Harmonic Scalpel Assisted Laparoscopic Cholecystectomy Vs Monopolar Assisted Laparoscopic Cholecystectomy

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ABSTRACT

Introduction: Laparoscopic cholecystectomy is the standard of care for Gall Stone diseases. Conventionally monopolar energy source is used for dissection of cystic artery and duct and dissection of Gall Bladder from GB fossa. There are high risk of thermal injury and biliary complications, more visceral and solid organ injury due to frequent exchange of instruments. All these factors lead to increased operating time and complications. The use of harmonic assisted laparoscopic cholecystectomy has decreased the operating time and complications. The objective of this study was to compare Harmonic assisted Laparoscopic cholecystectomy with conventional monopolar energy.

Material and Methods:- This prospective study was carried out on 158 patients which were randomly assigned to either group. Total 75 patients were present in conventional monopolar assisted LC and 83 patients in Harmonic assisted LC.

Result: This study reveals that in harmonic assisted Laparoscopic cholecystectomy time taken for surgery is less, minimal thermal dispersion of energy, reduced requirements of analgesics, reduced incidence of bleeding and GB perforation.

Conclusion: Harmonic Assisted Laparoscopic Cholecystectomy advantage over Conventional Monopolar Assisted Laparoscopic Cholecystectomy with respect to operating time, postoperative pain, and perioperative complications. Thus its use should be advocated where Facilities are available.

Keywords: harmonic Scalpel Assisted Laparoscopic Cholecystectomy (HLC), Conventional Laparoscopic Cholecystectomy (CLC), Monopolar Devices

INTRODUCTION

Laparoscopic Cholecystectomy has become increasingly common since 1980 and has replaced open cholecystectomy as the standard of care.[1,2] The laparoscopic approach causes less mortality and morbidity compared to conventional cholecystectomy. It also offers the advantage of being minimal invasive, less hospital stays, less post-operative pain and early recovery.[3-5]

The conventional Laparoscopic cholecystectomy uses monopolar hook and other instruments for dissection and titanium clips for cystic duct and cystic artery occlusion. Alternative techniques were also devised like linear staples, endoloops /sutures, but were hardly used. The use of monopolar energy source for dissection is associated with high risk of thermal injury and more biliary complications, more visceral and solid organ injury due to frequent exchange of instruments.[6] There are also higher chances of slippage of titanium clips due to change of instruments during surgery.[7-10] With the use of electrocautery, there is excessive smoke production and hence diminishes the vision. Hence there is increased chances of lateral tissue damage.

The ultrasound scalpel relies on the application of ultrasound within the harmonic frequency range of tissue and allows simultaneous coagulation and cutting.[11] The temperature created and lateral spread of energy are lower than caused by monopolar hooks and thus reducing the risk of tissue damage.[12-14] The harmonic scalpel can seal luminal structures upto 5mm thickness and thus can be used to divide cystic artery and duct. It has been shown an effective method in various studies.[15-18] However, the diameter and thickness of cystic duct varies considerably due to the pathology like fibrosed gall bladder, acute/chronic cholecystitis. Hence the fear of bile leak precludes the use of total clipless laparoscopic cholecystectomy. Using harmonic scalpel for complete procedure except the clipping of cystic duct may provide the advantage of shorter operating time, less bleeding and other complications when compared to conventional laparoscopic cholecystectomy.[19] Hence this study was done to asses the role of harmonic scalpel in laparoscopic cholecystectomy, where whole procedure was done with harmonic scalpel except the clipping of cystic duct which was done by titanium clips, as compared to conventional laparoscopic cholecystectomy.

Aim

The aim of this study was to compare the operating time and various perioperative complications between the harmonic scalpel assisted laparoscopic cholecystectomy (HLC) and conventional laparoscopic cholecystectomy (CLC) where monopolar devices are used.

Method

This randomized study was carried out prospectively on 158 patients with symptomatic cholelithiasis who underwent cholecystectomy between Jan 2017 to June 2018 at Military

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Hospital Dehradun. All the surgeries were performed by two surgeons, hence there was not much variations in the expertise available. All the surgeries were performed under general anesthesia.

