

Clinical Predictors for Difficult Single Incision Laparoscopic Cholecystectomy

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Abstract: *Background: Single-incision laparoscopic cholecystectomy (SILC) has been developed to further minimize the invasiveness of laparoscopic cholecystectomy by reducing the number of incisions. Knowledge of preoperative clinical factors to predict difficult SILC may be used for the preoperative counselling of the patients regarding the successful outcome of the surgery as well as to predict the risk of conversion preoperatively for selected patients, prepare the patient psychologically and minimize the procedure related cost. Objective: The present study was conducted to know about clinical predictors for difficult SIC. Methods: The study was a hospital based prospective observational study where 50 patients undergoing elective laparoscopic cholecystectomy due to gall stone diseases were included in the study. Multiple logistic regression analysis was done to predict difficult single incision laparoscopic cholecystectomy. Results: Out of 50 patients 15 patients underwent difficult SILC, while 35 patients had undergone easy single incision laparoscopic cholecystectomy independent risk factors in multivariate logistic regression analysis for difficult SILC were: age >50 years, BMI \geq 25 kg and multiple attacks of acute cholecystitis in past. Conclusion: Clinical Factors associated with difficult SILC age >50 years, BMI \geq 25 kg and multiple attacks of acute cholecystitis in past.*

Keywords: single incision laparoscopic cholecystectomy, gall stone diseases, risk factors, multiple attacks of acute cholecystitis in past

1. Introduction

Laparoscopic cholecystectomy has now become the procedure of choice for symptomatic gall stone disease.^[1] Recently, a single-incision laparoscopic cholecystectomy (SILC), also called as transumbilical laparoscopic cholecystectomy or laparoendoscopic single site (LESS) cholecystectomy, has been developed to further minimize the invasiveness of laparoscopic cholecystectomy by reducing the number of incisions.^[2, 3] Various randomized controlled trials have shown that SILC can provide better cosmetic results, shorter duration of hospital stay and early recovery as compared with conventional laparoscopic cholecystectomy.^[4]

Considering that the main benefit of single incision laparoscopic cholecystectomy (SILC) appears to be improved cosmesis, it is important to complete the procedure via a single incision. Because the number of incisions is the primary concern for patients who hope to undergo SILC, the ability to identify an individual patient's risk for needing additional ports is important. If conversion is necessary for whatever reason, the benefit of the minimal access concept is lost. Therefore, every effort should be made to increase the probability of successful completion of the laparoscopic procedure to be attempted through single incision.^[5]

Some factors which can be accessed preoperatively to reliably predict the feasibility of successful single incision laparoscopic cholecystectomy or the requirement for

additional ports have been observed in previous studies.^[6-9]

Thus, for surgeons it would be helpful to establish criteria that would assess the risk of conversion preoperatively and risk of postoperative complications. Factors, which can be assessed preoperatively can reliably predict feasibility of the successful single incision laparoscopic cholecystectomy and the requirement of extra ports. Knowledge of these factors, may be used for the preoperative counselling of the patients regarding the successful outcome of the surgery as well as to predict the risk of conversion preoperatively for selected patients, prepare the patient psychologically, minimize the procedure related cost, help overcome financial constraints, which is a significant problem in developing countries and possibility of the conversion so that needful arrangements can be made by the patients.^[10, 11]

Therefore, present study was planned to know about clinical predictors for difficult single incision laparoscopic cholecystectomy.

2. Subjects and Methods

Study design, settings and participants:

It was a hospital based prospective observational study conducted over a period of one year from June 2020 to June 2021 in general surgery department of a tertiary care teaching hospital in Himachal Pradesh, India. All the

patients undergoing elective laparoscopic cholecystectomy due to gall stone diseases were included in the study. Patients with common bile duct calculus, suspicion of carcinoma gall bladder, features of obstructive jaundice, Cholelithiasis during pregnancy and absolute contraindications to laparoscopic cholecystectomy were excluded from the study. So, total 50 patients undergoing single incision laparoscopic cholecystectomy were enrolled for study.

