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ORIGINAL ARTICLE

Quality assessment using EQ-5D-5L after lung surgery for non-small cell lung cancer (NSCLC) patients

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Abstract

Objectives Aim of this study was to elucidate an alteration of quality of life (QOL) score before and after video-assisted thoracoscopic surgery (VATS) for non-small cell lung cancer (NSCLC) patients using the 5-level EuroQol-5D questionnaire (EQ-5D-5L). We also investigated how the preoperative QOL scores affected the postoperative clinical outcome prospectively.
Methods Between July 2018 and December 2018, 24 consecutive NSCLC patients who underwent VATS were recruited. The EQ-5D-5L for Japanese was used with face-to-face interviews to estimate the utility values of QOL.
Results QOL scores were significantly declined after surgery (0.81 ± 0.19 vs. 0.74 ± 0.11: $P = 0.049$). The levels of EQ-5D-5L questionnaire were not significantly different before and after surgery except Q4 (pain control). The levels of Q4 were significantly worsened after surgery (1.33 ± 0.56 vs. 1.88 ± 0.61, $P < 0.001$). Operation time and bleeding in the preoperative low-QOL score group ($N = 13$) was longer (215.4 ± 52.3 min. vs. 173.5 ± 42.3 min., respectively: $P = 0.045$) and more (116.2 ± 152.7 ml vs. 22.7 ± 20.1 ml, respectively: $P = 0.049$) than those in the high-QOL score group ($N = 11$).
Conclusions QOL survey for lung cancer patients using EQ-5D-5L is simple and useful to identify the issue facing at the medical team. Preoperative low QOL score could be a predicting factor for the longer operation time and more bleeding.

Keywords Lung surgery · EuroQol · Pain · Quality of life · VATS

Introduction

A survival benefit was considered to be a hard endpoint and no matter how the patients were survived [1]. Most surgeons focused on the survival alone and disdained the quality of the survival itself [2]. We are facing on super-aging society in the future generation which a social responsibility in the young generation would be increasing unprecedentedly [3]. Therefore, cancer patients should not only survive but also maintain any social productivity during cancer management or after the therapy.

A lot of quality assessment has been proposed to evaluate the quality of life (QOL). QOL is a subjective assessment of the feeling in the patients [4–6]. The World Health Organization proposed different indicators of QOL, such as an ability to play, modify social roles in life, adaptation, and mental well-being [7]. The 5-level EuroQol 5-dimension (EQ-5D-5L) is one of the assessment tools to estimate QOL and provide the QOL score which could calculate a quality-adjusted life year (QALY) and use to evaluate the incremental cost-effectiveness ratio (ICER) [8]. Short-term clinical outcome after surgery has been well reported [9, 10]. However, clinical satisfaction and quality of the condition after surgery have not been fully understood.

Aim of this study was to elucidate an alteration of QOL before and after video-assisted thoracoscopic surgeries (VATS) for non-small cell lung cancer (NSCLC). We also investigated how the state of the QOL before surgery affects the postoperative clinical outcome.

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Patients and methods

Patients

Between July 2018 and December 2018, 24 consecutive NSCLC patients who underwent VATS were recruited prospectively for this study after providing informed consent and procedures securing respondents' anonymity were applied. The study was approved by the Internal Review Board at the Sapporo Medical University (approved ID: 302-55 and approved date: July 12, 2018).

Assessment of QOL

The EQ-5D-5L questionnaire [8], the Japanese version of which has been validated in a previous work [5], was used with face-to-face interviews to estimate the utility values of QOL. The five dimensions assessed by the EQ-5D-5L are mobility (MO), self-care (SC), usual activities (UA), pain/discomfort (PD), and anxiety/depression (AD), each of which has five levels of severity. The level 1 is able to do without any difficulty or to feel comfortable. The level 5 is hard to do any task or feel uncomfortable. Using the scoring function from Japan, these health state parameters were transformed into a utility value ranging from 0 to 1, in which 0 represented death and 1 indicated full health. Calculator is available in the EQ-5D homepage (https://euroqol.org/) and each coefficient of the five items such as MO, SC, UA, PD, and AD described in the literature [5]. The intended use of EQ-5D-5L was registered before recruiting the patients (ID: 26966).

