Comparative Evaluation of C-reactive Protein and Total Leucocyte Count in Conventional Laparoscopic Cholecystectomy and Single Incision Laparoscopic Cholecystectomy

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Abstract- To study the role of and do the comparative evaluation of the levels of C-Reactive Protein and Total Leucocyte Count in patients of conventional laparoscopic cholecystectomy and Single incision laparoscopic cholecystectomy.

Method: The present prospective study included ultrasonographically proved 50 patients of symptomatic cholelithiasis and were posted for elective cholecystectomy. These patients were admitted in Surgical Wards of Indira Gandhi Medical College, Shimla .SILC were performed on 25 (50% of patients) and cLC were conducted in rest of 25 (50%) patients. The patients were selected randomly. Relevant history, clinical examination and investigations were recorded. The consent of all these patients was taken. All the patients were subjected to same general anesthesia, antibiotics, perioperative analgesics and intravenous fluids. SILC was done by infra umblical incision and cLC was done by three /four Trocar Technique.

Results: The age of patients included in the study ranged from 15 years to58 years with mean age of 39.45 years. The mean age was 30.80 years in the single incision laparoscopic cholecystectomy and 35.40 years in conventional laparoscopic cholecystectomy group respectively, which is statistically insignificant(p-value =0.095).In the present study 86% of the total patients were females, 14% were males. The BMI ranged from 18-30 Kg/m^2 with mean BMI of 21.44 Kg/m^2 . CRP on second post operative day of these patients ranged from 6.2 mg% to 120 mg%. In the SILC group, CRP mean was 61.98± 37.06 mg% in the cLC group, CRP mean was 65.08 ± 39.6 mg%. The p-value for CRP at second post operative day between SILC and cLC group was 0.781. The p-value for TLC on second post operative day between SILC and cLC was 0.29.

Conclusions: Single incision laparoscopic cholecystectomy appears to be as safe, effective and feasible technique and good alternative to conventional laparoscopic cholecystectomy with potential advantages of cosmesis. The cost associated with single incision laparoscopic cholecystectomy and conventional laparoscopic cholecystectomy procedures appear similar. Ultimately, the decision as to whether to perform single incision laparoscopic cholecystectomy or conventional laparoscopic cholecystectomy will be depended on the preferences of individual surgeons and patients.

Index Terms- Laproscopic cholecystectomy, single port, conventional cholecystectomy.

I. Introduction

Over the last 20 years, conventional laparoscopic cholecystectomy (cLC) as less invasive method, has replaced open cholecystectomy in the treatment of patients with symptomatic gallstone disease. In recent years, a search for even more minimally invasive approaches has led to innovative techniques of single incision laparoscopic surgery (SILS) and natural orifice transluminal endoscopic surgery (NOTES). While substantial drawbacks of NOTES technique including technical challenges and scarcity of instrumentation, have limited its adoption so far[1] the SILS has met more favorable acceptance in surgical community. Its feasibility and safety have been proved in a number of surgical procedures including cholecystectomy [2, 3].

Compared to conventional LC which is performed via three or four abdominal ports, the single incision laparoscopic cholecystectomy (SILC) is performed using only one infra umbilical entry into the abdominal cavity. The first SILS procedures were done with several ports placed next to each other through a single skin incision but with multiple fascial perforations [4, 5]. Recent development of multichannel port devices allows entry into the abdominal cavity through a single fascial incision. Diminishing the number of ports to only one seems attractive due to its potential to reduce wound related complications, to decrease postoperative pain and to improve cosmetic outcome.

Surgery, “controlled deliberate injury”, for purpose of therapy, induces a series of biochemical and hormonal responses in the body, that include alteration in the expression of acute phase reactants C–reactive protein (CRP) and total leucocyte count (TLC). In general, the magnitude of changes in CRP is apparently taken as proportional to the extent of overall surgical insult[7] .

Recent evidence indicates that trauma induced stress hormone responses are insufficient to explain the broad spectrum of post injury defects, particularly in relation to immune system. Stress of injury leads to production of cytokines and acute phase proteins, which initiates increase in the levels of “Stress” hormones, loss of muscle proteins, greater vascular permeability and changes in white blood cell count. Some of these responses are homeostatic defense mechanism but others such as catabolic state are thought to be deleterious. Magnitude of metabolic response to surgical trauma, is proportional to degree of injury

and reduction of excess trauma by "Laparoscopic Techniques" might therefore diminish the response.

Generation of acute-phase proteins is well recognized response to tissue injury. CRP is a key marker of acute phase protein and provides dependable screening test, for acute phase reactants[6]. Post operative rise in CRP and TLC have been reported by many researchers, whereas other workers have found no significant difference in CRP levels between conventional LC(cLC) and SILC[7].

Since the introduction of conventional laparoscopic cholecystectomy (cLC) and SILC in our institution,we have been seeing how easily and rapidly patients recover from surgery. An effort was made in the present study to comparatively evaluate the pattern and magnitude of metabolic response to injury by assessing role of CRP and TLC as stress markers in conventional laparoscopic cholecystectomy and SILC.

II. MATERIAL AND METHODS

The present prospective study included ultrasonographically proved 50 patients of symptomatic cholelithiasis and were posted for elective cholecystectomy. These patients were admitted in Surgical Wards of Indira Gandhi Medical College, Shimla .SILC were performed on 25 (50% of patients) and cLC were conducted in rest of 25 (50%) patients. The patients were selected randomly. Relevant history, clinical examination and investigations were recorded as per performa attached (annexure 1). The consent of all these patients were taken as per consent form (annexure 2). All the patients were subjected to same general anesthesia, antibiotics, perioperative analgesics and intravenous fluids. SILC was done by infra umblical incision and cLC was done by three /four Trocar Technique.