Operational definition:

Single incision laparoscopic cholecystectomy was considered as difficult if any of the following 4 criteria was fulfilled during the surgery:

1. Time taken from skin incision to skin closure more than 60 minutes.
2. Time taken for adhesiolysis at Calot's triangle more than 20 minutes
3. Time taken for adhesiolysis of gall bladder at gall bladder fossa more than 20 minutes
4. Addition of ports (either one, two or three)

Surgical technique

Patient was placed supine on the table with the legs split apart. Both arms were placed at an angle less than 90° to the torso. Umbilicus was everted and an infra umbilical curved (smiling) incision 2.0 to 2.5 cm in length was given (Fig.1). This was deepened through fat and flaps were undermined to expose fascia. A Veress needle was inserted through this incision and 12 mm Hg pneumoperitoneum with CO₂ was induced and maintained. We used two ports one 5 mm port for camera and another 10 mm working port through which laparoscopic needle holder, Maryland forceps and extractor were introduced at the various steps of SILC



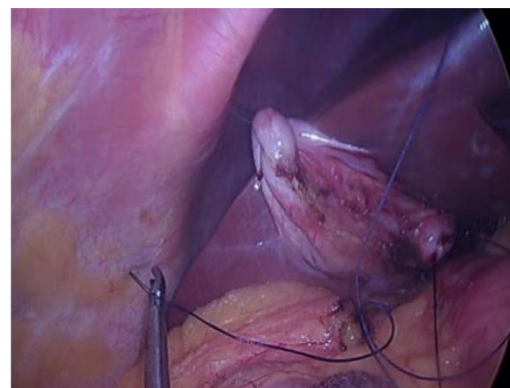
Figure 1: Suture taken through the fundus of GB Fig.4: suture taken through hartmann's pouch

procedure. The camera port was at the left margin (patient's) of 10 mm port (Fig.2)

Placement of traction sutures

This was the key step of our SILC technique. Needle was introduced through intercostal space above the costal margin which was introduced into peritoneal cavity with the help of laparoscopic needle holder. This needle was then taken through fundus of GB and then back to the same intercostal space. This traction suture helped in elevating GB fundus. Another traction suture was introduced at epigastrium just below xiphisternum. This suture was then passed through the Hartmann's pouch, and was brought out at subcostal parietal wall at anterior axillary line. This helped in lifting the Hartmann's area and helped in better dissection.

Dissection was started at posterior peritoneum to free the Hartmann's pouch and cystic duct. This was followed by further dissection of the anterior and posterior peritoneum overlying the Calot's triangle with the help of a right angled dissector. The cystic duct and cystic artery were skeletonized-the end point of this dissection was a "critical view". Cystic artery was identified, doubly clipped and divided. Similarly cystic duct was identified, doubly clipped and divided. Alternating medial and lateral rotation of the GB using ends of suture placed on Hartmann's pouch was done to dissect it from liver bed using a diathermy hook. Prior to final detachment of GB, meticulous haemostasis at liver bed was ensured and the subhepatic space was lavaged with saline (if required). GB was held by grasper at neck and extracted through umbilical 10 mm port. Careful closure of fascial incision was done to prevent port site hernia. The edges of fascial incision were grasped with Kelly's haemostat. Rectus sheath was closed with Vicryl no.1 suture. The fascia and the skin were infiltrated with local anaesthesia and the skin was closed using monocryl 3-0 subcuticular stitches.



Data were analyzed and statistically evaluated using SPSS software, version 25 (Chicago II, USA). Quantitative data was expressed in mean, standard deviation and difference between two comparable groups were tested by student's t-test (unpaired) while qualitative data were expressed in percentage. Statistical differences between the proportions were tested by chi square test or Fisher's exact test. Multiple logistic regression analysis was done to predict difficult single incision laparoscopic cholecystectomy for

all factors who were found significant in univariate analysis and odds ratio along with 95% CI was calculated. P value less than 0.05 was considered statistically significant.

Ethical Issues

All participants were explained about the purpose of the study. Confidentiality was assured to them along with

informed written consent. The study was approved by the Institutional Ethical Committee.

3. Results

Out of 50 patients 15 patients underwent difficult single incision laparoscopic cholecystectomy, while 35 patients had undergone easy single incision laparoscopic cholecystectomy. Out of 15 patients undergoing difficult

SILC, SILC was successfully completed through a single incision in 11 patients (73.33%), whereas additional ports were required in 4 patients (26.66%). Table 1 represents association of different demographic and clinical factors with difficult SILC. Among different clinical factors higher age, higher BMI, Multiple attacks of biliary colic acute cholecystitis in past and Palpable gall bladder were found to be significantly associated with difficult SILC.