Following patients were excluded from the study: -

Patients with acute cholecystitis were excluded from the study.

Laparoscopic cholecystectomy combined with some other procedure.

Laparoscopic cholecystectomy with CBD exploration.

Complication of laparoscopic cholecystectomy in form of CBD injury recognized pre-operatively.

Suspected GB Carcinoma and pregnant woman.

The patients were randomly allocated to either CLC or HLC group. For group A patients the conventional four port cholecystectomy was performed. After obtaining pneumoperitoneum, cystic artery and duct were dissected and clipped using titanium clips and then divided. Gall Bladder was separated from the GB fossa using monopolar hooks.

Group B patients allocated under HLC group were started with standard four port cholecystectomy. Pneumoperitoneum was obtained with carbon dioxide. The anatomy of Calot's triangle was well delineated to confirm for any variations. Cystic duct was clipped with titanium clips and divided. Further Harmonic scalpel was used wherever energy source was required. Gall Bladder was separated from GB bed using harmonic scalpel.

The primary outcome parameter studied was operating time which was calculated in minutes. The other parameters which was compared was postoperative pain, Surgical Site infection (SSI), significant bleeding and gall bladder perforation appearing intraoperatively.

RESULT

A total of 158 patients were part of this study in which 75 patients were included in group A (CLC) and 83 were in group B(HLC). the demographic profile of the patients in both the groups was comparable.

Age distribution

In the study the participants were from age group 24-73 in CLC and 21-69 in HLC group. This shows that cholelithiasis is more common in age greater than 40 years (table-1).

Age group	No of patients in Group A	No of patients in Group B	Total
20-30	10	11	21
30-40	19	21	40
>40	46	51	97
Total patients	75	83	158

Table-1: Age Distribution

Sex Distribution

Out of all patients in the study, 27 were male and 131 were female showing that Gall Bladder disease is more common in female. This clearly shows that cholelithiasis is more common in females (table-2).

Sex	No of patients in Group A	No of patients in Group B	Total
Male	13	14	27
Female	62	69	131
Total patients	75	83	158

Table-2: Sex Distribution

Body Mass Index (BMI)

Out of all patients 102 patients had BMI less than 30 while 56 patients had BMI greater than 30 (table-3).

BMI	No patients in Group A	No of patients in Group B	Total
<30	48	54	102
>30	27	29	56
Total	75	83	158

Table-3: BMI

Average Duration of Surgery

The mean duration of completing surgery in HLC group was 41 min, ranging from minimum 23 mins to maximum 64 mins. The mean duration of time required to complete surgery in CLC group was 59 min with minimum and maximum time required was 49 and 87 respectively. This shows that average duration of surgery was significantly reduced in Harmonic assisted Laparoscopic cholecystectomy (table-4).

Surgery duration	Group A	Group B
Minimum	49	23
Maximum	87	64
Mean	59	41
Median	56	39

Table-4: Duration of Surgery

Intraoperative complications

Two variables of intraoperative complications (Significant bleeding and gall bladder perforation) was compared in CLC

Intraoperative complications	Group A	Group B
Significant bleeding	6(8%)	2(2.41%)
GB Perforation	5(6.67%)	3(3.62%)

Table-5: Intraoperative complications

Pain Variable	Group A	Group B
Time when first Injectable analgesics required (in hours)	8.8 Hrs	10.6 Hrs
No of inj analgesics required (mean)	1.4	1.1
No of oral analgesics required(mean)	3.2	3.0

Table-6: Postoperative analgesic requirement

Variables	Group A	Group B
Intra-abdominal collection	2(2.66%)	00
SSI	7(9.33%)	3(3.61%)

Table-7: Postoperative complications

and HLC group. In CLC group 6(8%) patient had significant bleeding resulting in increased operative time and consequent drain placement, while in HLC group only 2(2.4%) had significant bleeding. 5(6.67%) patient in CLC group has gall bladder perforation resulting in bile leakage and increased operative time, while in HLC group there were only 3(3.62%) patient who had gall bladder perforation (table-3).