III. INCLUSION CRITERIA

All patients with ultrasonographically proved symptomatic cholelithiasis , fit for general anaesthesia were included in the study.

Patients having following conditions have been excluded from the study.

1. Acute Cholecystitis /Pancreatitis.
2. Choledocholithiasis
3. Jaundice / Hypoproteinemia/Malignancy
4. History of Allergy , Taking Steroids and Chemotherapy
5. Patients on Oral Contraceptive Pills/Pregnancy
6. Patients requiring peri-operative blood transfusion.
7. Conversion of cLC to OC.
8. Intra operative injury to adjacent organs/structures.
9. Patients developing peri-operative complications.

Serial measurements of TLC and CRP were done by sampling blood which was collected as mentioned below:-

1. Baseline Sample- Pre-operatively after overnight fasting.
2. At the time of completion of surgery with in 6 Hours.
3. 1st Post Operative day.
4. 2nd post operative day.

Data collected was analyzed statistically by using paired 't' test.

IV. C-REACTIVE PROTEIN ESTIMATION

3 ml of clotted blood sample was taken. The concentration of CRP was measured by NYCOCARD CRP SINGLE TEST KIT AND USING NYCOCARD READER II (AXIS– SHIELD, Norway).

MATERIAL

TD (Test Device) : Plastic device containing a membrane coated with monoclonal anti-CRP antibodies.

R-1 (Dilution Liquid) : (0.4 ml) Borate buffer (pH 9.0) and detergents.

R2 (conjugate) : (1 x 3.5 ml) Solution containing monoclonal anti-CRP antibodies with ultra small gold particles.

R3 (Working Solution) : (1 x 3.0 ml) Phosphate buffered NaCl solution (pH 7.4) and detergents

C+ (Control Positive) : (1 x 05 ml) Serum of human origin with added purified CRP

Capillary tubes : 5 ml end to end glass capillaries

Pipette (5 ml) and pipette tips
Capillary tube holder
Nycocard Reader II

Test Procedure

1. 5 µL capillary was filled with patient sample or C+ (Control Positive), and the capillary was dropped into the tube with R1(Dilution Liquid). The tube was closed and mixed well for 10 seconds.

2. 50 µL diluted sample or dilute C+ (Control Positive) was applied to the TD (Test Device). The sample was allowed to soak into the membrane (approx. 30 second).

3. One drop R/2 Conjugate was allowed to the TD (Test Device). The reagent was allowed to soak into the membrane (approx. 30 seconds).

4. R3 (Washing Solution) was allowed to the TD (Test Device). The reagent was allowed to soak into the membrane (approx. 20 second).

5. The result was read within 45 minutes using the NycoCard READER II following the READER II user instruction manual.

V. TOTAL LEUCOCYTE COUNT ESTIMATION

TLC was measured by AUTOMATED HEMATOLOGY CELL COUNTER (MELET SCHLOESING LABORATORIES OSNY-FRANCE)

- A collecting tube with anticoagulant EDTA K3 (violet or blue cap) was filled upto 2/3rd with the blood sample.
- Blood and anticoagulant were mixed thoroughly by inverting the tube 10 times .
- Appropriate bank was selected i.e. male adult /female adult/child .After selecting appropriate bank that particular bank was saved.
- The MS9 was ready to run the sample.

Following procedures were followed.

- Cap was taken off the tube
- The tube was placed in the holder by choosing the correct adaptor for the volume of the sample tube(red, blue, white or green)
- The analysis was started automatically by pressing << ALT>>C.
- The tube was taken out after the end of the analysis.
- The result was automatically displayed once the counting was done.

VI. CONVENTIONAL LAPAROSCOPIC CHOLECYSTECTOMY

First of all, the patient was asked to pass urine before entering operation theatre. With patient in supine position, general anesthesia was given. Cleaning and draping was done in the standard fashion. The patient was placed in reverse Trendelenberg position of 30 degree while rotating the table to left by 15 degree. This maneuver allowed the duodenum and colon to fall away from the liver edge.

The operating surgeon stood to the patient's left, the camera operator to the surgeon's left and the assistant on the patient's right. The video monitor was placed on the patient's right at the level of the shoulder, to give an unobstructed view for the surgeon and camera assistant.

The Veress needle was inserted through a stab incision in the infra-umbilical region, almost perpendicular to the abdominal wall with a slight angle towards the pelvis. Saline drop test was done for checking correct placement of Veress needle. (Saline drops were injected into peritoneal cavity. When no aspirate was returned, it checked the correct placement of Veress needle)

Pneumoperitoneum was created using this Veress needle through which CO_2 was insufflated into peritoneal cavity to a pressure of 13mm of Hg.10mm incision was made for 10mm trocar at the site of stab incision in the infra-umbilical region. The trocar was inserted towards the pelvis at an angle of about 80 degree to the anterior abdominal wall.

Laparoscope was introduced through the umbilical port and a complete examination of abdominal cavity was performed. The second trocar was placed under direct laparoscopic vision in the midline between the xiphoid and the umbilicus through a 10mm incision, ensuring that its entry into abdominal cavity was on the right side of the falciform ligament. Also the trocar was directed towards the gall bladder, so that there was no need to reposition it continuously throughout the procedure.

