

## Original Research Article

# Harmonic scalpel, the tool for new age laparoscopic cholecystectomy

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### ABSTRACT

**Background:** Among the various abdominal procedures, operations performed on the biliary tract are the most common and cholecystectomy is the commonest performed surgical procedure amongst them. Currently laparoscopic cholecystectomy (LC) is considered the gold standard treatment for symptomatic gallstone disease. Cholecystectomy done by harmonic scalpel is an attractive alternative technique being more cost effective and having equivalent results in regard to post-operative recovery and pain as compared to standard laparoscopic procedure. The objective of this study was to compare Clipless (Harmonic scalpel assisted) and Conventional Laparoscopic Cholecystectomy.

**Methods:** Patients with a diagnosis of symptomatic cholelithiasis were included in the present study. Patients were divided randomly into two groups. The control group (Group-A) underwent conventional LC using mono-polar electro-surgery for dissection of gallbladder bed and clips for ligation of cystic duct and artery while the study group (Group-B) underwent LC using the harmonic scalpel. The harmonic scalpel was used as the sole instrument for division of the cystic duct and artery as well as dissection of the gallbladder bed.

**Results:** The mean duration of surgery in the conventional LC group was found to be 46 min 50 sec and 33 min 10 sec in the clipless LC group, the difference being statistically significant ( $p < 0.05$ ). Perforation of gall bladder occurred in 12 cases in conventional LC group as compared to 2 cases in clipless laparoscopic ( $P < 0.05$ ).

**Conclusions:** The clipless LC approach has a definite edge over conventional LC, in regard to lesser duration of surgery, fewer operative complications and shorter post-operative hospital stay.

**Keywords:** Clipless, Gall bladder, Harmonic scalpel, Laparoscopic cholecystectomy

### INTRODUCTION

Open cholecystectomy being performed for more than 100 years, has been an effective method of treating gallstone disease and has demonstrated an acceptable low morbidity and mortality, with a variation from 0 to 0.8 percent.<sup>1-7</sup>

As advantages of LC have been clearly proved as less post-operative pain, minimal tissue trauma, improved cosmesis, shorter hospital stay, earlier return to work and possibly greater cost effectiveness, it has become the "Gold standard" for the management of symptomatic gall

stone disease. The standard LC is commonly performed by means of specialized instruments. For gallbladder dissection, the electro-surgical hook, spatula, and/or scissors, using high-frequency mono-polar cautery; have been used in most institutes. Occlusion by titanium metal clips is the most frequently used technique to achieve both cystic duct and artery closure/ligation.<sup>8</sup>

Although the LC is a safe technique, several reports have pointed out significant incidence of injuries and complications related to cautery, frequent instrument exchange and slippage of clips.<sup>9</sup> The ultrasonically activated (Harmonic) scalpel was designed as a safe

alternative to electro-cautery for the hemostatic dissection of tissue. This innovative method of cutting tissue was based upon the coagulating and cavitation effects provided by a rapidly vibrating blade coming in contact with tissue.<sup>10</sup>

So, the aim of present study is to compare Clipless (Harmonic scalpel assisted) and Conventional LC.

## METHODS

The present study was conducted in the Department of Surgery, over a period of 1 year from 1<sup>st</sup> July 2012 to 30<sup>th</sup> June 2013. 100 patients were included in this study who were admitted for LC. An informed consent was obtained from all patients.

Inclusion criteria included patients with symptomatic uncomplicated gallstones disease. Exclusion criteria were choledocholithiasis, jaundice/ hypo-proteinemia/ malignancy, age less than 18 years, cystic duct diameter more than 6 mm (to be assessed intra-operatively by blades of harmonic scalpel) and coagulation abnormality.

No intra-operative cholangiograms were performed. The diagnosis was established according to clinical history, laboratory data and findings on Ultrasonography (USG). The following preoperative data were collected: Detailed history, age, sex, general and systemic examination, complete haemogram, blood sugar, liver function test, renal function test, pulmonary function test, serum electrolytes, X ray chest, ECG, abdominal USG, other specific investigation if required. Patients were divided randomly into two groups. The control group (Group-A) underwent conventional LC while the study group (Group-B) underwent LC using the harmonic scalpel.

