Original Research Paper

Volume - 13 | Issue - 03 | March - 2023 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

General Surgery

TYPE OF SURGICAL ENERGY (HARMONIC SCALPEL vs ELECTROCAUTERY) USED IN STANDARD 4-PORT LAPAROSCOPIC CHOLECYSTECTOMY AND ITS OUTCOMES

Dr. Karan Gupta — Postgraduate Resident in general surgery, Osmania general hospital, Hyderabad Telangana

Dr. Mohammed Masood Pasha — Assistant Professor in general surgery, Osmania general hospital, Hyderabad Telangana

Dr. Lakshman Chaganti — MBBS, Osmania general hospital, Hyderabad Telangana

ABSTRACT The standard laparoscopic cholecystectomy is normally performed with a monopolar electrocautery, usually an electrosurgical hook, especially for the dissection of the gallbladder, cholecystic duct, and cholecystic artery. The Harmonic scalpel is an advanced, minimally invasive surgical device **Aims and objectives** that enable synchronous cutting, coagulation, and cavitation of the thicker tissue by a high-frequency (55,500 Hz) vibration. To study, in comparison the use of Harmonic scalpel vs Electrocautery in standard 4-port laparoscopic cholecystectomy and its outcomes, in the following parameters - Intraoperative bleeding, Postoperative pain, Need for subhepatic drain placement Postoperative surgical site infection (SSI), Early discharge **Materials and methods:** This randomized study was performed prospectively from June 1 2021 to May 30 2022 on 60 patients at Osmania General Hospital Hyderabad, Telangana Patients were randomly allocated into 2 groups for the standard 4 port LC - with 30 patients undergoing gallbladder dissection with a harmonic scalpel and 30 patients undergoing gallbladder dissection with electrocautery. **Results:** The mean±SD of age in the study was 40.72±10.98 for females and 51.18±10.19 for males. There was a statistically significant difference ($p < 0.05$) in regards to less intraoperative bleeding, less postoperative pain, and early discharge in the harmonic scalpel group. **Conclusion:** It was concluded in our study that harmonic scalpel has a significant advantage($p < 0.05$) over electrocautery in terms of intraoperative bleeding, post-operative pain, and duration of hospital stay i.e. postoperative day of discharge.

KEYWORDS : Harmonic scalpel, Electric cautery, Standard 4-Port Laparoscopic Cholecystectomy

INTRODUCTION

The standard laparoscopic cholecystectomy (LC) is normally performed with monopolar electrocautery, usually an electrosurgical hook, especially for the dissection of the gallbladder, cholecystic duct, and cholecystic artery.[1]

The use of electrocautery in LC may cause excessive surgical smoke from cauterizing the tissues and may compromise the precision of dissection [2]. Furthermore, electrocauterization may cause iatrogenic injury of adjacent vessels and solid organs, such as the common bile duct[3] and the small intestine[4] via thermal side effects.

The Harmonic scalpel is an advanced, minimally invasive surgical device that has been used in LC for approximately a decade[5]. The scalpel enables synchronous cutting, coagulation, and cavitation of the thicker tissue by a high-frequency (55,500 Hz) vibration, which generates heat by tissue stress and friction to degenerate tissue protein[6]. This technique transfers minimal energy to the tissues in proximity and thereby minimizes the risk of collateral thermal damage[6]. In addition, using a Harmonic scalpel can securely close and seal the biliary ducts and vessels with a diameter of ≤5 mm without requiring vessel clipping[7]

The incidence of gallbladder perforation and biliary spillage has also been reported to be low with ultrasonic dissection compared to monopolar electrocautery during laparoscopic cholecystectomy[8,9].

1. To study, in comparison the use of a Harmonic scalpel vs Electrocautery in standard 4-port laparoscopic cholecystectomy
2. Outcomes for the type of surgical energy used are assessed, in the following parameters -

a. Duration of surgery
b. Intraoperative bleeding
c. Postoperative pain
d. Need for subhepatic drain placement
e. Postoperative surgical site infection (SSI)
f. Early discharge

MATERIALS AND METHODS :

This randomized study was performed prospectively from June 1, 2021, to May 30, 2022, on 60 patients at Osmania General Hospital. Hyderabad, Telangana. Patients were randomly allocated into 2 groups for the standard 4 port LC - with 30 patients undergoing gallbladder dissection with a harmonic scalpel and 30 patients undergoing gallbladder dissection with electrocautery.

Outcomes were assessed in both groups via the duration of surgery, intraoperative bleeding, need for subhepatic drain placement, postoperative pain and surgical site infection (SSI), and duration of hospital stay i.e. postoperative day (POD) of discharge.

Inclusion Criteria :

- Age - 21 to 65 years
- Gender - both male and female
- ASA class I or II
- Diagnosed as symptomatic cholelithiasis, chronic cholecystitis, acute cholecystitis with < 3 days of presentation or > 12 weeks of presentation

Exclusion criteria :

- Age - < 21 years or > 65 years
- ASA class III or IV
- Pregnant / Lactating female
- Complicated intrahepatic or extrahepatic bile duct stone
- History of previous upper abdominal surgery

Ultrasound abdomen confirmed cases of cholelithiasis were evaluated, after duly taking informed and written consent, they were taken up for definitive surgery in the form of LC with a standardized 4 port technique by the same surgical team each time.

