THREE-PORT VERSUS FOUR-PORT LAPAROSCOPIC CHOLECYSTECTOMY A TWO YEARS EXPERIENCE AT TWO ARMED FORCES TERTIARY CARE HOSPITALS

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ABSTRACT

Objective: To compare the outcomes of three-port versus four-port laparoscopic cholecystectomy (LC) and assess the safety and efficacy of three-port LC as routine procedure.

Study Design: Retrospective comparative study.

Place and Duration of Study: Combined Military Hospital Kohat/CMH Multan, from Oct 2013 to Dec 2016.

Methodology: Total of 403 patients were selected and were divided into two groups based on the principles of non-randomized clinical trial; group A having three-port laparoscopic cholecystectomy (LC) and group B having four-port laparoscopic cholecystectomy (LC). Fourth port in right axillary line at umbilicus level was not established in group A. Outcomes were recorded in terms of operating time, complications, pain assessment/ analgesic requirement and hospital stay.

Results: A total of 218 (54.09%) patients in group A and 185 (45.91%) patients in group B were assessed. The difference in terms of verbal pain score, analgesic requirement and duration of hospital stay/return to activity were significant statistically, all being less in group A. Cosmetic outcome as perceived by patients was also better in the group A because of less numbers of scars. Operative time (minutes) was less in group A in our study (35.59 ± 10.75) as compared to group B (50.17 ± 10.14). Results of other variables including intra-operative/post-operative complications were comparable among the two groups.

Conclusion: Three-port LC has advantages of being less painful, with less analgesics requirement and reduced hospital stay without compromising the safety and efficacy. It is more acceptable to patients due to less numbers of scars and better cosmesis.

Keywords: Four-port laparoscopic cholecystectomy, Laparoscopic cholecystectomy, Three-port laparoscopic cholecystectomy.

INTRODUCTION

Kelling made a landmark history of surgery by visualizing the peritoneum of a live dog with the help of cystoscope in a live demonstration during 1901[1]. Progress in this field was slow and ultimately first successful laparoscopic cholecystectomy (LC) was performed by Mouret in 1987 which was followed by Dubois and Perrisat in 1990[2,3]. LC is now the standard procedure for symptomatic gall stone disease[4]. Standard LC is performed through conventional four ports[5], the fourth port is used for either retracting the liver for better exposure of Calot's triangle (French Technique) or to hold fundus of gall bladder and retracting it to upwards and outwards for better view of Calot's Triangle (American Technique)[6].

Many trials have been published in national and international literatures where this minimal invasive procedure has been made more minimal by reducing the number and size of ports and the results are quite encouraging. These studies have reported three ports (even two ports) and newer technique of needlescopic cholecystectomy with the help of ultra thin scopes to be technically feasible, safe and comparable[7,8,9]. We sought to investigate the technical feasibility, safety, and comparison of three-port laparoscopic cholecystectomy versus standard four-port laparoscopic cholecystectomy in our setup. Technical feasibility was defined as performance of the LC without much difficulty by using the three-port

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technique. Safety was assessed by comparing the complications between two groups.

Benefits were measured by various parameters like operative time, complications, assessment of post-operative pain score, requirement of analgesia, duration of hospital stay, return to activity and cosmetic satisfaction after surgery.

METHODOLOGY

It was a retrospective comparative study. Total of 403 patients, with symptomatic gall stone disease, were selected by non-probability convenience sampling technique with their sample size calculated by online sample size calculator. They were reviewed by consulting the operating theatre/surgical wards and ITC (Intensive Therapy Centre) entry registers of Combined Military Hospital (CMH) Kohat and Combined Military Hospital (CMH) Multan during the period from 1st October 2013 to 31st December 2016.