Data collection

Medical records were used to identify physical data, operation time, intraoperative bleeding, duration of the chest drainage, hospital stay, smoking period, Brinkman index, and smoking cessation period. The EQ-5D-5L interview was performed at immediately after admission and at just before discharge the surgical ward.

Statistical analysis

SPSS (Version 22, IBM-SPSS, Inc., Armonk, New York, USA) was used in the analysis. Paired *t* test was used for comparison between preoperative QOL scores and postoperative QOL scores. Unpaired *t* test was used for comparison between the preoperative low-QOL score group ($N=13$) and the high-QOL score group ($N=11$). Levene's test was used to assess the equality of variances for a variable between the two groups. Histogram with probability curve was obtained simultaneously. The receiver operating characteristic (ROC) curve for calculating the area under the ROC curve (AUC) and interactive dot diagram were determined using the MedCalc software package (Ver 8.0.1.0, Mariakerke, Belgium). All results are expressed as mean ± standard deviation values. *P* values of <0.05 were considered to be significant.

Table 1 Clinical demographics of the patients

Background ($N=24$)	Mean ± SD
Age (years)	68.0 ± 9.1
Sex (men: women)	10:14
Height (cm)	158.8 ± 10.9
Weight (kg)	58.5 ± 9.9
Operation time (min.)	199.7 ± 53.5
Bleeding (ml)	76.3 ± 120.5
Lobectomy: segmentectomy	21:3
Stages (I:II:III)	18:4:2
Complications (Yes:None)	1:23
Duration of the chest drainage (days)	1.9 ± 2.5
Hospital stays (days)	13.1 ± 3.3

Table 2 Alteration of QOL scores and the levels of each EQ-5D-5L question

EQ-5D-5L	Preoperative score	Postoperative score	*P*
QOL scores	0.81 ± 0.19	0.74 ± 0.11	0.049*
Q1: Morbility	1.54 ± 0.93	1.38 ± 0.58	0.426
Q2: Self-care	1.13 ± 0.34	1.25 ± 0.53	0.185
Q3: Activity	1.63 ± 1.13	1.71 ± 0.75	0.723
Q4: Pain control	1.33 ± 0.56	1.88 ± 0.61	< 0.001*
Q5: Anxiety	1.51 ± 0.83	1.54 ± 0.72	0.714

* represent statistically significance ($P < 0.05$)

Results

We evaluated total 24 patients who received VATS for the NSCLC. Demographics of the patients are shown in Table 1. Mean age was 68.0 ± 9.1 years and body size was relatively petite which mean height and weight were 158.8 cm and 58.5 kg, respectively. Operation time was 199.7 min and bleeding was 76.3 ml. There was no blood transfusion at all. A postoperative complication was observed in only one patient who had a grade III subcutaneous emphysema and pneumothorax. There was no mortality. Duration of the chest drainage was 1.9 ± 2.5 days and hospital stays were 13.1 ± 3.3 days.

QOL score significantly declined after surgery (Table 2; 0.81 ± 0.19 vs. 0.74 ± 0.11, $P=0.049$). The levels of each EQ-5D-5L questionnaire were not significantly different

Table 3 Correlation coefficients (R) between wound length or number of ports and post-operative each EQ-5D-5L question ($P > 0.05$)

	Wound length (mm)	Number of ports
Q1	− 0.008	− 0.134
Q2	0.108	− 0.062
Q3	0.174	0.006
Q4	0.022	0.281
Q5	0.082	0.101

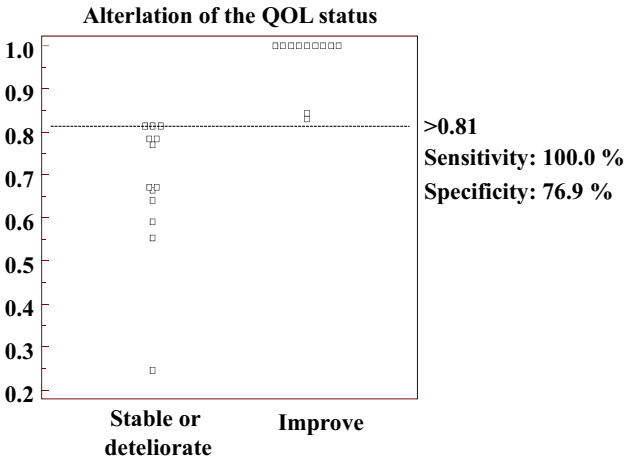

Fig. 1 Interactive dot diagram of alteration of the QOL status. The patients were divided into the stable or deteriorate QOL score group ($N = 13$) and the improve QOL score group ($N = 11$)

