

3　讨　论

术后住院时间是评估术后恢复的主要指标之一,围术期治疗包含了促进患者术后最佳恢复,使患者早日安全回家并恢复日常活动[9]。延期出院患者并发症、再入院率及经济成本显著增高,因此目前大量研究构建预测模型,分析延期出院的危险因素[10],以针对性制定诊疗方案。既往研究认为胸科手术术后住院时间与患者年龄、性别、吸烟史、是否存在合并症等及手术指标、麻醉指标相关,因此本研究回顾性分析了患者一般资料、手术方式、引流管留置时间、引流量、麻醉药、术后镇痛等与住院时间的相关性[11-12]。

本研究单因素分析结果显示,年龄、引流管留置时间、术后并发症与肺结节术后患者住院时长呈显著相关,与 Greer 等[13]和 Rogers 等[14]的研究一致。年龄是肺结节术后延迟住院的预测因素。此外,将术后住院时间划分为二分类变量,行二元 logistic 回归分析,结果发现,年龄、引流管留置时间和使用常规静脉镇痛泵是术后住院时长≥3 d 的独立危险因素。Hyer 等[15]发现脊柱手术患者年龄确实会增加住院时间,与阿片类药物依赖状态无关;由于各种可能与合并症相关的原因,老年人在医院停留的时间更长。本研究结果与其一致。

本研究发现常规静脉镇痛泵的使用与术后延迟出院存在一定正相关性,此前 Pizzi 等[16]发现,骨科术后接受阿片类药物治疗的患者相关不良反应与住院时长增加有关。在胸外科领域,D'Amico 等[17]发现,与基于阿片类药物的麻醉相比,胸外科手术中无阿片类药物麻醉与较低的术后并发症、较少的阿片类

药物需求以及更好的术后 48 h 镇痛效果相关,并且可减少患者住院时长,因此有理由推测,使用镇痛泵增加患者住院时长的风险部分原因是由于阿片类药物的使用。近期国内外广泛提出增强术后恢复(ERAS)的概念,基于多学科合作,预防术后延迟恢复,降低住院时长,而临床麻醉在其中发挥重要作用。大量研究推荐硬膜外镇痛、区域镇痛及多模式镇痛用于缓解胸外科手术术后急性疼痛,降低阿片类药物使用,促进术后快速恢复,本研究与相关研究结果一致[18]。但是目前为止,胸科手术术后最佳镇痛技术是静脉镇痛还是硬膜外镇痛仍未达成共识,尚有待进一步研究。

本研究的单因素分析结果表明,两组间在手术类型和术中补液量失液量方面差异有统计学意义。然而,在后续的回归分析中,这些差异并未达到显著水平。同样,单因素分析未发现镇痛泵的使用有统计学意义,但纳入回归分析后却发现了与单因素分析不一致的结论。由于单因素分析中,一种变量与结局的关联可能受到其他变量的影响和相互作用,呈现出一个综合性结果,而多因素回归分析则能够调整其他混杂因素的影响,从而揭示自变量对因变量的真实效应。

本研究仍存在一些局限性。首先,作为一项回顾性研究,数据收集可能存在偏倚。其次,由于电子信息系统的不完善,依赖于已有的医疗记录和数据,存在信息偏倚的风险。第三,数据质量可能受到医疗记录的准确性和完整性以及可获得性和可用性的影响,限制了研究的深度和广度。

综上所述,本研究发现年龄大、引流管留置时间长及使用常规静脉镇痛泵是术后住院≥3 d 的独立危险因素,应通过术前针对性积极干预,减少术后并发症,虽然阿片类药物的剂量和不良反应率是典型的,但也应强调平衡疼痛管理与事件风险的必要性。

利益冲突　无

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