

Research Article

Comparison of Direct Pressure versus Electrocauterization of Liver Bed for Bleeding Control in Laparoscopic Cholecystectomy

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Abstract

Background: Gallstones are very common worldwide with a prevalence of 6% in men and 29% in women of all ages. Laparoscopic cholecystectomy is the gold standard treatment for gallbladder diseases associated with frequent complication of haemorrhage. Applying direct pressure or electrocauterization can be used for securing hemostasis and pain control.

Objective: To compare hemostatic control by direct pressure versus electrocauterization while dissecting the gall bladder from liver bed during laparoscopic cholecystectomy in terms of intra-operative bleeding, Post-operative bleeding and pain.

Methods: This randomized controlled trial was conducted at Surgical Unit of Mayo Hospital Lahore. Total 200 patients were enrolled, in 100 patients haemorrhage from liver bed was controlled by applying direct pressure with the help of gauze for 5 minutes (Group A) and remaining 100 patients (Group B) it was controlled by electrocauterization. Intra-operative bleeding, post-operative bleeding, and post-operative pain scores were recorded and all patients were discharged after 24 hours of close monitoring.

Results: The mean age of cases in A Group and B group was 40.38 ± 12.30 and 42.15 ± 10.40 years respectively. Intraoperative bleeding was secured in 85 (85%) patients in Group-A and in 96(96%) patients in Group-B. Group-B treatment was more effective than Group-A treatment for bleeding (p-value= 0.008). Mean pain score of patients at 12th hour was 4.76 in group A and 5.55 in Group B. It was 3.09 in group A and 3.60 in group B at 24th hour postoperatively with p-value of 0.0001.

Conclusion: Electrocauterization is a better technique for hemostasis of liver bed in comparison with direct pressure during laparoscopic cholecystectomy.

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Key Words: Direct pressure, Electrocauterization, Laparoscopic cholecystectomy, Liver bed, Intraoperative bleeding, Post-operative bleeding, Bleeding control, Postoperative Pain.

Introduction

Gallstones are very common worldwide with prevalence of 6% in men and 29% in women of all ages¹. Laparoscopic cholecystectomy is the gold standard treatment for gallbladder diseases (Gall Stones)².

Hemorrhage is the frequent complication of laparoscopic

removal of gall bladder.³ It can be a challenging event, if ample and unmanageable haemorrhage abruptly concealed the vision which leads to the conversion of laparoscopic cholecystectomy into an open procedure⁴. Hemostatic methods used in laparoscopic cholecystectomy are monopolar electrocautery, bipolar electrocautery, ultrasonic coagulator and direct pressure on the liver bed⁵.

In this study we elaborated an easy and effective method to stop the bleeding from the liver bed in such situation. The hemostasis of small direct tributaries coming from liver bed during laparoscopic cholecystectomy, is either to apply direct pressure with hot sponge for few minutes or by electrocauterization⁶.

One study of four hundred and fifty one cases conducted in the department of general surgery, King Edward medical university, Lahore demonstrated the effectiveness of application of direct pressure and other modes of hemostasis for the liver bed in laparoscopic cholecystectomy and revealing the direct pressure application as 83 Percent effective for the bleeding control.⁷

Another Study was done at Al-Jamhori teaching hospital in Mosul, in which 320 patients underwent laparoscopic cholecystectomy, they demonstrated that the electrocautery effectiveness was 65% for securing hemostasis in laparoscopic cholecystectomy.⁸

The rationale of this study is to evaluate the effectiveness and safety of direct pressure compared to electrocauterization for securing hemostasis and pain control. Previously there was no such study which directly compared the both techniques as we have done. But most of the studies have used electrocautery with other modalities for controlling per-operative bleeding during laparoscopic cholecystectomy. So in this study we compare direct pressure and electrocauterization for hemostasis of liver bed in laparoscopic cholecystectomy as these two methods are internationally acceptable.