Two 5mm ports were placed, one in the subcostal region, in the midclavicular line for the atraumatic grasper for the left hand of the surgeon and another at the level of umbilicus along anterior axillary line for the assistant's rachet (with lock) grasper, by 5mm stab incisions.

With the laparoscope through the umbilical port, a rachet grasper was introduced through the lateral 5mm trocar to grasp the fundus of the gall bladder. The assistant applied traction upward and backward to establish optimal exposure.

Another atraumatic grasper was introduced through the midclavicular port. When the anatomy was evident, the grasper was used to catch Hartmann's pouch and apply the necessary traction.

Working with both hands , the surgeon took the grasper that holded Hartmann's pouch in his or her left hand and applied upward and lateral traction to identify the structures in the cholecystoduodenal ligament and the common bile duct.

A 5 or 10mm instrument, generally an atraumatic Maryland curved dissector was introduced through the subxiphoid port with the right hand and blunt dissection was started in the cholecystoduodenal ligament, which was simple when there was no intense acute or chronic inflammation. This dissection allowed identification of the cystic duct, bile duct and cystic artery.

Once the junctions of the cystic duct to the gallbladder and to the bile duct were identified and the right peritoneal attachment of the gallbladder dissected out, traction was applied to Hartmann's pouch to the right side of the patient and slightly upwards to enable dissection of the left peritoneal attachment. At this point care was taken to avoid injury to the small arteries that accompany the cystic lymph node located near the cystic artery bifurcation.

In case of haemorrhage, the Monopolar Electrocautry or harmonic scalpel was used.

Once all the structures were clearly identified then the cystic duct and artery were divided. To perform this, two staples were placed in the cystic duct, using clip applicator, one proximal to the main duct and the other as close as possible to the gallbladder to prevent spillage.

Two staples were placed distally and one proximally on the cystic artery and both structures were divided with metzenbaum scissors. To dissect and release the gallbladder from the rest of the hepatic bed, a hook or spatula connected to the monopolar Electrocautry device was used, with the irrigation and aspiration at the same time. Dissection was performed ensuring careful haemostasis while the graspers in the fundus and Hartman's pouch were used to give a good exposure.

Before removing the gallbladder completely, a careful examination of the hepatic bed was performed to verify haemostasis and the bleeding points were cauterized. Drains were left as a routine in most of the cases, introduced by most lateral 5mm port.

The gall bladder was extracted by subxiphoid port by claw forceps. All incisions of 10mm were sutured with vicryl (port closure 35mm) to avoid herniations and post operative complications.

VII. SINGLE INCISION LAPAROSCOPIC CHOLECYSTECTOMY

Equipment and Instruments:

We used conventional laparoscopic instruments and equipment for performing SILC. We used 5mm laparoscope for performing the procedure. A sharp image that allows clear distinction between tissue planes and tissue textures is essential for safe dissection.

Position of the patient, team and equipment:

The patient was positioned supine on the operating table with the legs split apart and strapped firmly to the leg boards. Both arms of the patient were placed on arm boards at an angle less than 90º to the torso. The surgeon stood on the left side of the patient, with the assistant opposite to him during the placement of the first port. For rest of the procedure, the surgeon stood between the legs and the camera person stood to his right (near the left leg of the patient). The monitor trolley was placed above the patient's right arm. The diathermy pedal was placed near the surgeon's left foot and all tubes and cables were fixed such that they do not interfere with the camera person.

Placement of ports:

We had given an infraumbilical curved incision. The umbilicus was everted and held with two-toothed forceps in a cephalic and caudal position prior to making an incision of length 2-2.5 cm. This was deepened through the fat and the flaps were undermined to expose the fascia over a distance of 2-2.5 cm. The left edge of the skin incision was retracted and a fascial stab incision was made. A Veress needle was introduced through this incision and after confirmation of its intraperitoneal position; CO_2 pneumoperitoneum was induced and maintained at 12 mm Hg. In the initial cases a 10 mm port was inserted at the incision line and the two five mm ports were placed 0.5 cm inferiorly and laterally on either side through the same skin incision. A grasper introduced through the right lateral port was used for fundal traction. The dissector introduced through the left lateral port was used to dissect the fine Calot's triangle. The instrument port and the telescope port were crossed by a chopstick method to avoid "sword fighting'' and clashing of instruments in the abdomen. At this stage, the patient's position was changed to an anti-Trendelenberg one with a left-sided tilt which helped in the better exposure of the Calot's triangle. Later we used only two ports one five mm port for five mm camera and another was ten mm working port through which laparoscope, needle holder, grasper and extractor were introduced at the various steps of SILC procedure.

Placement of traction sutures :

This was the key step of the SILC i.e. "puppeteer"[8] technique, in which traction sutures were used to hold gall bladder. At the beginning of the procedure, a grasper or a dissector was used to move the omentum away from the right upper quadrant so as to obtain a view of the fundus of the gallbladder. Flimsy omental adhesions, if present, were teased off at this stage. We used a strand of 1-0 vicryl on a 60-mm straight needle for placing the traction sutures. The needle was introduced laterally through one of the intercostal spaces above the level of the costal margin on right side. A laparoscopic needle holder brought the needle into the peritoneal cavity and placed it on the omentum. The needle was then regrasped at its midpoint, a bite of the fundus of the gallbladder was taken and the needle was driven out through the same intercostal space. The needle was retrieved using an open needle holder and the suture was pulled out leaving two ends of 5-6 cm. The suture was divided and a haemostat was applied to both ends close to the skin, resulting in elevation of the gallbladder fundus. Another traction suture was taken in which the needle was introduced from the epigastric region just below the xiphi sternum .This needle was passed through the Hartmann's pouch with the help of needle holder and then taken out from lateral abdominal wall. Both ends were held with hemostats. This helped in lifting the Hartmann's area and helped in better dissection.