before and after surgery except Q4 (Table 2). The levels of Q4 were significantly worsened after surgery (1.33 ± 0.56 vs. 1.88 ± 0.61, $P < 0.001$). None of EQ-5D-5L question correlated with both wound length and number of ports (Table 3).

Interactive dot diagram of the QOL scores indicated optimal cut-off values to identify the alteration of the QOL scores in the perioperative period (Fig. 1). We have divided the patients into preoperative low-QOL score group (≤ 0.820: $N = 13$) and high-QOL score group (≥ 0.820: $N = 11$) base on the cutoff values. Clinical comparison between the groups is shown in the Table 4. The age in the low-QOL score group was significantly lesser than the one in the high-QOL score group (64.5 ± 8.9 vs. 72.1 ± 7.9 y.o.: $P = 0.041$). In addition, operation time and bleeding in the low-QOL score group were significantly longer (215.4 ± 52.3 vs. 173.5 ± 42.3 min.: $P = 0.045$) or more (116.2 ± 152.7 vs. 22.7 ± 20.1 ml: $P = 0.049$) than those in the high-QOL score group.

We drew the histogram of both preoperative and postoperative QOL scores with distribution curves (Fig. 2). The curve of the preoperative QOL scores presented the gentle slope (Fig. 2a). On the other hand, the one of postoperative QOL scores presented a sharp curve (Fig. 2b). Distribution curves of Q4 (pain control) before and after the operation were simply displaced to deteriorate the side with similar shapes (Fig. 3a, b).

Discussion

We evaluated QOL for the patients who received initial VATS for NSCLC using EQ-5D-5L self-reporting questionnaire. QOL scores were significantly deteriorating after surgery compared to the one before surgery. The preoperative low QOL scores could predict longer operation time and more bleeding. Distribution curve of the QOL scores became sharp. A pain-associated questionnaire is the only domain which was significantly deteriorating after surgery,

Table 4 Clinical comparison between groups of the low QOL scores ($N = 13$) and the high QOL scores ($N = 11$)

$N = 24$	Low QOL scores ($N = 13$)	High QOL scores ($N = 11$)	P
Age (years)	64.5 ± 8.9	72.1 ± 7.9	0.041*
Sex (male:female)	7:6	2:9	0.072
Height (cm)	162.3 ± 11.2	154.7 ± 9.3	0.089
Weight (kg)	60.0 ± 8.6	56.8 ± 11.5	0.447
Stages (I:II:III)	8:3:2	10:1:0	0.215
Operation time (min.)	215.4 ± 52.3	173.5 ± 42.3	0.045*
Bleeding (ml)	116.2 ± 152.7	22.7 ± 20.1	0.049*
Duration of the chest drainage (days)	2.2 ± 2.9	1.6 ± 1.8	0.569
Hospital stays (days)	13.5 ± 3.7	12.7 ± 2.9	0.559
Smoking period (years)	23.7 ± 21.2	25.4 ± 17.9	0.838
Brinkman index	568.5 ± 597.0	470.0 ± 385.1	0.643
No smoking period (years)	28.5 ± 27.7	25.6 ± 27.9	0.804

* represent statistically significance ($P < 0.05$)