Methods:

All patients undergoing laparoscopic cholecystectomy between ages of 12 to 70 years having cholelithiasis, confirmed on Ultrasound of either gender were included in the study and admitted through outdoor patient department of North Surgical Unit of Mayo Hospital Lahore from July 2018 to January 2019. Patients having history of bleeding disorder, previous multiple abdominal surgeries, gall bladder mass or Ascites confirmed on ultrasonography were excluded from the study. All the patients that presented during the study period and fulfilled the inclusion and exclusion criteria were enrolled in the study through non-probability, purposive sampling technique following inclusion and exclusion criteria. Research analysis carried out after approval from the Institutional Review Board and ethical committee with registration no. 41/RC/KEMU. Sample size of

200 patients (100 patients in each group) is estimated by using 5% level of significance, 90% power of test with expected percentage direct pressure as 83%⁷ and electrocauterization as 65%⁸. The demographic information including name, age, gender, address was collected through pro-forma after taking informed consent from patient. All admitted patients were divided into two groups by lottery method. All patients underwent three ports laparoscopic cholecystectomy by the consultant surgeon (having experience of five years in laparoscopic surgery). Cystic duct and cystic artery was secured with clips and cystic artery is dissected with electrocautery. Gall bladder was dissected from liver bed with the help of L Hook. In Group A bleeding from liver bed was controlled by applying direct pressure with the help of gauze for 5 minutes (which if not succeeded then considered dropout and managed by other hemostatic technique which include bipolar electrocautery and clipping). In Group B, bleeding was controlled by monopolar electrocauterization (which if not succeeded then considered dropout and managed by other hemostatic techniques). Primary outcome variable was Ooze (blood spillage) from gall bladder fossa which changes colour of gall bladder bed after removing gall bladder during laparoscopic cholecystectomy assessed by the surgeon. Secondary outcome variable was postoperative bleeding from gall bladder bed which was assessed within 24 hours of the operation, with radiological findings on ultrasound (more than 10ml) consistent with hematoma or collection of blood more than 10 ml in drain and postoperative pain was analyzed by visual analogue scale abelling 0-3 (mild), 4-7 (moderate) and 8-10 (severe). Pain score was calculated at 6, 12 and 24 hours postoperatively and routine analgesics were given (Intravenous ketorolac 30mg 8 hourly). Collected data was entered to SPSS version 21 and was analyzed. Quantitative data like age and pain score was described as mean $\pm$ SD. Qualitative variables like gender, per-operative bleeding, post-operative bleeding was described as frequencies, percentages and proportions. Comparison of outcome for pain score between two groups Direct Pressure and Electrocauterization was done with the help of independent sample t-test and for per operative and post operative bleeding with Chi Square test. P-value $\leq$ 0.05 was considered significant.

Results:

In this study, mean age of patients in Group-A and in Group-B was 40.38 ± 12.30 and 42.15 ± 10.40 years respectively. In Group-A 13(13%) patients were

male and 87 (87%) were female. While in Group-B 10 (10%) patients were male and 90 (90%) were female. Intraoperative bleeding was secured in 85(85%)

patients in Group-A and in 96 (96%) patients in Group-B, p-value = 0.008, Table 1.

Table-1: Intraoperative bleeding status and drain placement

Intraoperative bleeding status in Treatment Groups				
	Group-A	Group-B	Total	P-Value
Secured	85 (85%)	96 (96%)	181	0.008
Unsecured	15 (15%)	4 (4%)	19	
Total	100	100	200	
Drain placed in Treatment Groups				
Yes	16 (18.8%)	11 (11.4%)	27	0.165
No	69 (84%)	85 (89%)	154	
Total	85	96	181	
Collection of blood in Drain (>10 ml/24 Hours) in Treatment Groups				
Yes	0 (0%)	0 (0%)	00	
No	16 (100%)	11 (100%)	27	
Total	16	11	27	
Postoperative hematoma on Ultrasound after 24 hours in Treatment Groups				
Yes	0 (0%)	0 (0%)	00	
No	85 (100%)	96 (100%)	181	
Total	85	96	181	

Table-2: Pain Score at 6,12 and 24 hours

Pain status at 6 th hour in treatment groups			
	Group-A	Group-B	P-value
N	85	96	0.000
Mean	7.55	6.75	
SD	0.62	1.35	
Minimum	6.00	3.00	
Maximum	9.00	9.00	
Descriptive statistics for Pain status at 12 th hour in treatment groups			
N	85	96	0.000
Mean	4.76	5.55	
SD	0.97	1.23	
<i>Minimum</i>	3.00	2.00	
<i>Maximum</i>	7.00	8.00	
<i>Pain status at 24th hour in treatment groups</i>			
<i>N</i>	<i>85</i>	<i>96</i>	<i>0.000</i>
<i>Mean</i>	3.09	3.60	
<i>SD</i>	0.68	1.10	
<i>Minimum</i>	2.00	1.00	
<i>Maximum</i>	6.00	7.00	