Dissection of the Calot's triangle:

The posterior peritoneum was divided to free the Hartmann's pouch. This was followed by further dissection of the anterior and posterior peritoneal leaves overlying the Calot's triangle with the help of a hook and/or a Maryland dissector. The cystic artery and the cystic duct were skeletonised - the endpoint of this dissection was obtaining a "critical view".

Control of the cystic artery:

The two windows in the Calot's triangle were dissected more widely than during an conventional LC so as to safely observe the tips of the instruments controlling the artery and the duct. We had clipped the cystic artery with a 10-mm reusable clip applicator. Subsequently, the cystic artery was divided.

Control of the cystic duct:

If the cystic duct appeared narrow, it was clipped thrice with 10-mm clips and divided. If the duct appeared wide, we preferred to pass a No. 1 polyglactin suture around it, exteriorize the same and fashioned an extracorporeal Meltzer's knot. This knot was then snugged down onto the cystic duct with the help of a metal knot-pusher. The duct was divided between two extra corporeally tied ligatures. If there was a suspicion of an impacted stone in the cystic duct, it was controlled on the gallbladder side, divided partially to allow the stone to be milked out, and then the stump was ligated using extracorporeal knotting. A 10-mm port was used for introducing a spoon forceps for the retrieval of stones from cystic duct or those that may spill from the gallbladder if it was perforated during dissection. The divided ends of the cystic artery and duct were carefully inspected to confirm their secure closure.

Dissection of the gallbladder:

Alternating medial and lateral rotation of the gallbladder using the ends of the suture placed on Hartmann's pouch was done to dissect the gallbladder from the liver bed using a diathermy hook. Prior to the final detachment of the gallbladder,

meticulous haemostasis in the liver bed was ensured and the subhepatic space lavaged with saline. The fundal traction suture was loosened and the gallbladder was freed from the liver.

Specimen extraction:

Gall bladder was then held at neck with the grasper and extracted through the umbilical 10 mm port.

Closure of the incision:

Careful closure of the fascial incision was done to prevent formation of port-site hernia. The edges of the fascial incision were identified, grasped and elevated using fine Kocher's forceps. We closed the rectus sheath using vicryl no.1 suture. The fascia and the skin were infiltrated with a local anaesthetic and the skin was closed using sutures.

Postoperative course:

The postoperative care was identical to that of patients undergoing standard laparoscopic cholecystectomy. Intravenous analgesics and anti-emetics were administered for the duration of hospital stay. Patients were allowed to ambulate and take liquids after 6-8 hours of surgery. Findings were recorded as per Performa attached

VIII. RESULTS

The present study was conducted in the Department of Surgery, IGMC, Shimla over a period of 1 year from 1st July, 2012 to 30th June, 2013 on 50 patients who were admitted for elective cholecystectomy. These patients were alternatively divided into two groups of 25 patients each. Group 'A' included patients in whom SILC was done and Group 'B' included patients who underwent cLC. Detailed history was taken, thorough clinical examination was done and appropriate investigations were carried out in each case which were recorded in the Performa attached. The following observations were made:

1:- AGE DISTRIBUTION IN SINGLE INCISION AND CONVENTIONAL LAPAROSCOPIC CHOLECYSTECTOMY GROUP:-

The age of patients in the present study ranged from 15 to 58 years. In SILC group, the age ranged from 15 to 58 years and the mean age was 30.88±9.248 (standard deviation) years, whereas in cLC group, the age ranged from 15 to 54 years and the mean age was 35.20±9.923 (standard deviation) years. Patients were grouped as : below 30 years,30-45 years and more than 45 years .Majority of patients were in between 30-45 years and were 56% and 68% in SILC and cLC groups respectively . The youngest patient in SILC group was 15years of age, whereas in cLC group, youngest patient was of 16 years (see master charts). The p value for age of patients between SILC and cLC groups was 0.095 . (Table 1a,1b) .

Table no 1a :- GROUP STATISTICS (AGE)

	Group	N	Mean	Std. Deviation	Std. Error Mean
Age	SILC	25	30.88	9.248	0.850
	cLC	25	35.32	9.923	0.980

Table no 1b :- Age Distribution

Age (years)	SILC		Clc	
	No. of patients (n=25)	%age	No. of patients (n=25)	%age
<30	10	40	5	20
30-45	14	56	17	68
>45	1	4	3	12

pvalue= .095, (p >0.05 - insignificant).