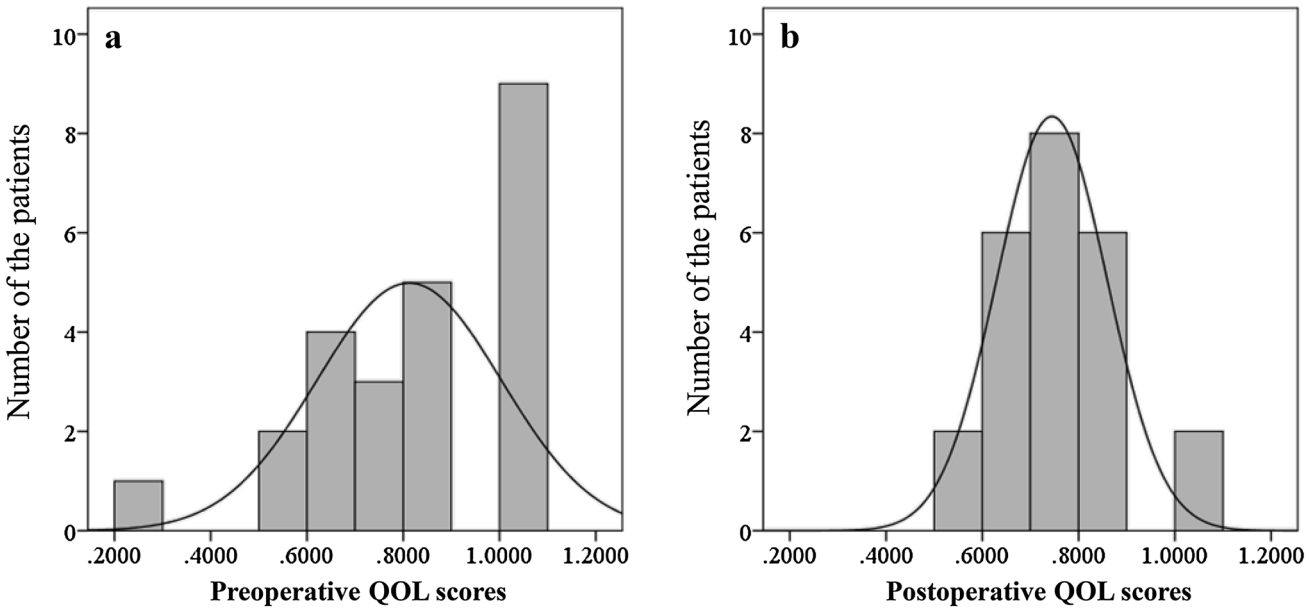

Fig. 2 Histogram of the EQ score before (**a**) and after (**b**) video-assisted thoracoscopic surgeries (VATS) with distribution curve