Surgical procedure:

All the patients had received premedication, general anesthesia with endotracheal intubation, and intravenous antimicrobial prophylaxis as routine surgical prophylaxis with ceftriaxone, 30 minutes before the incision. They were in reverse- Trendelenburg position and inclined laterally to the left at an angle of 30 degrees. A nasogastric tube was placed at the beginning of the procedure. The standard 4-port technique was used to perform laparoscopic cholecystectomy. Pneumoperitoneum created Using carbon dioxide insufflation and maintained at 12 mmHg. Calot's triangle and gallbladder bed were dissected with the harmonic scalpel or by laparoscopic monopolar electrocautery. Titanium clips were used for ligation and sealing of cystic duct and cystic artery in both groups. The gallbladder was mobilized from the gallbladder bed, and any obvious bleeding or biliary leakage was controlled. In both groups, the subhepatic drain

was placed if extensive dissection has been done. All patients were instructed to resume ambulatory activities and intake of liquid diet on postoperative day 1 and were discharged if clinically found fit. Later, all the patients were followed up at the outpatient clinic at regular intervals for 6 weeks.

RESULTS

The mean±SD of age in the study was 40.72±10.98 for females and 51.18±10.19 for males.

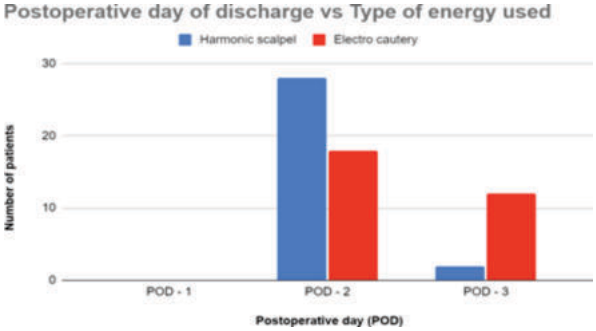

Figure 1: Postoperative day of discharge vs Type of energy used. .

However, no statistically significant difference was noted between both groups in regard to the need for subhepatic drain placement ($p = 0.16$) and postoperative SSI ($p = 0.64$).

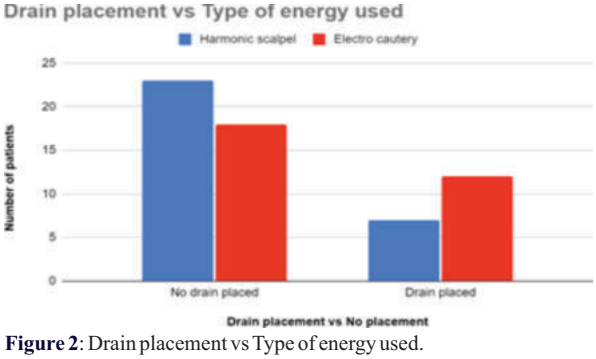

Figure 2: Drain placement vs Type of energy used.

DISCUSSION

Symptomatic cholelithiasis is one of the most commonly encountered diseases in hospital settings[10,11]. Laparoscopic cholecystectomy has become the standard of care for Gallstone diseases.

There have been various studies where the harmonic scalpel has been used for the entire surgery[15-17]. This is based on the concept that a harmonic scalpel can seal vessels up to 5mm in diameter. In our study, the entire dissection was carried out with Harmonic Scalpel except clipping of the cystic duct, where titanium clips were used. This was done to reduce the bile leakage from the divided cystic duct. The major limitation of using the Harmonic scalpel is its relatively high cost, especially in underprivileged practices[17].

A commonly encountered problem is bleeding from the liver bed for which the harmonic scalpel has the benefit of stopping the bleeding without causing smoke[15]. The harmonic scalpel, being a multifunctional instrument, replaces four instruments namely, the dissector, clip applicator, electrosurgical hook/spatula, and scissors. Hence, there is no requirement of changing instruments frequently, and this reduces time. No smoke is emitted when the harmonic scalpel is used and thus, the camera lens does not require to be cleaned frequently, which saves time[13,14,16].Bleeding during LC occurs mainly from slippage of clips applied on the cystic artery or from the gallbladder fossa. The safety of harmonic scalpel for effective occlusion and division has been shown in studies[12]. The bleeding from GB fossa is effectively controlled by using a harmonic hook as it produces less smoke.

Pain in the postoperative period is mostly due to visceral irritation. The lateral shear of monopolar energy spreads up to 0.5 cm compared to 1.5 mm in ultrasonic devices. In our study, the postoperative pain and the requirement for analgesia are reduced in the harmonic scalpel group as compared to the electrocautery group.