2:- SEX DISTRIBUTION:-

Out of 50 patients, 43 patients (86%) were female and 7 patients (14%) were male. In the SILC group 24 patients (96%) were female and only 1 patient (4%) was male, whereas in the cLC 19 patients (76%) were females and 6 patients (24%) were males. (Table 2)

Table no 2 :- Sex Distribution

p value= 1.00 (p >0.05- insignificant)

Sex	SILC		Clc	
	(n=25)	%age	(n=25)	%age
Male	1	4	6	24
Female	24	96	19	76

3:-BASAL METABOLIC INDEX (BMI) :-

The BMI ranged from 18 to 3O kg/m^2 with mean BMI of 21.08 whereas it was 21.04 and 21.88 in the SILC and cLC groups respectively. The p value is0.20 which is statistically insignificant. (Table 3)

Table no 3 :- BASAL METABOLIC INDEX (BMI) :-

BMI(Kg/M^2)	SILC		c LC	
	No. of patients (n=25)	%age	No. of patients (n=25)	%age
18-20	16	64	2	8
21-23	9	36	15	60
24-26	0	0	6	24
27-29	0	0	1	4
30-32	0	0	1	4
MEAN	21.04		21.88	

p value= .20 (p >0.05- insignificant)

4:- COMPARISON OF DURATION OF SURGERY (DOS):-

Only one (4%) patient of SILC group was operated during the time interval of 20-39 minutes while in cLC group 13(52%) were operated during the similar time interval. During 40-59 minutes of time interval 16(64%) patients in SILC group had undergone surgery while in cLC group 12(48%) patients were

operated in this time interval. In 60-79 minutes of time duration 8 (32%) of the patients were operated in SILC group while the entire patient in cLC group had been operated before this time interval. The mean time for the duration of surgery was 53.32 min in SILC group and in cLC group mean operating time was 39.40min, with p value 0.001 ,showing that the operating time in the SILC group was significantly high as compared to the cLC group. (table 4)

Table 4:- COMPARISON OF DURATION OF SURGERY (DOS):-

Time (in minutes)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
20-39	1	4	13	52
40-59	16	64	12	48
60-79	8	32	0	0
MEAN	53.32		35.20	

p value= <.001 (p <0.05- significant).

5:- COMPARASION OF TLC (BASE LINE)

The pre operative TLC of these patients ranged from 4.78 m/mm^3 to 9.56 m/mm^3. In the SILC group, pre operative TLC ranged from 4.10 m/mm^3 to 8.80 m/mm^3 and the mean was 6.286±1.147 m/mm^3(standard deviation) . In the cLC group, pre operative TLC ranged from 4.38 m/mm^3 to 9.36 m/mm^3 and the mean was 6.654±1.569 m/mm^3(standard deviation). The p value for pre operative TLC between OC and LC groups was 0.349. (Tables 5)

Table 5:- COMPARASION OF TLC (BASE LINE)

TLC (in m/mm)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
4.00-7.90	24	96	19	76
8.00-11.00	1	4	6	24
>11.00	0	0	0	0
MEAN	6.286		6.654	

p value= 0.349, which is insignificant.

6 :- COMPARASION OF TLC (WITH IN 6 HOURS

TLC with in 6 hours ranged from 4.2 m/mm^3 to 11.63 m/mm^3 . In the SILC group, mean was 7.106±2.361 m/mm^3(standard deviation). In the cLC group, TLC ranged from 2.2 m/mm^3 to 12.00 m/mm^3 and the mean was 9.991±14.547 m/mm^3(standard deviation) .The p value for TLC between SILC and cLC groups was 0.333. (Table 6).

Table 6 :- COMPARASION OF TLC (WITH IN 6 HOURS)

TLC (in m/mm)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
4.00-7.90	19	76	19	76
8.00-11.00	4	16	5	20
>11.00	2	8	1	4
MEAN	7.106		9.991	

p value =0.333 ,which is insignificant.

7 :- COMPARASION OF TLC (WITH IN 24 HOURS)

TLC on 1st post operative day (24 hours after surgery) of these patients ranged from 4.4 m/mm^3 to 12.2 m/mm^3. In the SILC group, mean was 7.554±3.196 m/mm^3(standard deviation) .In the cLC group, the mean was 7.122±2.351 m/mm^3(standard deviation) .

Number of patients were 25 in each group .Majority of patients had TLC between 4.00 -7.90m/mm^3 .i.e. 56 % and 64% in SILC and cLC group respectively .The p value for TLC on 1st post operative day between SILC and cLC groups was 0.589.(Table 7).

Table 7 :- COMPARASION OF TLC (WITH IN 24 HOURS)

TLC (in m/mm)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
4.00-7.90	15	56	16	64
8.00-11.00	9	36	8	32
>11.00	2	8	1	4
MEAN	7.554		7.122	

p value = 0.589 ,which is insignificant.

8 :- COMPARASION OF TLC (WITH IN 48 HOURS)

TLC on 2nd post operative day (48 hours after surgery) of these patients ranged from 4.3 m/mm^3 to 12.8 m/mm^3 . In the SILC group, mean was 8.923±2.165 m/mm^3(standard deviation). In the cLC group, mean was 7.339±2.776 m/mm^3 (standard deviation). Number of patients were 25 in each group .Majority of patients had TLC between 4.00 -7.90m/mm^3 .i.e. 52 % in cLC group. In SILC group,majority of patients had TLC between 8.00 -11.00m/mm^3 .i.e. 52 %.The p value for TLC on 2nd post operative day between SILC and cLC groups was 0.029. (Table 8).

Table 8 :- COMPARASION OF TLC (WITH IN 48 HOURS)

TLC (in m/mm)^3	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
4.00-7.90	8	32	13	52
8.00-11.00	13	52	11	44
>11.00	4	16	1	4
MEAN	8.923		7.339	

p value= 0.029, which is insignificant.