Patients were placed in the supine position on operation table. After giving general anesthesia, pneumoperitoneum was created using a Veress needle inserted through a small skin incision in infraumbilical region. A 10mm trocar was inserted through infraumbilical port after creating pneumoperitoneum with intraperitoneal pressure being kept at 13-15 mm of Hg. Telescope was inserted through the same port and peritoneal cavity was inspected for any injury to viscera and major blood vessels. Nasogastric tube was inserted if the stomach was dilated. A 10 mm trocar was inserted in midline just below the xiphoid process keeping its direction towards the gall bladder. Two 5mm trocar was be inserted, one in the right sub-costal region in mid-clavicular line and other at the level of umbilicus in right anterior axillary line. Subxiphoid port was used as the main working port. The sub-costal 5mm port was used to hold the infundibulum and lateral port at the level of umbilicus in anterior axillary line was used for holding the fundus of gall bladder.

In controls (Group-A), the fold of peritoneum covering the cystic artery, cystic duct and lymph node were

dissected and the junction between gallbladder and the cystic duct was defined and the cystic duct was dissected towards the common bile duct. After identification of cystic duct, cystic artery, common bile duct, three clips were applied to cystic artery and cystic duct. Both of these two structures were cut between these clips leaving 2 clips towards cystic stump side. Gall bladder were separated from its bed using spatula or electro-hooks.

In study group (Group-B), the fold of peritoneum covering the cystic artery, cystic duct and lymph node were dissected using a harmonic scalpel. After identification of cystic duct, cystic artery, common bile duct the harmonic scalpel was used for division of the cystic duct and artery as well as for dissection of the liver bed.

Extraction of gallbladder was similar in both groups. The gallbladder was extracted through the epigastric port after ensuring hemostasis. Operative site was inspected for any perforation of gall bladder, stone spillage, injury to adjoining structures, bleeding or any other complications and note made thereof. A closed suction drain was placed in the sub-hepatic space to know for any collection. The two 5 mm trocars and the 10 mm subxiphoid trocar were removed under telescopic view. All the four port sites were closed after removing gas.

### *Following parameters were evaluated in the present study*

Duration of procedure from time of trocar insertion up to trocar removal, intra-operative gallbladder perforation, number of times the lens cleaned, intra-operative bleeding and approximate amount of blood loss, post-operative pain was assessed by four-point scale, post-operative complication i.e.-cystic duct leak, cystic artery bleed or any other collection following surgery and the average length of hospital stay. At the end of the first postoperative week, patients underwent clinical examination and an abdominal Ultrasonography (USG) with special attention to the presence or absence of any sub-hepatic (or otherwise) fluid collections. All patients were evaluated for any collection by USG on 2<sup>nd</sup> post-operative day and in OPD on 7<sup>th</sup> day after operation.

## RESULTS

100 patients of symptomatic cholelithiasis were randomly allotted Group A and Group B and were evaluated in the present study. The patients in these two groups were similar as regards to age, sex, symptomatology and general physical examination and laboratory investigations. In the present study, females were 78% while males constituted only 22% showing a female preponderance. All the laparoscopic surgeries were done through 4 ports. The total duration of surgery was shorter in clipless LC group. The mean duration of surgery in the conventional LC group was found to be 46 min 50 sec and 33 min 10 sec in the clipless LC group and the

difference was found to be statistically significant (Table 1). In the present study perforation of gall bladder occurred in 12 cases in conventional LC group as compared to 2 cases in clipless laparoscopic LC (Table 1).

In the present study camera was cleaned less frequently in clipless LC with a mean of  $0.88 \pm 0.18$  times as compared to conventional LC with a mean of  $2.54 \pm 0.19$

times which was statistically significant (Table 1). In the present study the difference in blood loss in clipless LC and conventional LC was statistically insignificant. Both the groups experienced pain postoperatively without any significant difference. Bile leak was noted in 2 patients, 1 in each group in the present study. Postoperative wound infection, paralytic ileus, chest infection and wound dehiscence were also not seen in present study in any of the group.

