

# Long-Term Patient-Aspect Outcomes of the Single-Port Laparoscopic Cholecystectomy

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## Abstract

**Background:** Single port laparoscopic cholecystectomy (SPLC) is a widely performed advanced technique in laparoscopic surgery which has many benefits compare to conventional three port laparoscopic cholecystectomy (TPLC). The purpose of this study was to compare the patients' satisfaction of SPLC and TPLC after one year of operation by using questionnaire which not only objective factors such as results of operation and hospital days but also subjective factor such as social and cosmetic quality of life. **Materials and Methods:** This study analyzed the data of 74 patients (SPLC = 42, TPLC = 32) who underwent the laparoscopic cholecystectomy between March and July 2013. The patients were asked to complete a patient-assessment questionnaire measuring the postoperative social and cosmetic quality-of-life values at the 12-month mark. **Results:** Statistically significant differences in the age, sex distribution, and body mass index are absent between the two groups. All the average scores of the different parameters of the social-activity aspect—satisfaction with physical condition, limitation of nutrition, stamina, postoperative pain level, returning to social life, impairment of social life, degree of complications, and cost-effectiveness of the surgery—are not statistically significant in both groups. Alternatively, all the results of the cosmetic aspect—scar influence on charms ( $p < 0.001$ ), satisfaction regarding scar appearance ( $p = 0.015$ ), and patient's score of scars ( $p < 0.001$ )—show statistically significant differences. **Conclusion:** The SPLC is a safe and an attractive approach regarding the patients of this study. It offers a more effective cosmetic result that may be conveyed by a greater patient satisfaction.

## Keywords

Long-Term Outcome, SPLC, Patients, Satisfaction

## 1. Introduction

Single-incision laparoscopic procedures have evolved gradually to include a multitude of various surgeries. The current literature documents the usage of single-incision or single-port access surgery for cholecystectomies, adrenalectomies, splenectomies, appendectomies, herniorrhaphies, bariatrics, and colon surgery [1] [2] [3]. Navarra *et al.* [4] performed the first single-incision laparoscopic cholecystectomy in 1995. Since that time, the *single-port laparoscopic cholecystectomy* (SPLC) has been a novel technique, comparable with the conventional multi-incision laparoscopic cholecystectomy (CLC), for the uncomplicated, benign gall bladder (GB) diseases with respect to the safety and efficacy [5] [6] [7]. With the increasing patient demand for enhanced cosmetic outcomes, the SPLC results in a single and smaller wound, thereby satisfying the patient. In addition to the SPLC cosmetic advantage, the potential benefits of reduced postoperative pain and faster recovery have been reported [8] [9].

The patient satisfaction, however, has only been estimated from the operator perspective in many studies, and the operative factors are not directly associated with the patient demands. The capacity of the operator-estimated operative factors regarding the revelation of the patient quality of life (QoL) is questionable. The cosmetic outcomes are not easily objectified, and if they can be objectified by researchers, they cannot reveal the patient satisfaction directly. The questionnaire is one of the most effective tools for the assessment of the patient satisfaction; therefore, the authors attempted to investigate the actual patient satisfaction using a questionnaire that was answered by the patients themselves. Additionally, if the questionnaire is answered for a long-term follow-up, the responses can reflect the actual long-term outcomes according to the patient view.

This study comprises a long-term follow-up study for which the questionnaire tool is employed to compare the SPLC with the *three-port laparoscopic cholecystectomy* (TPLC). The long-term effectiveness of the patient view is the primary interest of the present study, rather than the SPLC efficacy in the immediate postoperative period. To the authors' knowledge, a dearth of the patient-view studies exists relative to those of the operator view, especially regarding the long-term follow-up. The intention of this study comprises demonstrations of the difference between the patient and operator views, and whether the SPLC or the TPLC is ultimately more satisfactory for the patients over the long term after the operation.

## 2. Materials and Methods

### 2.1. Patients

The data of 74 patients who had undergone the laparoscopic cholecystectomy between March and July 2013 were analyzed for this study. When determining sample size, we considered about the loss to long term follow-up (approximately 5% in general) for statistical reliability. All the surgeries were performed by a

single surgeon at a single medical center. For the research investigation, the two groups, SPLC ( $n = 42$ ) and TPLC ( $n = 32$ ), were separated. The preoperative demographic characteristics and the postoperative outcomes of the two groups were compared. The clinical and operation information consist of the patient sex, age, height, weight, body mass index (BMI), operation time, complication number, postoperative hospital days, and postoperative follow-up interval.