9 :-COMPARASION OF CRP (BASELINE)

The pre operative CRP of these patients ranged from 2 mg% to 5 mg%. In the SILC group, pre operative CRP was < 5 mg% . In the cLC group, pre operative CRP was also < 5 mg% .The p value for pre operative CRP between SILC and cLC groups was insignificant.

Table 9 :-COMPARASION OF CRP (BASELINE)

CRP (in mg/dl)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
<5	25	100	25	100
6- 10	0	0	0	0
>10	0	0	0	0

p value in 1.00 , insignificant.

10 :- COMPARASION OF CRP (WITH IN 6 HOURS)

CRP with in 6 hours ranged from 5 mg% to 48 mg% .In the SILC group, CRP mean was 22.98±17.55 mg%(standard deviation). In the cLC group, CRP mean was 20.58±22.6 mg%(standard deviation). Number of patients were 25 in each group .Majority of patients had CRP value below 5 mg% i.e. 80 % and 60% in SILC and cLC group respectively. The p value for CRP between SILC and cLC groups was 0.854. (Table 10) .

Table 10 :- COMPARASION OF CRP (WITH IN 6 HOURS)

CRP (in mg/dl)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
<5	20	80	15	60
6- 10	01	4	2	8
11- 20	03	12	2	8
>20	01	4	6	24
MEAN	22.98		20.58	

p value =0.854, which is insignificant.

11 :- COMPARASION OF CRP (WITH IN 24 HOURS)

CRP on 1st post operative day (24 hours after surgery) of these patients ranged from 5 mg% to 120 mg% . In the SILC group, CRP mean was 47.10±33.28 mg% (standard deviation). In the cLC group, CRP mean was 45.40±28.54 mg%(standard deviation). Number of patients were 25 in each group .Majority of patients had CRP value more than 20 mg% i.e. 60 % and 76% in SILC and cLC group respectively. The p value for CRP at 1st post operative day (24 hours after surgery) between SILC and cLC groups was 0.854. (Table 11).

Table 11 :- COMPARASION OF CRP (WITH IN 24 HOURS)

CRP (in mg/dl)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
<5	3	12	2	8
6- 10	2	8	0	0
11- 20	5	20	4	16
>20	15	60	19	76
MEAN	47.10		45.40	

p value =0.854 ,which is insignificant.

12 :- COMPARASION OF CRP (WITH IN 48 HOURS)

CRP on 2nd post operative day (48 hours after surgery) of these patients ranged from 6.2 mg% to 120 mg% . In the SILC group, CRP mean was 61.98±37.06 mg%. In the cLC group, CRP mean was 65.08±39.6 mg%. Number of patients were 25 in each group .Majority of patients had CRP value more than 20 mg% in each group i.e. 80 % in both SILC and cLC group. The p value for CRP at 2nd post operative day between SILC and cLC groups was 0.781 .(Table 12).

Table 12 :- COMPARASION OF CRP (WITH IN 48 HOURS)

CRP (in mg/dl)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
<5	1	4	1	4
6- 10	1	4	2	8
11- 20	3	12	2	8
>20	20	80	20	80
MEAN	61.98		65.08	

p value = 0.781, which is insignificant.

IX. DISCUSSION

Laparoscopic cholecystectomy (three or four trocars) is known to be a gold standard for cholecystectomy [9,10]. As a result of development of new surgical technique and highly sophisticated technologies, surgical approach to gallbladder has tendency to become less invasive by reducing number and size of operative ports and instruments [9,11,12]; with intention of less postoperative pain, shorter hospitalization time and better cosmetic results. Single-incision laparoscopic (SILC) cholecystecomy is a step toward these objectives, because it cannot be overstated that every incision and trocar placement poses a risk of bleeding, organ damage and incisional hernia. [12,13.]

CRP and TLC are well known systemic stress factors. In order to understand more about the impact of stress factors like C- reactive protein and total leucocyte count during the surgery and after the surgery, study was conducted in IGMC,shimla. In this study 25 patients who underwent cLC were compared with 25 patients who underwent SILC. The patients in reference to variables such as age, height, weight or BMI were similar in the two different groups of cLC and SILC .

The aim of this study was to compare single incision laparoscopic cholecystectomy with 4 port laparoscopic cholecystectomy in terms of preoperative and post operative CRP and TLC at different time intervals and to look for any significant difference between these two groups.

1. **AGE DISTRIBUTION IN SINGLE INCISION AND 4PORT LAPAROSCOPIC CHOLECYSTECTOMY GROUP:-**

The age of patients included in the study ranged from 15 years to 58 years. The mean age was 30.8 years in the SILC and 35.40 years in cLC group respectively,which is statistically insignificant(p value=.095).

Rasic Zaraco et al 2010[14], in his study conducted to compare SILC and cLC also has shown no significant age differerence.

2. SEX DISTRIBUTION:-

In the present study 86% of the total patients were females and 14 % were males (Table 2, Figure 2). There was 1 male (4%) and 24 females (96%) in the SILC and 6 males (24%) and 19 females (76%) in the cLC group. The study of H. Rivas et al[60] in which 80 women (85%) and 15 men (15%) were included in SILC group and female to male ratio was 16:3.

The study conducted by Roland Raakow et al[15] had included 142 women (65%) and 78 (35%) men. Of all the above cited studies it has been supported the fact that gall stones are more common in females.

