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Comparative study of monopolar electrocautery versus ultrasonic dissection of gall bladder in laparoscopic cholecystectomy: A prospective observational study

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Abstract

Aims and Objectives: To compare monopolar electrocautery versus ultrasonic dissection of gall bladder in laparoscopic cholecystectomy in terms of duration of surgery, intra-operative complications, post-operative drain used, post-operative pain and duration of hospital stay.

Methods

Set up: A tertiary care hospital-based study in the department of General Surgery, IGMC, Shimla.

Study Period: One-year w.e.f.1st July 2019 to 30th June 2020.

Setting: This study was done in the Department of General Surgery at Indira Gandhi Medical College and Hospital, Shimla w.e.f.1st July 2018 to 30th June 2019 on 100 patients admitted for laparoscopic cholecystectomy, randomly divided into 2 groups; Group 1- dissection done with harmonic scalpel, Group 2- dissection done with electrocautery.

Study Design: Observational study

Parameters recorded: A) Intra-operative - operative time, intra-operative gall bladder perforation and blood loss, number of times lens cleaned during surgery, use of drain;

B) Post-operative - post-operative pain, length of hospital stay, post-operative complications.

Results: The patients in these two groups were similar as regards to age, sex, symptomatology, general & systemic examination and laboratory investigations. Data was analysed and the following observations were made: Gallstones were more common in females. Majority of the patients belonged to the middle age group (40-59 yrs). In the present study perforation of gall bladder occurred in 24% of cases in group 1 as compared to 38% of cases in group 2, lens was cleaned less frequently in group 1 as compared to group 2, drain was used in 24% of patients in group 1 whereas it was used in 40% of patients in group 2, The total duration of surgery was shorter in harmonic group. Mean intra-operative blood loss, pain score at 6 & 24 hours in Group 1 was less than in Group 2, Mean duration of hospital stay was 1.64 +- 0.66 days in group 1 and 2.88+- 1.09 days in group 2.

Conclusion: The harmonic scalpel use for dissection of gall bladder offers various advantages over conventional use of monopolar electrocautery in terms of safer dissection, lesser duration of surgery, decreased number of times lens cleaned intra-operatively, lesser post-operative pain and lesser duration of hospital stay. These factors result in lesser morbidity to patient and early recovery.

Keywords: Laparoscopic cholecystectomy, cholelithiasis, gall bladder, ultrasonic dissection, monopolar electrocautery

Introduction

Symptomatic Cholelithiasis is a common disease with incidence of 10-25% ^[1]. Laparoscopic cholecystectomy is the "Gold Standard" for the treatment of symptomatic gallstone disease. It has the advantages of less post-operative pain, better cosmetic results, shorter hospital stay, early return to work and is cost effective ^[2].

Though laparoscopic cholecystectomy is considered a safe procedure, local thermal injuries and distant tissue damage caused by monopolar electrocautery are common problems. During dissecting gall bladder from the liver bed by monopolar electrocautery, the incidence of gall bladder perforation during Laparoscopic cholecystectomy is 20-40%. Perforation of gall bladder and spillage of bile and stones disrupts the flow of surgery and prolongs its duration ^[3-4].

Ultrasonic dissection is an alternative to monopolar electrocautery during laparoscopic cholecystectomy. It generates less thermal injury, produces a smaller zone of tissue damage and more precise dissection. The incidence of gallbladder perforation is also low with ultrasonic dissection as compared to monopolar electrocautery during laparoscopic cholecystectomy. Ultrasonic dissection produces a minimal amount of smoke and char resulting in faster dissection and also provides an enhanced vessel sealing capacity and is less traumatic to the patient [5-6]. The present study is conducted to compare the use of monopolar electrocautery and ultrasonic dissection of gall bladder in laparoscopic cholecystectomy in terms of intra-operative and post-operative parameters.

Methods

- A prospective observational study was undertaken in Department of General Surgery, Indira Gandhi Medical College and Hospital, Shimla, H.P. after taking clearance from Ethical committee.
- It included 100 patients undergoing laparoscopic cholecystectomy.
- Patients were randomly divided into 2 groups – Group 1 and Group 2.
- Group 1 included patients undergoing laparoscopic cholecystectomy in whom gall bladder dissection was done by ultrasonic harmonic scalpel.
- Group 2 included patients undergoing laparoscopic cholecystectomy in whom gall bladder dissection was done by monopolar electrocautery.
- Case reporting forms were used for data entry.
- Patients were taken up for laparoscopic cholecystectomy and the surgery was performed by consultants using a uniform technique of laparoscopic cholecystectomy involving 4 ports, with the surgeon and assistant positioned as in the standard North American approach.
- In Group 1 patients, dissection of calot’s triangle and gall bladder from liver bed was done using harmonic scalpel.
- In Group 2, monopolar electrocautery was used for calot’s dissection and gall bladder dissection from liver bed done using hook/spatula.

The following parameters were recorded in each group

1. Intra-operative parameters

- Operative findings – status of gall bladder, adhesions, calot’s triangle anatomy, gall bladder perforation leading to bile or stone spillage, bleeding, use of Haemostat (Spongostan/Surgicel) and number of times lens was cleaned.
- Duration of surgery.
- Bleeding – assessed by gauze visual analogue method and % saturation of gauze piece [Table 1].
- Use of drain.

2. Post-operative parameters

- Post-operative pain at 6 hour and 24 hours – pain score from Modified Early Warning System [7] used [Table 2].
- Duration of hospital stay (days)
- Nature and amount of drainage in drain (when used)
- Any post-operative complication

Data was collected, compiled and analysed using Epi-info version 7.2.4.0 and P-value <0.05 was considered statistically significant.