Table 1: Clinical factors to predict difficult SILC

	Total (n=50)	Easy (n=35)	Difficult (n=15)	P value
	Mean±SD	Mean±SD	Mean±SD	
Age in years	37.40±10.65	32.89±7.30	47.93±9.86	<0.001
Height	163.58±7.48	162.94±6.88	165.07±8.80	0.52
BMI (kg/m ²)	22.43±3.34	21.25±2.25	25.20±3.89	<0.001
Gender				
Male	13 (26.0%)	8 (22.9%)	5 (33.3%)	0.49
Female	37 (74.0%)	27 (77.1%)	10 (66.7%)	
Multiple attacks of biliary colic acute cholecystitis in past				
No	33 (66.0%)	31 (86.6%)	2 (13.3%)	<0.001
Yes	17 (34.0%)	4 (13.4%)	13 (86.7%)	
Palpable gall bladder				
No	43 (86.0%)	35 (100.0%)	8 (53.3%)	<0.001
Yes	7 (14.0%)	0	7 (46.7%)	

After doing multivariate logistic regression analysis, age >50 years [OR: 1.21 (95% CI: 1.05-1.38)], BMI ≥25 kg/m² [OR: 1.31 (95% CI: 1.03-1.74)] and multiple attacks of acute cholecystitis in past [OR: 8.56 (95% CI: 1.78-77.86)] were found to be independent predictors for difficult cholecystectomy (Table 2).

Table 2: Multivariate analysis of preoperative factors that predict the difficult SILC

Factor	Odds ratio	95% CI	P value
Age >50 in years	1.21	1.05-1.38	<0.01
BMI ≥25 kg/m ²	1.31	1.03-1.74	0.04
Multiple attacks	8.56	1.78-77.86	0.011
Palpable gall bladder	1.23	0.78-1.56	0.76

4. Discussion

In the present study, SILC was completed with a single incision in 46 patients (92%), whereas at least one additional port was required in 4 patients (8%).

Several authors^[7, 12, 13] have reported that increasing age is a significant predictor of difficult single incision laparoscopic cholecystectomy. Elderly patients probably have longer history of gall bladder disease, with more episodes of acute attacks, with chronic cholecystitis causing fibrotic adhesions. Our study gave similar findings to Sato N et al^[7] and Araki K et al^[13]. Meillat H et al^[14] in 2015 reported that height >172 cm was one of the independent factors associated with additional trocar requirement and prolonged operative duration.20 Indeed, the distance between the umbilical trocar and the gallbladder increases with height. However in our study we did not find any significant association between increasing height and difficult SILC.

Obesity has been found to have a significant association with difficult single incision laparoscopic cholecystectomy as there is fat laden tissue in the calot's triangle which leads to difficult dissection. The creation of pneumoperitoneum is also a difficult task in overweight patients. There are several retrospective studies available

in the literature that have documented successfully treated morbidly overweight patients using a single-port technique but having BMI >35 kg/m² may not be candidate for SILC.^[15, 16] The reason for this opinion is that higher BMI is accepted as a significant risk factor for conversion to a multiport approach. The significant increase in conversion rates in obese patients reported in the literature^[17-19] was reproduced by our study. In our study BMI >25 kg/m² and <30 kg /m² was seen in 6 patients, out of which 4 (66.6%) were found to have difficult single incision laparoscopic cholecystectomy, hence, we found significant correlation between BMI and difficult single incision laparoscopic cholecystectomy (P <0.001).

In our study, 34 patients had multiple attacks of biliary colic or acute cholecystitis in past and out of these 13 patients (38.3%) had undergone difficult SILC which is similar to Nadoni R⁵⁶ et al study. Multiple attacks of acute cholecystitis or GSIP can lead to difficulty in identification of normal anatomy of gall bladder, which can lead to difficult cholecystectomy and may be a reason for conversion. Similar result has been concluded in other studies as well^{7, 57, 58, 59} for laparoscopic cholecystectomy. In our study there were 7 patients of symptomatic cholelithiasis with palpable gall bladder on clinical examination, these 7 patients (14%) had difficult SILC.

Our results were similar to study done by Randhawa et al.^[20] and Agrawal et al.^[21] for difficult laparoscopic cholecystectomy. The palpable gall bladder could be due to distended gall bladder, mucocele or empyema of gall bladder (due to stone impacted at neck of GB), thick walled gall bladder or due to adhesions between gall bladder and omentum and they are sometimes difficult to handle and may pose a problem in carrying out laparoscopic cholecystectomy.

5. Conclusion & Recommendations

It can be concluded from the study that age >50 years, BMI ≥ 25 kg and multiple attacks of acute cholecystitis in past were found to be independent predictors for difficult cholecystectomy. Hence, compounding effect of multiple predicting factors must be considered for high suspicion of difficult single incision laparoscopic cholecystectomy and an experienced team should be arranged to tackle the difficulties before planning surgery and patient should be counselled accordingly before surgery to avoid legal consequences.

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