## 2.2. Surgical Procedure

The details of the surgical procedure have been described previously [10]. The study preparation required all the patients to be placed in the supine position under general anesthesia. The operator and the first assistant were on the left side of the patient. After a midline transumbilical incision of 2.5 cm was made in the lithotomy position, camera and surgical devices were inserted using the OCTO Port multichannel port (Dalim Surg Net, South Korea). For the surgical devices, the single-port articulating instruments and the conventional laparoscopic instruments that are used in the conventional three-port surgery, including the 30° angled rigid laparoscope with the 5-mm diameter that is mainly used for cameras, were combined. The gall bladder was dissected after the exposure of the Calot's triangle area, followed by the ligation of the cystic duct with the 10-mm Hem-o-lok clip (Weck Closure Systems, U.S.) and the ligation of the cystic artery with the 5-mm Hem-o-lok clip (Weck Closure Systems, U.S.). Then, the gall bladder was separated from the liver bed and removed directly through the port site without the catch bag. An additional port was inserted when it was dangerous to only use the SPLC for the surgery execution, or if it was difficult to dissect the adjacent structures. A drain was not inserted after the SPLC operation. The drain insertion depends on the port number and the inflammation grade.

## 2.3. Questionnaire

We developed an our own patient assessment questionnaire including social and cosmetic categories which considered known quality of life index such as Short Form Health Survey (SF-36) and other studies of cosmetic results of SPLC. The patients were asked to complete the questionnaire that measures the social and cosmetic QoL criteria 12 months after the operation. All the subjects were interviewed personally and the questionnaire was filled out individually. When patients completed the questionnaire, they freely expressed their opinions at isolated space, and the doctor was not involved at all. The ethical committee of the institution approved the study.

The body weight and height were measured to evaluate the BMI aspect that significantly influences the QoL and postoperative complications [11] [12]. The social-aspect questionnaire consists of the following 8 categories: 1. Satisfaction with physical condition; 2. Limitation on nutrition; 3. Stamina; 4. Postoperative pain level; 5. Returning to social life; 6. Impairment of social life; 7. Degree of

complications; and 8. Cost-effectiveness of surgery. The cosmetic-aspect questionnaire consists of the following 4 categories: 1. Influence of scars on charms; 2. Satisfaction with appearance of scars; 3. Patient's score of scars; and 4. Influence of scars on everyday life. Each category question can be given four or five possible responses ([Appendix 1](#)).

## 2.4. Statistical Analysis

The continuous data were presented as the mean  $\pm$  standard deviation. To determine the significant factors as the port number was increased, the linear-by-linear association and the Jonckheere-Terpstra test were used for both the categorical and continuous numerical data. To exclude the confounding factors of the additional-port usage during the operation, the one-port and three-port operations, exclusive of the two- or four-port usage, were compared separately, for which the Student's t-test was used. To identify the risk factors that affected the complications, the logistic-regression analysis was used. Based on the results of the univariate analysis, each of the questionnaire items that showed significantly different results with the increasing port number was re-analyzed using the multiple-regression test, thereby identifying the variables that caused the differences. The statistical computations were performed using the SPSS Statistics software (version 20; IBM, U.S.).

## 3. Results

This study comprises the total of 74 patients (SPLC = 42, TPLC = 32). There are no statistically significant differences in the age, sex distribution, or BMI ([Table 1](#)). According to the preoperative diagnosis, the GB stone ( $n = 19$ ) is the most common condition in the SPLC sample, followed by the GB polyp ( $n = 18$ ), acute cholecystitis ( $n = 4$ ), and GB empyema ( $n = 1$ ). In the TPLC sample, the most common diagnosis is the acute cholecystitis ( $n = 16$ ), followed by the GB stone ( $n = 9$ ), GB empyema ( $n = 4$ ), and GB polyp ( $n = 3$ ). The operation time of the SPLC group is slightly shorter, and this is the only statistically significant difference between the two groups, with the averages of  $46.9 \pm 1.6$  min for the SPLC group and  $61.3 \pm 4.2$  min for the TPLC group ( $p = 0.005$ ).

Postoperative complications occurred in 1 case of the SPLC group (umbilical discharge) and 2 cases of the TPLC group (umbilical discharge and port-site seroma); the patients recovered with the provision of supportive care during and after the hospital stay. The postoperative hospital days and the postoperative follow-up interval of the two groups do not differ significantly. Due to the national insurance system of South Korea, the typical hospital stay of the LC patients is more than 2 days.