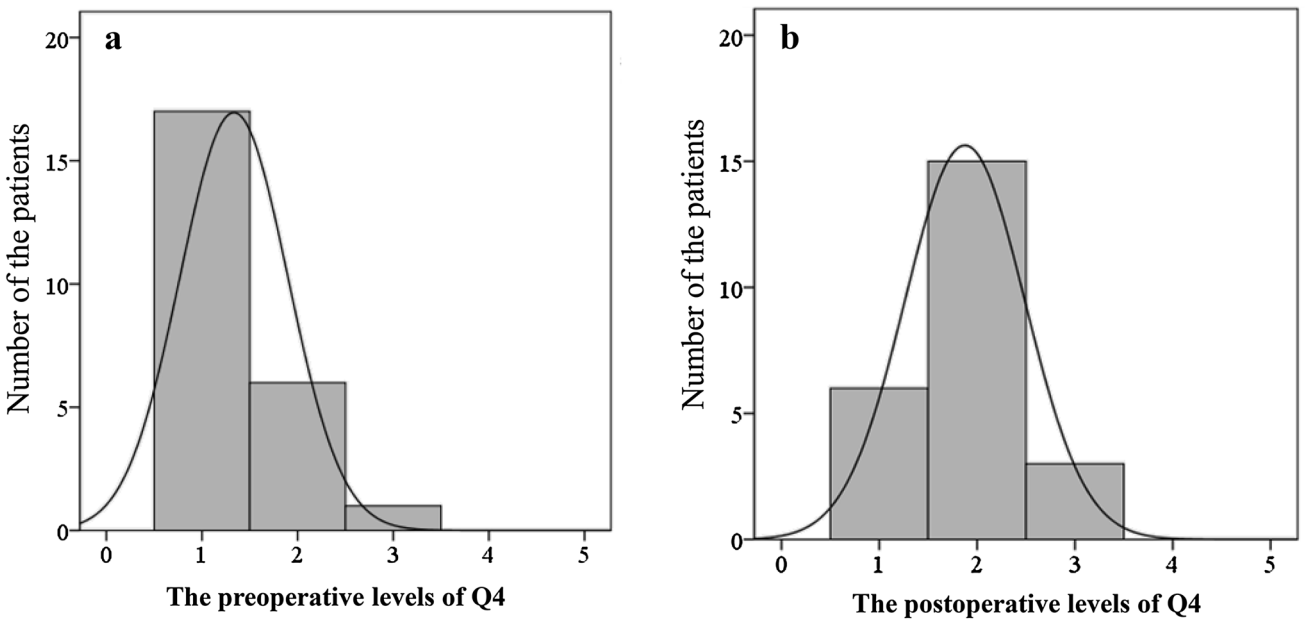

Fig. 3 Histogram of the Q4 score before (**a**) and after (**b**) video-assisted thoracoscopic surgeries (VATS) with distribution curve

although the distribution curve was simply displaced to deteriorate side.

QOL assessment is important to evaluate the medical quality and allow us to compare it among different medical institutions [7]. It also could be used for distributing medical resources with proper judgment. EQ-5D-5L was developed by the EuroQol Group which has been reported across the world including US, UK, other European countries, China, Singapore, Brazil, Japan, and others. It composed of simple five domains, such as "mobility", "self-care", "usual activities", "pain/discomfort", and "anxiety/depression" assessed at five levels of description [7, 8]. The nation-specific QOL scores could be obtained from each pattern depending on the five domains with five different levels [5]. QOL scores are reflected in QALY calculations for economic evaluations and those were also recommended by the guidelines [11]. Therefore, EQ-5D-5L could be one of the best assessment tools to evaluate clinical quality after any surgery.

Several factors have been identified to improve QOL or deteriorate QOL in patients with lung cancer [4, 6, 12]. Pharmacological and non-pharmacological modalities for ameliorating disease symptoms (fatigue, pain, and dyspnea) could propose to improve QOL in lung cancer patient [4]. Our study identified that the domain of pain control was responsible to deteriorate QOL scores. It is consistent with previous reports regarding a factor for influencing QOL [4, 6]. On the other hand, pharmacological and non-pharmacological modalities in our strategy might be inappropriate to maintain QOL after surgery. Inadequate management of the QOL underscored a disease control for improving QOL [8]. In our case, we should focus on modifying our clinical pathway dealing with pain control exclusively.

Surgical treatment could improve QOL of the lung cancer patients who had mild or fewer symptoms [4]. The histogram of QOL scores after surgery became sharp, which indicated that low-score patients would be improved and high-score patients would be deteriorated. It also indicated that QOL improvement after surgery could achieve in the patients whose QOL status was at a very low level due to severe symptoms. On the other hand, the QOL of the patients who maintained at high levels declines after surgery in anyway. We should reaffirm that QOL after surgery does not only decline but also improve depending on the symptoms of the patients.

We showed low QOL scores could be a predicting factor for longer operation time and more bleeding. Low QOL scores have been identified as a poor prognostic factor for NSCLC patients after surgery [13]. In addition, preoperative low QOL score proved to be associated with postoperative morbidity after pulmonary lobectomy [14]. Low QOL scores could be associated with disease progression which made the operation difficult although the stage did not prove to be significantly different among low-QOL and high-QOL groups in this study. On the other hand, VATS and minimized surgical procedures could maintain QOL scores after surgery [15]. Most of our patients were stage I and all the patients received initial VATS for NSCLC. Therefore, our finding might be due to the specific condition under which the patients were, in the relatively early stage and managed by the VATS. However, this study implied that preoperative QOL score might give a unique aspect on both objective and subjective outcomes in the NSCLC patients after surgery.

In conclusion, QOL survey for NSCLC patients using EQ-5D-5L is simple and useful to identify the issue faced by the medical team. It also could predict operation time and bleeding under specific circumstances. A large study and long observation should be needed for confirming the clinical outcome and evaluating medical economics to calculate QALYs in the future.

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Compliance with ethical standards

Conflict of interest Ryo Koide and other co-authors have no conflict of interest.

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