3. **BASAL METABOLIC INDEX (BMI):-**

The BMI ranged from 18 to 3O kg/m^2 . Mean was 21.04 in the SILC and 21.88 in the cLC group respectively. The p value was >0.206 which was statistically insignificant. (table3).

The BMI in the study of Asakuma et al[16] was 22+-2kg/m^2 in both SILC and 4 port LC group.

Study conducted by Dragon schwartz et al[17] , in 2010 have shown no significant difference in BMI in SILC and cLC.

4. COMPARISON OF DURATION OF SURGERY (DOS):-

Only 1 (4%) patient of SILC group was operated during the time interval of 20-39 min while in 4port LC group 13 (52%) were operated during the similar time interval. During 40-59 min of time interval 16(64%) patients in SILC group had undergone surgery while in 4port LC group 12(48%) patients were operated in this time interval. In 60-79 min of time duration 8(32%) of the patients were operated in SILC group while all the patient in 4port LC group had been operated before this time interval. The mean time for the duration of surgery was 53.32min in SILC group and in 4port LC group mean operating time was 39.40min, showing that the mean operating time in the SILC group was significantly high as compare to the 4port LC group. P value= <.oo1 (p <0.05- significant).

The study conducted by Evangelos C. Tsimoyiannis et al[18] had found Mean operative time 37.3 ± 9.16 min in 4 port LC and 49.65 ± 9.02min in SILC. Thus, the results of the present study are similar to that reported above in the manner that total duration of surgery in SILC group is more than that in the cLC group.

Zaraco et al 2010[14], in his study conducted to compare SILC and cLC also has shown no significant differerence in terms of duration of surgery .It was 46 min in SILC and 43 min in cLC

5. PRE OPERATIVE TLC

The mean pre operative TLC in the SILC group, the mean was 6.286±1.147 m/mm^3 whereas in the cLC group, the mean pre operative TLC was 6.654±1.569 m/mm^3. The result was comparable in both the groups (p = 0.395). which is insignificant

Wright VJ et al[19] also compared systemic stress response in the form of TLC pre and post operatively and found no significant difference between SILC and cLC.

6. TLC WITH IN 6 HOURS:-

TLC with in 6 hours ranged from 4.2 m/mm^3 to 11.63 m/mm^3. In the SILC group, mean was 7.106±2.361 m/mm^3. In the cLC group, TLC ranged from 2.2 m/mm^3 to 12.00 m/mm^3 and the mean was 9.991±14.54 m/mm^3. The p value for TLC between SILC and cLC groups was 0.333. (Table 6).

Darzi et al 2011[20] also compared systemic stress response in the form of TLC pre and post operatively and found no significant difference between SILC and cLC.

7.COMPARASION OF TLC (WITH IN 24 HOURS)

TLC on 1st post operative day (24 hours after surgery) of these patients ranged from 4.4 m/mm^3 to 12.2 m/mm^3. In the SILC group, mean was 7.554±3.196 m/mm^3. In the cLC group, the mean was 7.122±2.351 m/mm^3. The p value for TLC on 1st post operative day between SILC and cLC groups was 0.589. (Table 7).

As shown by p value there is no significant difference between both groups.

8. COMPARASION OF TLC (WITH IN 48 HOURS)

TLC on 2nd post operative day (48 hours after surgery) of these patients ranged from 4.3 m/mm^3 to 12.8 m/mm^3. In the SILC group, mean was 8.923±2.165 m/mm^3. In the cLC group, mean was 7.339±2.776 m/mm^3. The p value for TLC on 2nd post operative day between SILC and cLC groups was 0.029. (Table 8).

pvalue= 0.290, which is insignificant.

Same finding was supported by McGregor et al ,2011 in his study[7].

9 .COMPARASION OF CRP (BASELINE)

The pre operative CRP of these patients ranged from 2 mg% to 5 mg%. In the SILC group, pre operative CRP was ,< 5 mg% . In the cLC group, pre operative CRP was also < 5 mg% . As all values were < 5 mg% , so p value for pre operative CRP between SILC and cLC groups was insignificant.

10. COMPARASION OF CRP (WITH IN 6 HOURS)

CRP with in 6 hours ranged from 5 mg% to 48 mg% .In the SILC group, CRP mean was 22.9±17.55 mg%. In the cLC group, CRP mean was 20.58±22.6 mg%. The p value for CRP between SILC and cLC groups was 0.854. (Table 10) .

McGregor et al 2011[7], measured CRP,TLC and IL-6 after gall bladder removal in both groups i.e. SILC and cLC and found no significant difference in both these groups.

11. COMPARASION OF CRP (WITH IN 24 HOURS)

CRP on 1st post operative day (24 hours after surgery) of these patients ranged from 5 mg% to 120 mg% . In the SILC group, CRP mean was 47.10±33.23 mg%. In the cLC group, CRP mean was 45.40±28.54 mg%. The p value for CRP at 1st post operative day (24 hours after surgery) between SILC and cLC groups was 0.854. (Table 11).

Froghi et al (2011)[21] reported that serum IL-6, TNF-α, CRP and TLC levels were not significantly different in the SILC and 4PLC groups at baseline and at six , 24 hours and 48 hours after surgery (p>0.05 for all).

12 . COMPARASION OF CRP (WITH IN 48 HOURS)

CRP on 2nd post operative day (48 hours after surgery) of these patients ranged from 6.2 mg% to 120 mg% . In the SILC group, CRP mean was 61.98±37.06 mg%. In the cLC group, CRP mean was 65.08±39.6 mg%. The p value for CRP at 2nd post operative day between SILC and cLC groups was 0.781 .(Table 12).