CMH Kohat is a 400 bedded Hospital with 20 bedded surgical ITC and CMH Multan, 600 bedded Tertiary Care Hospital with 28 bedded surgical ITC. Pre-operative workup of elective cases was done in OPD whereas emer-gency cases were investigated as indoor. Workup included detailed history, physical examination and investigations including blood CP, urine RE, liver function tests, viral markers, coagulation profile and ultra sound examination. Other investigations done were pertinent to the requirement as per comorbids; patients having multiple co-morbid diseases were investigated and excluded, later on, from the study only if fell in category of high risk/ASA-IV.

Age limit for inclusion criteria was between 25 to 65 years. Elective cases had pre-operative workup in OPD. Emergency cases with symptoms of less than 48 hours duration were included. Pre-operative workup for emergency cases was done as indoor.

Patients having ASA-IV, viral marker positive for hepatitis B, C and HIV, common bile duct stones, gall stone pancreatitis, previous abdominal surgery were excluded. Patients with coagulopathy, cirrhosis/portal hypertension, peritonitis and suspected malignancy were also excluded from study.

Patients were divided into two groups by their days of admission with that consultant based on the principles of non-randomized clinical trial. Group A: three-port LC done in 218 patients. Group B: four-port LC done in 185 patients.

Informed written consent was taken; further explaining to group A patients that it was not routine conventional method and there is possibility of this procedure to be converted to four-port/open procedure. All relevant facts were approved by Institutional Review Board and Ethical Committee (IRB & EC) of CMH Kohat and CMH Multan.

All patients were operated upon under general anaesthesia. In both groups, one 11mm olympus tri-star reuseable trocar/cannula was inserted infra-umbilically as camera port for zero degree olympus telescope. Pneumoperitoneum was created by using either open/Hassan's Technique or closed/Verres Needle insertion. Second 11 mm sub-xyphoid (main working port) and third port (6mm) in mid-claviculur line 3-5 cm below costal margin were established. In group B, fourth port (6mm) in anterior axillary line at umbilicus level was established.

Surgeon stood on the left side of the patient with LED Monitor in front of him and assistant standing on left side of surgeon as camera holder. Maryland forceps (olympus) were introduced through sub-xyphoid port with right hand and left hand was used to handle/maneuver the gall bladder holding it from Hartmann's pouch with 5mm forceps. In group B another assistant standing on right side of patient was holding the fundus of gall bladder and retracting gall bladder and liver upwards and outwards, with 5mm locking forceps (olympus). After starting dissection at infundibulum-gallbladder junction Calot's triangle was defined along with cystic duct and artery. A 10mm clip applicator (olympus) was used through sub-xyphoid port

for application of clips to cystic duct and cystic artery separately. Gall bladder was dissected out of liver bed by using electrical hook cautery.

Dissection was preferably started at gall bladder/cystic duct junction instead of cystic duct/common bile duct junction in group A patients. This step made good use of left hand forceps for both retraction and dissection. Gall bladder was removed in modified glove basket, usually from umbilical port; sub-xyphoid port was used for small thin gall bladder. Port wounds were closed with 2/0 vicryl sutures.

Conversion to four-port and open cholecystectomy were made when there was uncontrolled bleeding, bile leakage of unclear origin, difficult anatomy and difficult handling due to hanging liver margin or thick walled/stone packed gallbladder.

All the patients were given one single dose of nalbin/maxalon by anaesthetist during recovery. After completion of operation and recovery from anaesthesia, patients were kept in surgical ITC till next morning round and then shifted to respective surgical wards. Analgesic (Inj Tramadol 100mgs) I/V was administered as per requirement and documented during initial 48 hours. Verbal pain score was recorded during the same period and was also documented. Patients were discharged when ambulant, comfortable and switched over to oral medications.

Outcomes were measured in terms of operating time, conversion to open cholecystectomy, intraoperative and post-operative complications, pain score/analgesic requirement, hospital stay/ return to activity and cosmetic satisfaction. Verbal pain score 1-3 was taken as low pain score whereas 4-10 as high pain score. Inj Tramadol 100mgs I/V was administered as per requirement and recorded as per numbers of ampoules.