The comparison of the patient-questionnaire information and answers between the two groups is presented in [Table 2](#). All the average scores of the different parameters of the social-activity aspect are as follows: 1. Satisfaction with physical condition ( $p = 0.975$ ); 2. Limitation on nutrition ( $p = 0.820$ ); 3. Stamina

**Table 1.** Characteristics of patients.

Port number (total n = 74)	1 (n = 42)	3 (n = 32)	p-value
Male sex (%)	18 (42.9)	12 (37.5)	0.688
Age, years	55.1 ± 2.1	56.6 ± 3.3	0.677
Height (cm)	161.2 ± 2.8	164.2 ± 1.7	0.458
Weight (kg)	61.9 ± 1.9	62.2 ± 1.9	0.917
BMI	26.5 ± 3.5	23.0 ± 0.5	0.451
Diagnosis			
GB polyp	18	3	
GB stone	19	9	
Acute cholecystitis	4	16	
GB Empyema	1	4	
Operation time (min)	46.9 ± 1.6	61.3 ± 4.2	0.005
Number of complications	1	2	0.358
Hospital days after operation (days)	2.0 ± 0.1	2.4 ± 0.2	0.050
Follow up interval after operation (days)	361.2 ± 1.8	364.8 ± 2.7	0.167

GB: Gallbladder, BMI: Body Mass Index.

**Table 2.** Analysis on number of ports and risk of complications.

Items of questionnaire	1 Port vs 3 ports (p-value)	Risk of Complications*
Sex	0.688	
Age	0.677	
Height (cm)	0.458	
Weight (kg)	0.917	<b>0.035</b>
BMI	0.451	
Social 1	0.975	
2	0.820	
3	0.600	
4	0.629	
5	0.730	
6	0.670	
7	0.742	
8	0.690	
Cosmetic 1	<b>&lt;0.001</b>	
2	<b>0.015</b>	
3	<b>&lt;0.001</b>	
4	0.235	
Operation time	<b>0.005</b>	
Complications	0.358	
Drain	<b>&lt;0.001</b>	<b>0.044</b>
Hospital days after operation	<b>0.050</b>	
Follow up interval after operation	0.167	

\*Analyzed by multivariate logistic regression.

( $p = 0.600$ ); 4. Postoperative pain level ( $p = 0.629$ ); 5. Returning to social life ( $p = 0.730$ ); 6. Impairment of social life ( $p = 0.670$ ); 7. Degree of complications ( $p = 0.742$ ); and 8. Cost-effectiveness of surgery ( $p = 0.690$ ). These average scores are not statistically significant in both groups.

Alternatively, as shown in **Table 2**, the cosmetic-aspect results regarding the first three questions show statistically significant differences, as follows: 1. Influence of scars on charms ( $p < 0.001$ ); 2. Satisfaction with appearance of scars ( $p = 0.015$ ); and 3. Patient's score of scars ( $p < 0.001$ ). Whereas the results of the last question, 4. Influence of scars on everyday life ( $p = 0.235$ ), are statistically similar in both groups, as is also shown in **Table 2**.

#### 4. Discussion

The evolution of the gallbladder surgery from the Langenbuch's first cholecystectomy with the hospital stay of 6 weeks into the day-care specialty following the LC introduction is indeed fascinating [13]. The main thrust throughout the history of the cholecystectomy has been the pain reduction and the cosmesis improvement, and the notion of the scarless surgery has mainly led to the increased patient acceptance of the procedures [14].

Potential benefits regarding the decreased port number for the completion of the laparoscopic procedures compared with that of the traditional multiport approach have been reported. A recent study demonstrated that the SPLC produced a superior cosmetic result, less pain, and faster recovery in the selected patients [15] [16] [17] [18]. Other studies also present the superior cosmetic results [19] [20] [21] and the decreased morbidity, primarily regarding the postoperative pain [9] [17] [18], as the projected benefits of the SPLC over the CLC [22]. Only a number of studies, however, have compared the patient-aspect benefit between the SPLC and CLC operations.

The present study explored the patient perception of the postoperative social and cosmetic results. One important result of this study is the greater satisfaction of the SPLC-patient group regarding the scars. The various associated factors of the social-activity aspect are not statistically significant, while the cosmetic score of the SPLC group is significantly higher. It is probable that this result will lead to an increasing number of people favoring the SPLC if they are indicated and can choose, because the other factors such as pain, complications, and hospital days are comparable; moreover, the postoperative cosmetic benefits become much more important for the patient view compared with the doctor view that perceives scars as merely consequential surgical wounds. Therefore, this scar problem needs to be considered from a new perspective. If only the predicted surgical achievement and the other-patient preoperative conditions are similar, the cosmetic aspect should be considered as an important criterion in the selection of the operation method.