Table 1: Bleeding – assessed by gauze visual analogue method and % saturation of gauze piece

Size of gauze (in cm.)	25% soaked	50% soaked	75% soaked	100% soaked
10x10	3 cc	6 cc	9 cc	12 cc
30x30	25 cc	50 cc	75 cc	100 cc
45x45	40 cc	80 cc	120 cc	160 cc

Table 2: Modified Early Warning System

0	No pain at rest; no pain on movement
1	No pain at rest; slight pain on movement
2	Intermittent pain at rest; moderate pain on movement
3	Continuous pain at rest; severe pain on movement

Results

Data was collected, analyzed and following inference was drawn:

Table 3: Data was collected, analyzed and following inference was drawn

Parameters	Group 1 (mean)	Group 2 (mean)
Mean Age	48.36 years	44.96 years
Intra-op bile/stone spillage	12%	17%
Gall bladder perforation	24%	38%
Frequency of lens cleaning	2.42 ± 0.99	3.68 ± 0.91
Intra-operative blood loss	40 cc	53 cc
Use of drain	24%	40%
Use of haemostat	38%	40%
Pain score at 6 hours	2.70	2.92
Pain score at 24 hours	1.06	1.36
Duration of surgery	40 minutes	50 minutes
Duration of hospital stay	1.64 days	2.88 days

Discussion

Cholecystectomy is presently one of the most common laparoscopic surgery performed worldwide. Although, it is a safe technique and considered gold standard treatment for cholelithiasis, several reports have pointed out injuries and complications which includes possible tissue damage by high-frequency electro-cautery involving vascular and biliary structures in the vicinity of the cystic duct and artery, bile leakage, visceral and solid organ injuries. Most electrocautery injuries go unrecognized during surgery or present late. But injury such as gallbladder perforation during laparoscopic cholecystectomy may greatly hinder the surgical procedure by leading to inevitable spillage of bile and stones into the peritoneal cavity. This may prolong the surgical procedure and have serious consequences.

The ultrasonically activated (Harmonic) scalpel was designed as a safe alternative to electro-cautery for the haemostatic dissection of tissue as it eliminates the unrecognized electrical arcing injuries, generates less thermal injury, and produces a smaller zone of tissue damage, a more precise dissection and no production of smoke. It is also safer to use in patients with artificial pacemaker.

The rate of gall bladder perforation in present study were 24% in group 1 and 38% in group 2. Janssen *et al.* [8] reported that the gallbladder perforation with stone spillage was 6 times higher in the electro-cautery group than the ultrasonic dissection group. There is no smoke production when using harmonic scalpel. Thus, the frequency of lens cleaning was more in group 2 as compared to group 1, ultimately leading to less duration of surgery in group 1 than group 2 (40 ± 8.63 minutes versus 50.8

\pm 9.33 minutes). Shorter mean duration of surgery in the ultrasonic dissection group may be attributed to several factors. The Harmonic Ace is a multifunctional instrument; it replaces 4 instruments routinely used in laparoscopic cholecystectomy: namely, the dissector, clip applier, scissors and electrosurgical hook or spatula. Finally, the activation of the ultrasonic dissector does not produce smoke and allows the surgeon to work in a clear operative field throughout the operation^[9].

The intra-operative blood loss was 38.92 ± 35.53 cc in Group 1 and 52.90 ± 46.35 in Group 2. Bleeding during LC either from a slippage of clips from the cystic artery or bleeding from the Gall Bladder fossa may make the operating field blurred, which may pose an advertent injury to the biliary system and prolongs the operating time. Bleeding from the liver bed is also a commonly encountered problem that prolongs the operating time, as it takes time to control diffuse bleeding from the liver bed. Electrocautery with the ball tip is conventionally used to stop bleeding from the GB fossa; however, the crust formation and stickiness of electrocautery make the use of such an instrument difficult^[9]. The smoke emitted from the electrocautery also makes the operating field hazy and delays the identification of the bleeding point. A harmonic scalpel with a hook and ball dissector has the advantage of stopping the bleeding without producing smoke.

There was a statistically significant reduction in post-operative pain and duration of hospital stay in Group 1 patients as compared to Group 2. Mean pain score at 6 and 24 hours was 2.70 and 1.06 in Group 1 and 2.92 and 1.36 in Group 2. Jain S. *et al.*^[10] noted that post-operative pain was significantly less in the harmonic shear group. This is attributed to less release of inflammatory mediators, as there is less lateral tissue and nerve damage. Also, the duration of peritoneal distension is less due to the shorter surgery duration, thereby directly affecting the duration and degree of traction to vessels and nerve.

The mean duration of hospital stay was 1.64 days in Group 1 and 2.88 days in Group 2. This decrease might be due to shorter operation time, better haemostasis, lesser complications and early recovery in patients.

Overall, the ultrasonic harmonic scalpel has been emerging as a better method for dissection during laparoscopic cholecystectomy and has almost replaced electrocautery in modern era laparoscopic surgeries.

Conclusion

Laparoscopic Cholecystectomy is the gold standard for treatment of gall stones. Since its inception the energy sources used for dissection have evolved in form of monopolar electrocautery to ultrasonic harmonic scalpel.

In this study the use of harmonic scalpel technology in laparoscopic cholecystectomy offered significant advantages over traditional electrocautery in a number of relevant outcomes, including lesser duration of surgery, decreased number of times lens cleaned intra – operatively, decreased post-operative pain, lesser duration of hospital stay. Whereas it was found to be comparably better option in terms of less incidence of Intra – operative gall bladder perforation, blood loss & usage of drain. In conclusion Ultrasonic harmonic is a safe, effective method of laparoscopic dissection in gallbladder stone disease with added advantage over Monopolar electrocautery in terms of safer dissection.

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