**Table 1: Comparison of various parameters in Group A and Group B.**

	Conventional LC (Group A)	Clipless LC (Group B)	P- value
No of patients	50	50	
Mean duration of surgery	46 min 50 sec	33 min 10 sec.	<.005
Gall bladder perforation	12 cases	2 cases	>.005
No of times camera cleaned intra-operatively	$2.54 \pm 0.19$ times	$0.88 \pm 0.1$ times	<.005
Intra-operative blood loss	$20.5 \pm 1.50$ cc	$16.10 \pm 2.22$ cc	>.005
Mean pain score	1.64	1.62	>.005
Post-operative bile leakage	1 case	1 case	
Post-operative hospital stays	$2.40 \pm 0.13$ days	$1.70 \pm 0.13$ days	>.005

Mean duration of post-operative hospital stay was  $2.40 \pm 0.13$  days for conventional LC group and  $1.70 \pm 0.14$  days for clipless LC group and the difference was statistically insignificant (p-value: 0.50). Post-operative USG was normal in all patients except in 2 cases in which there was bile leak. 1 patient in Group A developed cystic duct leak who did not respond to conservative management and underwent ERCP stenting. 1 patient in Group B who was the case of acute cholecystitis and operated within 48 hrs of acute attack developed post-operative cystic duct leak. Clinical observation with spontaneous resolution occurred in this patient after 2 weeks (Table 1).

**Statistical analysis**

The results were statistically evaluated and analyzed by Chi Square test and unpaired t-test. Value (p) less than 0.05 was considered statistically significant. All analyses were conducted using the statistical software SPSS 20.

**DISCUSSION**

LC is the gold standard for treatment of gall stone disease. Since its inception LC has evolved in terms of technique from 4 ports to 3 port and single incision LC (SILS). Clipless LC is the latest technique in the armamentarium of laparoscopic surgeons. As conventional LC gained wider acceptance, complications which were rarely seen with open cholecystectomy become more evident. These include distant tissue damage by the high-frequency electro- cautery involving vascular and biliary structures in the vicinity of the cystic duct and artery, bile leakage due to slippage of the clips, and visceral and

solid organ injuries due to frequent instrument exchange, which is sometimes performed without optic guidance.<sup>9</sup> In clipless LC, harmonic scalpel is used in place of scissors, dissector and clip applicator, therefore limiting the number of passages through the trocars and consequently, reducing the possibility of causing injuries to the intra-abdominal organs.<sup>11</sup>

In the present study mean duration of surgery in conventional LC group was 50 minutes 20 sec. and in clipless LC group was 36 minutes 10 sec. The difference in the duration of surgery was statistically significant (p-value: 0.00). Similarly, in study conducted by Zaidi AH et al and Gelmini R et al operative time was shorter in clipless LC group as compared to conventional LC group.<sup>12,13</sup> Patients who undergo clipless LC have shorter operation time because here a single instrument is used for dissection of gall bladder bed, cutting, coagulation as well as division of cystic duct and cystic artery.

In the present study incidence of gall bladder perforation was less as compared to conventional LC which is in accordance with the study of Bessa SS where gall bladder perforation was seen 10% in clipless LC group as compared to 30% cases in conventional LC group and was statistically significant (p-value: 0.002).<sup>14</sup> Accidental perforation of gall bladder during conventional LC is very common especially during dissection from its bed with electro-cautery but such complication is rare with harmonic scalpel as its cavitation effect on the surrounding pericholecystic tissues, especially in the region of the liver bed, allows easier mobilization of the gallbladder, thus avoiding inadvertent compromise of the gallbladder wall and bile spillage.<sup>15</sup> In the present study

camera was less frequently cleaned in clipless LC probably due smokeless field provided by harmonic scalpel. The harmonic scalpel is not only a safe and effective instrument but also a reliable substitute for clips because it provides effective biliary and vascular control. It presents itself as a viable alternative because of the shorter operation time and cost effectiveness that are inherent to this procedure as it utilizes a single instrument for dissection as well as for ligation.<sup>13</sup>

This study clearly shows that clipless LC is a safer alternative to conventional LC with shorter operative time, early recovery and comparable complications rate, although larger studies are needed to substantiate the same.

## CONCLUSION

The clipless LC approach has a definite edge over conventional LC, in regard to lesser duration of surgery, fewer operative complications and shorter post-operative hospital stay. Clipless LC is a safe, effective method with added advantage over conventional LC and should be preferred wherever feasible.

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