All the data were analyzed using SPSS-20. Continuous variables were calculated as mean ± SD and compared using the two sample t-test; *p*-value of ≤0.05 was considered significant. Ordinal variables were compared using the chi- square test.

RESULTS

A total of 403 patients were included in this study; of which 316 (78.41%) were females and 87 (21.59%) were males. The mean ages of these patients were 44.42 ± SD 8.28 years in group A and 44.22 ± SD 7.99 years in group B with an age range of 25-65 years. In this study 218 (54.09%) patients under went three-port and remaining 185 (45.91%) patients under went four-port laparoscopic cholecystectomy.

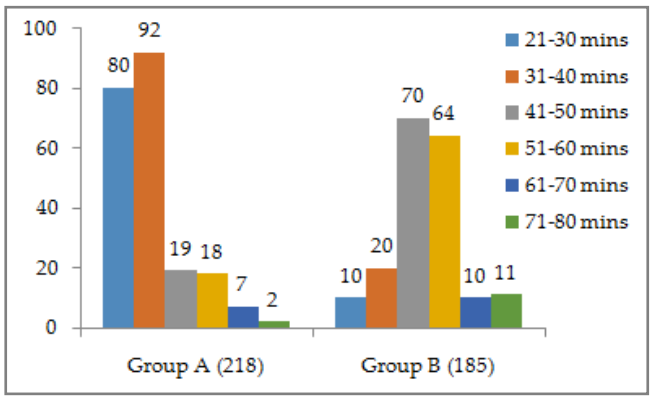

Figure-1: Operative time.

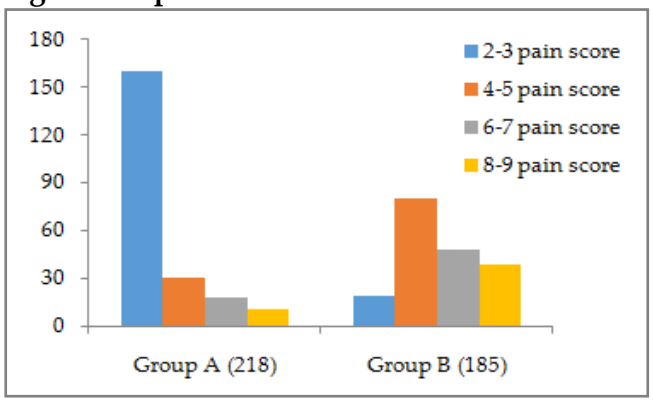

Figure-2: (pain score).

The mean time (minutes) was less in group A (35.59 ± SD 10.75) with range of 21-70 minutes as compared to group B (50.17 ± SD 10.14) with range of 31-80 minutes (figure-1) having *p*-value <0.001 table-III.

Total of 10 patients among group A underwent conversion to four-port laparoscopic cholecystectomy and was than counted in group B. Ten patients (3.21%) in group A and eight patients (3.24 %) in group B were converted to open cholecystectomy because of uncontrolled

bleeding, bile leakage, difficult anatomy and difficult handling of gall bladder as mentioned in conversion criteria. Results were statistically non significant with *p*-value of 0.401 (>0.05) among two groups table-II.

Pain at 12, 24, 36 and 48 hours post-operatively was less in group A (mean 3.29 ± SD 1.54) with a range of 2-8 as compared to group B (mean 4.84 ± SD 1.59) with a range of 3-8. The *p*-value <0.001 was significant figure-II.

Inj Tramadol 100mgs I/V was given for pain management in both groups. Mean value was 2.38 ± SD 0.23 (range 2-3 amp) in group A and 3.44 ± SD 0.26 (range 3-4 amp) in group B with *p*-value of <0.001 which was significant table-III. Operative and post-operative complications had been tabulated in table-IV and were compare able in both group A and B with *p*-value ranges between 0.786-0.939 (non significant).

Table-I: Demographic analysis.