However, the controversy regarding the SPLC cosmetic effect is ongoing. Ma *et al.* found that the SPLC benefits regarding the patient overall and cosmetic

satisfaction are not significant [23]. Also, Garg *et al.* revealed that the patient perceptions regarding the cosmetic outcome after the SPLC and the CLC are similar in both groups [24]. Therefore, the results of this study should be considered with a large number of patients using the prospective randomized and blinded method.

Since the indications for SPLC are not yet clearly established, the application of SPLC is still limited in all patients. Our indication for SPLC was polyp disease and mild cholecystitis with gall bladder stone (no right-upper-quadrant abdominal tenderness in physical examination, no gall bladder wall thickening in image study) whereas TPLC was applied to previous laparoscopic surgery indication [10]. With difference of patient selection, SPLC was mainly operated on patients with mild disease and that was easier to perform than TPLC. Furthermore, this study carried the patients' information from only one skillful surgeon who did 500 cases of SPLC until now. Some studies have shown that an operating time decreased according to the increase of the surgeon's experience [25] [26] [27].

Several study limitations need to be considered here. While the patient-completed questionnaire was developed and provided to all the patients for the objective measuring of their social and cosmetic satisfaction, the self-developed questions were not validated, and this is in contrast to the SF-36 or the Gastrointestinal Quality of Life Index (GIQLI), which are well-validated QoL-analysis tools. The authors just obtained the data regarding the patient perceptions of the social and cosmetic outcomes, but these data do not represent the entirety of the patient-aspect long-term outcomes. Furthermore, during the question answering, the patients were not shown or did not experience the SPLC and TPLC post-operative results simultaneously, so they answered the questions according to their highly subjective perceptions without a comparison of both operations. In general, the public consider the single-incision surgeries as a more advanced, less invasive, and more cosmetically pleasing method, and this might have influenced the patient answers.

## 5. Conclusion

The results of this study show that the SPLC-patient perceptions regarding the postoperative cosmetic outcomes are more favorable; alternatively, though, the various parameters of the social-activity aspect are not statistically significant, and this means that the SPLC offers a more favorable cosmetic result, which may be conveyed by the greater patient satisfaction. As the postoperative cosmetic outcomes represent a much more important event with respect to the patient view compared with the doctor view, the cosmetic aspect should be considered as an important criterion in the selection of the operation method.

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## Appendix 1

### Patient Assessment Questionnaire

Single port (                    )/Three port (                    )

#### **Patient information**

- 1) What is your gender? (Male/Female)
- 2) How old is your age? (                    years old)
- 3) What is your height? (                    cm)
- 4) What is your weight? (                    kg)

#### **Social aspects**

- 1) Are you satisfied with your physical condition after surgery?  
 Very satisfied  Satisfied  Moderate  Dissatisfied  Very dissatisfied
- 2) Do you think this surgery give you a limit on your nutrition?  
 Extremely  Quite a bit  Moderately  A little bit  Not at all
- 3) Do you think your stamina has decreased after surgery?  
 Extremely  Quite a bit  Moderately  A little bit  Not at all
- 4) Are postoperative pain levels acceptable?  
 Extremely  Quite a bit  Moderately  A little bit  Not at all
- 5) Do you think this surgery and recovery process give you somewhat constrained to return your social activities?  
 Extremely  Quite a bit  Moderately  A little bit  Not at all
- 6) Do you think this surgery is somewhat impaired your social life after surgery?  
 Extremely  Quite a bit  Moderately  A little bit  Not at all
- 7) How do you think about the degree of complications of surgery you experienced?  
 Not at all  Slightly  Moderately  Severe  Very Severe
- 8) What do you think about the cost-effectiveness of this surgery?  
 Very cheap  Cheap  Moderate  Expensive  Very expensive

#### **Cosmetic aspects**

- 1) Do you think the surgical wounds (scars) affect your outward charm??  
 Extremely  Quite a bit  Moderately  A little bit  Not at all
- 2) Are you satisfied with the appearance of your scars?  
 Very satisfied  Satisfied  Moderate  Dissatisfied  Very dissatisfied
- 3) How many points if you give marks to your scars?  
1    2    3    4    5    6    7    8    9    10  
(1= Very severe scarring 10 = Almost no scarring) (Score:                    )
- 4) Have you had problems in everyday life because of surgical wounds(scars)??  
 Extremely  Quite a bit  Moderately  A little bit  Not at all

Thank you for your answering the questions.