The risk of SSI depends on various factors like duration of surgery, spillage of bile, nutritional status of patients, and any comorbidities. The rate of SSI is less in laparoscopic surgery compared to open surgery. In our study 03 patients had SSI in the electrocautery group compared to 02 patients in the harmonic scalpel group. All cases were superficial SSI which were managed conservatively.

The overall hospital stay in harmonic scalpel is less than the electrocautery group in the study conducted by Janssen et al.[14]

CONCLUSION

Laparoscopic cholecystectomy performed with ultrasonic devices is effective and feasible. This method offers considerable advantages, such as minimal thermal dispersion of energy, reduced requirements of analgesics, and reduced incidence of bleeding.

The major limitation of using the Harmonic scalpel is its relatively high cost, especially in underprivileged practices[17]. The study was conducted prospectively to compare the clinical outcomes of using a harmonic scalpel as compared to electrocautery in gallbladder bed dissection in laparoscopic cholecystectomy.

It was concluded in our study that a harmonic scalpel has a significant advantage($p < 0.05$) over electrocautery in terms of intraoperative bleeding ($p = 0.01$) , post-operative pain($p = 0.001$), and duration of hospital stay i.e. postoperative day of discharge ($p = 0.002$)

However, our study could not conclude a decrease in operative time in the harmonic scalpel group and no statistically significant difference was observed in terms of the need for subhepatic drain placement and postoperative SSI

Further randomized trials are required to prove a definite advantage of the harmonic scalpel over conventional electrocautery for laparoscopic cholecystectomy.

REFERENCES

1. Soper NJ, Barteau JA, Clayman RV, Becich MJ. Safety and efficacy of laparoscopic cholecystectomy using monopolar electrocautery in the porcine model. *Surg Laparosc Endosc*. 1991;1:17–22.
2. Wu JS, Luttmann DR, Meininger TA, Soper NJ. Production and systemic absorption of toxic byproducts of tissue combustion during laparoscopic surgery. *Surg Endosc*. 1997;11:1075–1079.
3. Humes DJ, Ahmed I, Lobo DN. The pedicle effect and direct coupling: delayed thermal injuries to the bile duct after laparoscopic cholecystectomy. *Arch Surg*. 2010;145:96–98.
4. Ho AC, Horton KM, Fishman EK. Perforation of the small bowel as a complication of laparoscopic cholecystectomy: CT findings. *Clin Imaging*. 2000;24:204–206.
5. Sietses C, Eijsbouts QAJ, von Blomberg BM, Cuesta MA. Ultrasonic energy vs monopolar electrosurgery in laparoscopic cholecystectomy: influence on the postoperative systemic immune response. *Surg Endosc*. 2001;15:69–71.
6. Sasi W. Dissection by ultrasonic energy versus monopolar electrosurgical energy in laparoscopic cholecystectomy. *JSLS*. 2010;14:23–34.
7. Minutolo V, Gagliano G, Rinzivillo C, Li Destri G, Carnazza M, Minutolo O. Usefulness of the ultrasonically activated scalpel in laparoscopic cholecystectomy: our experience and review of literature. *G Chir*. 2008;29:242–245.
8. Power C, Maguire D, McAnena OJ, Calleary J. Use of the ultrasonic dissecting scalpel in laparoscopic cholecystectomy. Surg Endosc. 2000;14(11):1070-3.
9. Jain SK, Tanwar R, Kaza RC, Agarwal PN. A prospective, randomized study of comparison of clipless cholecystectomy with conventional laparoscopic cholecystectomy. J Laparoendosc Adv Surg Tech A. 2011;21(3):203-8.
10. Takada T, Strasberg SM, Solomkin JS, Pitt HA, Gomi H, Yoshida M, et al. TG 13 Updated Tokyo guidelines for the management of acute cholangitis and cholecystitis. J Hepatobiliary Pacreat Sci. 2013;20:1-7
11. Stromberg C, Nilsson M. Nationwide study of the treatment of common bile duct stones in Sweden between 1965 and 2009. Br J Surg. 2014;98:1766-74.
12. Vu T, Aguilo R, Marshall NC: the clipless technique of laparoscopic cholecystectomy using the harmonic scalpel. Ann R Coll Surg Engl. 2008;90:612.
13. Lee SJ, Park KH. Ultrasonic energy in endoscopic surgery. Yonsei Med J. 1999;40(6):545-9.
14. Janssen IM, Swank DJ, Boonstra O, Knipscheer BC, Klinkenbijl JH, Goor H. Randomized clinical trial of ultrasonic versus electrocautery dissection of the gallbladder in laparoscopic cholecystectomy. Br J Surg. 2003;90(7):799-803.
15. Lamont T, Watts F, Panesar S, Fie J, Matthew D. Early detection of complications after laparoscopic surgery: summary of a safety report from the National Patient Safety Agency. BMJ. 2011;342:7221. Kandil T, Nakeeb A, Hefnawy E. Comparative study between clipless laparoscopic cholecystectomy by harmonic scalpel versusconventional method: a prospective randomized study. J Gastrointest Surg. 2010;14(2):323-8.