Variables	Group A(218)	Group B(185)
Age Range	25-65 years	25-65 years
Mean Age ± SD	44.42 ± 8.28 years	44.22 ± 7.99 years
Male n (%)	45 (20.64%)	42 (22.70%)
Female n (%)	173 (79.36%)	143 (77.30%)

Table-II: Conversion to open cholecystectomy.

Conversion	Group A	Group B	*p*-value
Open Cholecystectomy n (%)	10 (3.21%)	8 (3.24%)	0.401
None n (%)	208 (96.79%)	175 (96.76%)	

Table-III: Peri-operative results.

Variables	Group A(218)	Group B(185)	*p*-value
	Mean ± SD	Mean ± SD	
Operation Time (minutes)	35.59 ± 10.75	50.17 ± 10.14	<0.001
Pain Score (verbal pain score 2-9)	3.29 ± 1.54	4.84 ± 1.59	<0.001
Analgesic (Inj Tramadol 100 mg I/V) No. of Ampules	2.38 ± 0.23	3.44 ± 0.26	<0.001
Hospital Stay (days)	3.42 ± 1.02	4.47 ± 0.99	<0.001
Return to Activity (days)	7.52 ± 1.15	7.79 ± 1.37	0.03

Table-IV: Complications.

Variables	Group A	Group B	*p*-value
Bleeding (major >100 ml)	5 (2.29%)	8 (4.32%)	0.786
Bile Duct Injury	4 (1.83%)	5 (2.70%)	
Visceral Injury	1 (0.46%)	1 (0.54%)	
Others	5 (2.29%)	4 (2.16%)	
None	203 (93.12%)	167 (90.27%)	
Bleeding <20 ml	174 (79.81%)	148 (80.0%)	0.937
Bleeding 20-50 ml	33 (15.14%)	29 (15.68%)	
Bleeding 51-75 ml	11 (5.05%)	8 (4.32%)	
Port Site Bleeding	12 (5.51%)	11 (5.95%)	0.939
Port Site Infection	06 (2.75%)	7 (3.78%)	
Port Site Hernia	01 (0.46%)	1 (0.54%)	
None	199 (91.28%)	166 (89.73%)	

Mean hospital stay (in days) for group A was less (3.417 ± SD 1.021) as compared to group B (4.472 ± SD 0.99). Difference was significant statis-tically with *p*-value 0.001. Almost same results were for return to activity. Mean days for that were 7.52 ± SD 1.15 in group A and 7.79 ± SD 1.37 in group B with *p*-value of 0.03 table-III. Group A (174/218) showed better acceptance for the cosmetic effect as compared to group B (90/185) with *p*-value of <0.001.

DISCUSSION

Laparoscopic cholecystectomy, since its inception, has got great revolution regarding the sizes and numbers of ports. The use of fourth port for fundus retraction is considered to be unnecessary by many schools of thought. Keeping this in mind, we designed this study and our results obtained were quite comparable with the data available in multiple national and international literatures. In this procedure of three-port laparoscopic cholecystectomy less operative time, less post-operative pain and early recovery are the major stakes to achieve, keeping in view the safety and efficacy of procedure as top priority[10,11]. Published data has shown positive results with *p*-value ≤0.05 in this regards[12,13,14].

Demographic distribution of our study show female to male ratio as 1: 3.63 whereas the ratio mentioned in studies of Kumar and Rana[15], Harsha *et al*[16], Reshi *et al*[17] are 1: 7.2, 1: 3.17, 1: 3.77 respectively. In our study set up of CMH Kohat female ratio was probably low due to cultural/ social factors of young ladies reluctant to report to hospital. Our patients in both groups were ranging from 25 to 65 years; that probably again reflect the cultural and social factors. Eight patients of more than 65 years of age were excluded from study because of having multiple comorbids/high anaesthetic risk already set as our exclusion criteria.

Common complications encountered during laparoscopic cholecystectomy are bleeding, bile leakage/perforation and bile duct injury during operative phase and infection and port site hernia in post-operative phase. Incidence of these were compare able among both three-port and four-port laparoscopic cholecystectomy with *p*-value ranging from 0.786 to 0.939 (>0.05). No mortality was noticed in either group. All these findings show three-port laparoscopic cholecystectomy to be safe, effective and practicable if performed by experienced surgeon, making success rate of both groups compareable.