Two studies compared the surgical stress response in SILC and 4PLC patients by measuring biochemical stress markers including IL-6, TNF-α, CRP and TLC, six and 24 hours after surgery (Froghi et al 2011; McGregor et al 2011). Froghi et al (2011) reported that serum IL-6, TNF-α, CRP and TLC levels were not significantly different in the SILC and 4PLC groups at baseline and at six and 24 hours after surgery[21] .

Similarly, McGregor et al (2011)[7] reported that serum IL-6 and CRP levels were not significantly different in the SILC and 4PLC groups at baseline and at 6 ,24 and 48 hours after surgery (p>0.05 for all).

X. SUMMARY

The present study was carried out in the Department of Surgery, IGMC, Shimla over a period of 12 months from 1st July 2012 to 30th June 2013 on 50 patients who were admitted with

clinical diagnosis of symptomatic cholelithiasis. The following observations were made:-

1):- The age of patients included in the study ranged from 15 years to 58 years with mean age of 39.45years . The mean age was 30.8 years in the SILC and 35.40 years in cLC group respectively,which is statistically insignificant(p value=.095).

2):- In the present study 86% of the total patients were females and 14 % were males. There was 1 male (4%) and 24 females (96%) in the SILC and 6 males (24%) and 19 females (76%) in the cLC group. The data shows that cholelithiasis is more common among females.

3):- The BMI ranged from 18 to 3O kg/m^2 with mean BMI of 21.44 It was 21.04 in the SILC and 21.88 in the cLC group respectively. The p value is >0.206 which is statistically insignificant.

4):- The total duration of surgery was more in the SILC group as compared to cLC group .The mean time for the duration of surgery was 53.40min in SILC group and in 4port LC group mean operating time was 39.80min, showing that the mean operating time in the SILC group was significantly high as compared to the 4port LC group. P value= <.oo1 (p <0.05-significant).

5):- As expected, the preoperative levels of the TLC and CRP were comparable in the two groups.

6.):- Mean of TLC with in 6 hours ,in SILC group was 7.106±2.361 m/mm^3 whereas in the cLC group, mean was 9.991±14.54 m/mm^3. The p value for TLC between SILC and cLC groups was 0.333.

7):- TLC on 1st post operative day (24 hours after surgery) of these patients ranged from 4.4 m/mm^3 to 12.2 m/mm^3. In the SILC group, mean was 7.554±3.196 m/mm^3. In the cLC group, the mean was 7.122±2.351 m/mm^3. The p value for TLC on 1st post operative day between SILC and cLC groups was 0.589. As shown by p value there is no significant difference between both groups.

8):- TLC on 2nd post operative day (48 hours after surgery) of these patients ranged from 4.3 m/mm^3 to 12.8 m/mm^3. In the SILC group, mean was 8.923±2.165 m/mm^3. In the cLC group, mean was 7.339±2.776 m/mm^3. The p value for TLC on 2nd post operative day between SILC and cLC groups was 0.029.

9) :- The pre operative CRP in both groups were <5 mg% , so p value for pre operative CRP between SILC and cLC groups was insignificant.

10):- CRP with in 6 hours ranged from 5 mg% to 48 mg% .In the SILC group, CRP mean was 22.9±17.55 mg%. In the cLC group, CRP mean was 20.58±22.6 mg%. The p value for CRP between SILC and cLC groups was 0.854.

11):- CRP on 1st post operative day (24 hours after surgery) of these patients ranged from 5 mg% to 120 mg% . In the SILC group, CRP mean was 47.19±33.28 mg%. In the cLC group, CRP mean was 45.40±28.54 mg%. The p value for CRP at 1st post operative day (24 hours after surgery) between SILC and cLC groups was 0.854.

12):- CRP on 2nd post operative day (48 hours after surgery) of these patients ranged from 6.2 mg% to 120 mg% . In the SILC group, CRP mean was 61.98±37.06 mg%. In the cLC group, CRP mean was 65.08±39.6 mg%. The p value for CRP at 2nd post operative day between SILC and cLC groups was 0.781.

XI. CONCLUSION

Recent developments in laparoscopic surgery have led to single incision laparoscopic surgery technique, in which instead of several ports placed throughout the abdomen only one entry site into the abdominal cavity is used. Moreover, with fewer abdominal incisions it seems justified to expect reduced wound related complications and less postoperative pain as well as better patient satisfaction with cosmetic outcome.

In this study 50 patients were taken and they had all variables similar i.e age, BMI as shown in the study.

As SILC is comparatively newer technique in the world of minimal asses surgery and it has its learning curve , so SILC took longer operative time than the cLC . We can say that as the experience increases with the SILC procedure the operative time will decrease .

Moreover,in this study, SILC was done with conventional instruments which are used for cLC.

In this study,no significant statistical difference were found in systemic stress factors i.e. CRP and TLC pre and post operatively in either of groups (SILC and cLC).

Hence based on the comparative evidence presented in this study, SILC appears to be as safe , effective and feasible technique and good alternative to cLC with potential advantages of cosmesis. The costs associated with SILC and cLC procedures appear similar. Ultimately, the decision as to whether to perform SILC or traditional/conventional LC will be dependent on the preferences of individual surgeons and patients.

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