Postoperative Analgesia

Intraoperatively Gall Bladder bed and subdiaphragmatic space was instilled with Inj Bupivacaine 5ml and 3ml each in all the patients to reduce the pain. Post operatively patients were given injectables analgesics when it was asked by the patient. From postoperative day 1 only oral diclofenac was given when asked by the patient. The time after which first injectable analgesics were given was higher in HLC group than CLC group probably because of less energy requirement and less collateral tissue damage. No of oral diclofenac tablet required on first postoperative day was almost same (table-6).

Postoperative complications:

Two postoperative complications were compared in CLC and HLC group. Total two patients had postoperative intrabdominal collections which was detected by ultrasound when patient was complaining of persistent pain in postoperative period. Both these patients were from CLC group. Both the patients were managed conservatively and follow up ultrasound showed resolution of collection. Total 10(6.32%) patients had superficial SSI, out of which 7(9.33%) patient were from CLC group and 3(3.61) patient were from HLC group. All the patients were managed conservatively to which they responded well (table-7).

DISCUSSION

Symptomatic cholelithiasis is one of the most commonly encountered disease in outdoor setting as well as in hospital settings.[20,21] Laparoscopic cholecystectomy has become the standard of care for Gall stone diseases. Conventionally monopolar energy source has been used for cholecystectomy in which incidence of bleeding and Gall bladder perforation rate is more. Moreover, there is excessive production of smoke producing blurring of vision.

There have been various studies where harmonic scalpel has been used for entire surgery.[15-18] This is based on the concept that harmonic scalpel can seal vessel upto 5mm diameter. In our study entire dissection was carried out with Harmonic Scalpel except clipping of cystic duct, where titanium clips were used. This was done to reduce the bile leakage from the divided cystic duct. Predicting the cystic duct diameter in patients with previous cholecystitis or cholangitis is difficult. Use of radiological means to detect cystic duct size is expensive and time consuming.

The use of Harmonic scalpel reduces the total operating time compared to conventional laparoscopic surgery (mean 41 min versus 59 min). This can be explained by the fact that one instrument (harmonic scalpel) replaces dissector, clip applicator, scissors and electrosurgical hook. So, there is no exchange of instrument. As there is less production of smoke, there is minimum requirement of camera lens to taken out and cleaned.

Bleeding during LC occurs mainly from slippage of clips applied on cystic artery or from GB fossa. The safety of harmonic scalpel for effective occlusion and division has been shown in studies.[22] The bleeding from GB fossa is effectively controlled by using harmonic hook as it produces less smoke. Out of 83 patients in HLC group only 02 patients had significant bleed which was controlled laparoscopically only. However, in CLC group 06 patients had significant bleed in which 01 was converted to open cholecystectomy for effective control of bleeding.

GB perforation is one of the most common intraoperative complications while doing LC. It causes operating procedure long and difficult due to continuous leakage of bile. It is mainly caused due to traction by grasper and tissue damage due to use of energy source. The Harmonic scalpel reduces the lateral thermal spread and decreases the GB perforation rate. In our study 05 patients in CLC group and 03 patients in HLC group has GB perforation.

Pain in the postoperative period is mostly due to visceral irritation. The lateral shear of monopolar energy spreads upto 0.5 cms compared to 1.5 mm in ultrasonic devices. In our study the postoperative pain and the requirement of analgesia is reduced in HLC group is less as compared to CLC group.

The risk of SSI depends on various factors like duration of surgery, spillage of bile, nutritional status of patients, any comorbidities. The rate of SSI is less in laparoscopic surgery is less compared to the open surgery. In our study 07 patients had SSI in CLC group compared to 03 patients in HLC group. All cases were superficial SSI which was managed conservatively.

CONCLUSION

Laparoscopic cholecystectomy performed with ultrasonic devices is effective and feasible. This method offers considerable advantages, such as decreased total operating time, minimal thermal dispersion of energy, reduced requirements of analgesics, reduced incidence of bleeding and GB perforation. The incidence of SSI and intraperitoneal collection was less in HLC group but it was not significant. The main hinderance for total clipless surgery is the cystic duct size as assessing the size of cystic duct in patients with cholecystitis or cholangitis is difficult.

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