Drain was placed in 16 (18.8%) out of 85 patients in Group-A and in 11 (11.4%) out of 96 patients in Group-B. In Group-A 0 (0%) patients out of 16 and

in Group-B 0 (0%) patient out of 11 had collection of blood > 10ml/24 Hours. In Group-A 0 (0%) patients out of 85 and in Group-B 0 (0%) patient out of 96

had Postoperative hematoma on ultrasound after 24 hours. At 6th hour mean pain score in Group-A and in Group-B showed significant difference. i.e. Group-A: 7.55 ± 0.62 vs. Group-B : 6.75 ± 1.35 , p-value = 0.000. At 12th hour significant difference was seen in mean pain score in both treatment groups. i.e. Group-A: 4.76 ± 0.97 vs. Group-B: 5.55 ± 1.23 , p-value=0.000. At 24th hour also significant difference was seen in mean pain score in Group-A and in Group-B patients. i.e. 3.09 ± 0.68 and 3.60 ± 1.10 , p-value = 0.000, Table 2.

Discussion:

In surgical centers the operative procedures involving extensive coverage, laparoscopic cholecystectomy is the standard surgical method for patients with symptomatic gallstone disease and other benign gallbladder diseases.⁹ It is the preferred due to less post-operative pain, short hospital stay, better cosmetic results and earlier return to work. It is accepted as a gold standard treatment for gall bladder surgery.¹⁰ But this laparoscopic cholecystectomy that is currently being frequently performed for gallstones has numerous complications.¹¹ The known complications are bile duct injuries with an incidence of 0.6%¹² and intraoperative bleeding with an incidence of less than 2%¹³. During Laparoscopic cholecystectomy the most life threatening complication is haemorrhage¹⁴. It can occur from any site during the procedure e.g port site, cystic artery, right hepatic artery, inferior vena cava and liver bed. Mostly the bleeding complications occur in acute cases because of adhesions, increased vascular supply and friable tissue due to inflammation, where surgeons encounter difficulty in dissecting calot's triangle⁷.

The well known methods to the achieve hemostasis from the gallbladder bed are; use of electro-cautery, Liga Sure, laparoscopic suture placement and direct pressure with a surgical gauze.

In this study we compared the outcome of direct pressure versus electrocauterization for hemostasis control of liver bed during laproscopic cholecystectomy. Our results showed that the efficacy of direct pressure for securing bleeding was significantly lower as that of electrocautrization (85% vs. 96%, p-value = 0.008).

One recent study reported the hemostasis efficacy for direct pressure and endoclip technique as 83% and 100%⁷. However in our study the efficacy of direct

pressure for controlling haemorrhage was higher than that of mentioned in the above study.

Chan et al., (2000) reported in his study that endovascular gastrointestinal anastomosis stapler is helpful in securing bleeding but malfunction may occur leading to significant blood loss and subsequently need for conversion to open procedure. In these cases vigorous bleeding did not allow immediate placement of clip and hemostasis was secured with the direct pressure by using surgical gauze and 10 mm smooth tipped spoon forcep instrument¹⁵.

Karne et al., (2014) observed that bleeding from liver bed occurred in 12.5% of the patients undergoing laparoscopic cholecystectomy. The incidence of bleeding from liver bed in acute cases was twice as compared to chronic cases¹⁶. Sahu et al., (2013) reported an incidence of densely adherent gall bladder to liver bed of more than 40% in cases with an acute attack of cholecystitis. They suggested that in such cases skeletonization, division and ligation of vessels becomes essential¹⁷. The reason for this difficulty is attributed to the fact that alteration of local anatomy occurs as a result of pericholecystitis and subsequently the cleavage plane between the gallbladder and liver bed is lost. These conditions predisposes the traversing vessels to the injury, when dissection of gallbladder from liver bed is attempted¹⁷.

In this study we have focused on another aspect of post-operative pain after laparoscopic cholecystectomy (LC). Studies have not compared / reported pain score in relation to use of different modalities for maintaining laparoscopic hemostasis. But we assessed pain score in both treatment groups postoperatively at 6th, 12th and 24th hour. Mean pain score of patients at 12th and 24th hour postoperatively was significantly higher in patients who underwent electro-cautery as compared to the direct pressure group.

Previous studies reported the use of the Harmonic scalpel with less postoperative pain but major cause may be a significantly shorter operative time for LC with Harmonic scalpel than with monopolar electrocautery¹⁸. However, Guanqun Liao study results showed that the two techniques were associated with similar post-LC pain and requirement for analgesics¹⁹. Karnail Singh in his study reported very low pain score post operatively in patients who underwent Laparoscopic Cholecystectomy with the use of electrocautery technique²⁰.

