

To Compare the Dissection of Gallbladder by Ultrasonic Harmonic Scalpel Versus Electrocautery in Laparoscopic Cholecystectomy

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ABSTRACT

Objectives: To assess the dissection of gallbladder by ultrasonic harmonic scalpel in comparison to electrocautery in laparoscopic cholecystectomy.

Study Design: A randomized control trial

Study Setting and Duration: Department of Surgery Ward-02 Jinnah Postgraduate Medical Centre, Karachi between June 2018 and February 2019.

Methodology: A total of 110 patients diagnosed with cholelithiasis were included in the study. The participants were randomly allocated into two groups i.e., harmonic scalpel group and electrocautery group. Patients were followed postoperatively in the ward and the outcome was measured at the end of two days after surgery.

Results: The average age of the patients was 44.56 ± 12.19 years. Out of 110 patients, 30 (27.3%) were male and 80 (72.7%) were female. It was found that the mean operative time (44.4 ± 3.64 min vs. 53.31 ± 8.09 min; $p=0.0005$), blood loss (10.27 ± 8.35 ml vs. 4.00 ± 3.65 ml; $p=0.0005$), post-operative pain (6.87 ± 1.04 vs. 4.29 ± 1.01 $p=0.0005$), and hospital stay (31.09 ± 10.58 vs. 24.11 ± 0.81 ; $p=0.0005$) were significantly lower in harmonic scalpel group than the electrocautery group.

Conclusion: Dissection of gall bladder with harmonic scalpel is safe and easy method and superior than electrocautery and can routinely be used if available.

Keywords: Laparoscopic cholecystectomy, Harmonic scalpel, Electrocautery

INTRODUCTION

Laparoscopic cholecystectomy is considered as the gold standard in the treatment and management of diseases of the gallbladder. ¹Laparoscopic cholecystectomy has considerably replaced the previously common surgical operation - open cholecystectomy owing to its enormous benefits.²

Usually, the cholecystectomy is executed using a dissector, an electrosurgical hook, and a spatula. ³ Several devices can be used to cut and coagulate during a laparoscopic surgery. However, each appliance has its benefits and risks. For instance, studies reveal that ultrasonic dissection is a better than electrocautery in terms of gallbladder perforation as well as duration of the operation.⁴ Monopolar electrosurgery is associated with significantly risk of perforation and other complications.⁵

Previous literature shows that in comparison to the conventional electrocautery, the adaptation to ultrasonic dissection during a cholecystectomy is associated with a significantly lower risk of bile leaks as well as perforation.⁶ Moreover, ultrasonic dissection such as harmonic scalpel is easier to use and handle. ⁵ There have been some studies that revealed certain unwanted effects on the tissue linked with the use of a harmonic scalpel during surgery and postoperatively.⁷

Harmonic scalpel is associated with enhanced cutting precision as well as it results in a less harmful surgical smoke. Furthermore, it causes less injury to the tissue hence, making it a preferable choice when selecting a tool for simultaneously cutting and coagulating during a laparoscopic cholecystectomy.⁸⁻¹⁰

Since, past studies supported the use of an ultrasonic device for dissection of the gall bladder, it was hypothesized that similar findings could be replicated in our

tertiary care center. The current study aimed to compare the use of harmonic scalpel which is an ultrasonic device with the traditional electrocautery.

MATERIAL AND METHODS

This was randomized control trial conducted at Department of Surgery, Ward-2, Jinnah Postgraduate Medical Centre Karachi during June 2015 to Feb. 2016. 110 patients included in the study and randomly allocated to groups by sealed envelope method. All patients diagnosed with symptomatic gall bladder stones between the ages of 20 and 70 years will be eligible partake in the study, irrespective of gender. Patients with previous upper abdomen surgery, acute cholecystitis, uncontrolled comorbidity, ASA iv or more, and gall bladder malignancy were not included in the study.

Permission from the ethical review committee was sorted prior to conducting the study. Informed verbal and written consent were taken from the patients before their induction in the study. Patients were explained what the surgical procedure would entail, the associated risks, and expected duration of the study.

Patients were operated by a single general surgeon having more than 3 years' experience in laparoscopic surgery. Surgery was performed using the conventional four ports, namely, the umbilical port, the port below the xiphoid, and two ports below the right costal margin.