Conversion rate to open cholecystectomy mentioned in different literature during 2010-2017 is 1-3% which is compare able in both groups of our study (10/218=3.21% in group A, 8/185=3.24% in group B) having *p*-value of 0.401 (>0.05) which show insignificant difference among two groups.

Time taken for three-port and four-port laparoscopic cholecystectomy was compare able in different studies. However in our study, time for three-port was noticeablely shorter (mean time 35.59 ± SD 10.75 minutes in group A and 50.17 ± SD 10.14 minutes in group B respectively) with *p*-value of 0.0001 (<0.05) probably because more senior/experienced surgeon performed the procedure of three-port laparoscopic cholecystectomy as compared to four-port laparoscopic cholecystectomy. Secondly we noticed it was more comfortable to dissect porta-hepatis while handling more mobile and moveable gall bladder with left hand forceps as compared to relatively fixed/ pushed gall bladder with liver with fourth port forceps. Time was also saved because of lack of fourth port insertion and closure. Alzawi *et al*[18] have also reported shorter time (46.1 vs 48.9 mins) in three-port laparoscopic cholecystectomy than four-port laparoscopic cholecystectomy though the difference was not much.

Group A had lesser demand of Inj Tramadol Ampoules (Mean 2.38 ± SD 0.23) as compared to group B (Mean 3.44 ± SD 0.26) in addition to low verbal pain score in group A (Mean 3.29 ± SD 1.54) as compared with group B (Mean 4.84 ± SD 1.59) with *p*-value 0.0001 (<0.05) for both parameters which is significant and reflects almost same results as in other studies[18,19]. Our results were also compareable as mentioned in studies done in India[19] and Nepal[20]. One worth mentioning fact is that we did not apply fourth dressings in cases of group A as was done in a study done by Kumar[20] making our assessment of pain scoring less reliable/patient biased. We intentionally did not use pethidine as analgesic because of its side effects of nausea/vomiting and sedation as men-tioned in a study of Al-Zawi *et al* and Siddiqui *et al*[18,21].

Three-port cholecystectomy is cost effective not only because of lesser use of analgesics, lesser hospital stay/early return to activity but also saving the cost of fourth port especially if the hospital is performing laparoscopic cholecystectomy using disposable ports in every patients without catering for the status of viral markers. Our study lacks to calculate this cost factors because we were performing laparoscopic cholecystectomy only in viral marker negative patients using re-useable trocars/cannulae.

Results in our study favour three-port laparoscopic cholecystectomy as better option if we consider lesser use of analgesic with less pain and better cosmesis, all having *p*-value less than 0.05 making these significant. These results are usually mentioned with mixed comments in different studies done in Pakistan (Abbotabad), Egypt and Italy[22-24]. In our study, patients were admitted one working day before surgery increasing hospital stay longer as compared to other studies of day-case procedure shown by Shireen *et al*[22] and we were unable to compare for duration of hospital stay and early return to activity with other studies. However group A patients showed lesser duration of hospital stay and early return to activity as compared to group B.

Safety of three-port laparoscopic cholecystectomy regarding bile duct injury has been main concern of many surgeons but we will comment with our experience that bile duct injury can be minimized if the dissection is started at infundibulum cystic duct junction and retracting gall bladder laterally rather than to dissect at cystic duct-common bile duct junction. Safety of our procedure was also endorsed in studies of 2013 and 2017[23].

CONCLUSION

We conclude that, in spite of certain limitations, use of three-port laparoscopic cholecystectomy is feasible and safe. However we recommend that this procedure should be done by experienced surgeon in laparoscopic techniques. The outcomes given in different literatures about three-port cholecystectomy as being of short operative time with usage of less analgesics and lesser hospital stay/early return to activity were also comparable in our study.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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