Time from incision to last stitch of closure of skin was noted. The gauze pieces were weighted prior to surgery. All the gauze pieces soaked with blood weighted and difference was calculated to assess blood loss during surgery. The usage of Visual analogue scale was explained to the patient before the surgery and the mean pain score was assessed at 12 and 24 hours postoperatively. Same

dose of antibiotic (third generation Cephalosporin) was given to all patients. Patients were followed postoperatively in the ward and the outcome was measured at the end of two days. Duration of hospital stay was noted in hours from the end of surgery till discharge. The data gathered of the outcome variables as stated in operational definition was collected on Performa.

Data was analyzed using statistical package for social sciences (SPSS, version 26). For all continuous variables, mean with standard deviation were calculated including mean age, duration of surgery, total loss of blood, and duration of hospitalization. Independent sample t test was applied to compare mean between groups for intraoperative parameters as listed before. $p < 0.05$ was set as the cut off value for statistical significance.

RESULTS

A total of 110 patients with cholelithiasis were included in this study. Patients were equally divided into two groups; fifty-five patients were placed in ultrasonic harmonic scalpel group and rest were placed in electrocautery groups. The average age of the patients was 44.56 ± 12.19 years. Out of 110 patients, 30 (27.3%) were male and 80 (72.7%) were female.

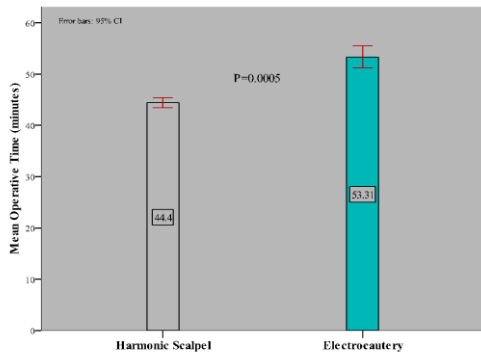


Figure 1: Comparison of Mean Operative Time Between Groups

Average operative time was significantly shorter in harmonic scalpel group than electrocautery groups (44.4 ± 3.64 min vs. 53.31 ± 8.09 min; $p=0.0005$) respectively as presented in figure 1.

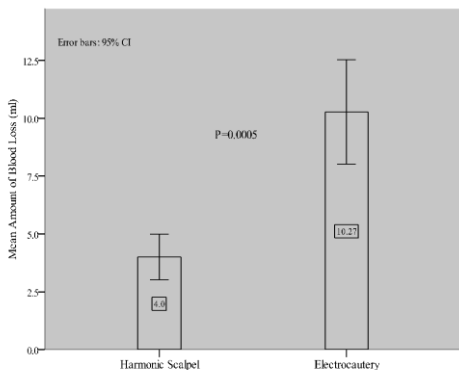


Figure 2: Comparison of Mean Amount of Blood Loss Between Groups

Average amount of blood loss was significantly high in electrocautery groups than harmonic scalpel groups (10.27 ± 8.35 ml vs. 4.00 ± 3.65 ml; $p=0.0005$) as shown in figure 2.

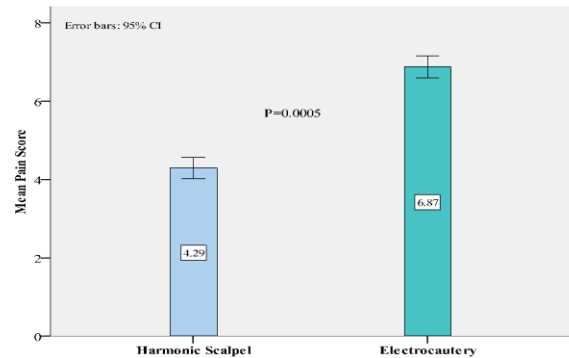


Figure 3: Comparison of Mean Pain Score Between Groups

Similarly mean pain score was also high in electrocautery groups than harmonic scalpel groups (6.87 ± 1.04 vs. 4.29 ± 1.01 $p=0.0005$) as shown in figure 3, and mean hospital stay was 31.09 ± 10.58 hours in electrocautery groups and 24.11 ± 0.81 days in harmonic scalpel group ($p= 0.0005$) as presented in figure 4.

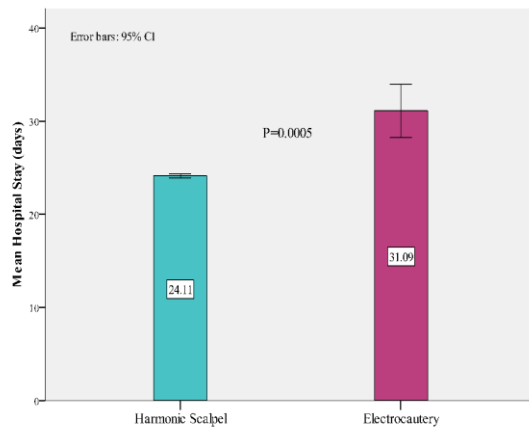


Figure 4: Comparison of Mean Hospital Stay Between Groups

DISCUSSION

The present study revealed that the mean operative time, loss of blood, and pain were significantly greater in patients managed with electrocautery as compared to the harmonic scalpel. The ultrasonic device: harmonic scalpel is as easy to use, efficacious, and a safe tool which can be used simultaneously for cutting and coagulating. Its precise cutting and less thermal injury to tissues gives it a clear and a significant advantage over electrocautery.¹¹⁻¹²

In comparison to harmonic scalpel, the use of electrocautery results in increased risk of thermal injuries with an imposed risk of gall bladder perforation. Mahabaleshwar V, et al., revealed that the incidence of gall bladder perforation in patients managed with electrocautery was significantly higher (40%) as compared to ultrasonic dissection (16%); $p=0.045$.¹³ Furthermore, the operative time in electrocautery group was longer than ultrasonic

dissection group ($p=0.001$). These findings were in accordance with the present study.

Amarin revealed that out of all the patients who underwent cholecystectomies at the center, none of them reported any bile leak or perforations. Ultrasonic device resulted in adequate and precise hemobiliary stasis during laparoscopic cholecystectomies.¹² No immediate postoperative complications were reported in association with the harmonic scalpel. Thus, concluding that harmonic scalpel not only provides a precise cutting of thick fibrous tissue but also does it efficiently and without any complications.¹²

It has been noted that inexperienced and younger surgeons were more inclined to use ultrasonic dissection, especially in complicated cases because it is easier to handle and use.¹⁴ Janssen et al., revealed that those surgeons with the least experience also took lesser time with harmonic scalpel as compared to when the surgeons used electrocautery (66.7 mins vs. 85.4 mins; $p=0.04$).⁴

Anis et al., assessed the operative outcomes of laparoscopic surgery for the management of cholelithiasis in electrocautery versus ultrasonic dissector groups. The authors revealed that in electrocautery group, gall bladder perforation was found in five patients whereas, in the ultrasonic dissector group, there was only one patient who suffered from gall bladder perforation.¹⁵

Even in patients with cirrhosis who underwent laparoscopic cholecystectomy, harmonic scalpel offered a safe and efficacious way to provide adequate hemobiliary stasis.¹⁶⁻¹⁷

In a recent systematic analysis authored by Jiang et al., nineteen studies were analyzed. The meta-analysis showed that ultrasonic device was strongly associated with shorter duration of operation (MD, -14.86; 95% CI, -79.57 to 14.90: $p<0.00001$), resulted in lower amount of blood loss ($p=0.004$), lower incidence of perforations (RR, 0.45, $p<0.0001$), and shorter hospitalization ($p=0.002$) as compared to electrocautery.¹⁸

In short, we strongly advocate the use of harmonic scalpel in both open and laparoscopic surgical procedures. However, as true with any research our study also had certain apparent limitations. Firstly, since it was a single center study, the sample population was undiversified and had similar socio demographics hence, the applicability of the findings on a larger Pakistani population will not be possible. Moreover, due to a lack of resources we were unable to keep a long-term follow-up of patients hence, unable to explore the long-term outcome of patients in either group.

CONCLUSION

This study found advantageous role of harmonic scalpel in comparison to electrocautery in terms of average operative time, amount of blood loss, mean pain score and mean hospital stay. The previous literature has shown similar findings supporting the effectiveness as well as safety and efficacy of harmonic scalpel in dissection of gall bladder.

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