Kari et al in his study reported that monopolar electrocautery can be used to manage cystic artery in laparoscopic gallbladder removal²¹. Redwan AA. in his study reported that the harmonic scalpel as well as clip or electrocautery was effective in laparoscopic cholecystectomy attaining hemostasis with short operative time²².

In this study hemorrhage was successfully controlled by both electrocautery and direct pressure application for 5 minutes. End suturing was performed in those four cases in which direct pressure application and electrocautery was not sufficient to halt bleeding. Multiple strategies discussed in literature to control hemorrhage during laparoscopic cholecystectomy including direct pressure application, cauterization, endocliping and endosuturing⁷. The advantage of electrocautery was that it reduces the time consumption peroperatively with decreased chances of converting laparoscopic surgery into open procedure. Meticulous hemostasis by electrocauterization reduces the chances of placing drain peroperatively which ultimately reduces the hospital stay of the patient and reduction in hospital cost.

Electrocautery do not have risk of postoperative complications like clip slippage, dislodgement, rebleeding and ulceration. In other words it could be formulated that electrocautery is a better alternative to direct pressure and surgical clips in experienced hands²³. The time duration, cost aspect and accessibility makes electrocautery more feasible specially in a low resource setting. However, the depth of burn with electrocautery is less predictable and current can be conducted through non-insulated apparatus and trocars. So laparoscopic surgeon must work carefully while doing dissection of the Calot's triangle. Unnecessary and excessive dissection or electrocautery use near common bile duct should be avoided²⁴.

The study mainly focused on hemostatic control of liver bed during laparoscopic cholecystectomy. The choice of technique is largely dependent on surgeon's choice. However, if the hemorrhage from liver bed is severe then in such cases cauterization and pressure application may fail. Oversewing of the bleeding vessels may be the only solution in those cases.²⁵ Additionally in setups where more advanced techniques such as harmonic scalpels are routinely used the incidence of hemorrhage from liver bed may

reduce. The limitation of this study is that it was conducted at a single center and on a limited number of patients. Future research is needed on this subject with large number of patients from multiple centers.

Conclusion:

Electrocauterization is a better technique for hemostasis of liver bed in comparison with direct pressure during laparoscopic cholecystectomy.

Ethical Approval: Given

Conflict of Interest: The authors declare no conflict of interest

Funding Source: None

References:

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2016. CA: a cancer journal for clinicians. 2016;66(1):7-30.
2. Lee SI, Na BG, Yoo YS, Mun SP, Choi NK. Clinical outcome for laparoscopic cholecystectomy in extremely elderly patients. Annals of surgical treatment and research. 2015;88(3):145-51.
3. Bartlett EK, Vollmer CM. The Classification and Injury Patterns of Iatrogenic Bile Duct Injury During Laparoscopic Cholecystectomy. In Management of Benign Biliary Stenosis and Injury 2015. Springer, Cham.
4. Rashid T, Naheed A, Farooq U, Iqbal M, Barakat N. Conversion of laparoscopic cholecystectomy into open cholecystectomy: an experience in 300 cases. Journal of Ayub Medical College Abbottabad. 2016; 28(1):116-9.
5. Marvel S, Monnet E. Energy Devices and Stapling Equipment. Small Animal Laparoscopy and Thoracoscopy. 2015;3(4):58-64.
6. Carachi R, Agarwala S, Bradnock TJ, editors. Basic Techniques in Pediatric Surgery: An Operative Manual. Springer Science & Business Media; 2013.
7. Muhammad Y, Gondal KM, Ahmed A, Rasul HA, Mukhtar Z. Incidence of Bleeding from Anomalous Vessels in Liver Bed and Mode of Hemostasis in Patients Undergoing Laparoscopic Cholecystectomy. Journal of Fatima Jinnah Medical University. 2016;10(2):116-9.
8. Ahmad MM, Alsaffar S, Tahir E, Mahjob NK. Harmonic versus electrocautery in the dissection of gall bladder in laparoscopic cholecystectomy. Annals of the College of Medicine Mosul. 2013;39(2):107-12.
9. Lai EC, Yang GP, Tang CN, Yih PC, Chan OC, Li MK. Prospective randomized comparative study of single incision laparoscopic cholecystectomy versus conventional four-port laparoscopic cholecyste-

- ctomy. *The American Journal of Surgery*. 2011;202(3):254-8.
10. Kaushik R. Bleeding complications in laparoscopic cholecystectomy: Incidence, mechanisms, prevention and management. *Journal of minimal access surgery*. 2010;6(3):59.
11. Pisanu A, Reccia I, Porceddu G, Uccheddu A. Meta-analysis of prospective randomized studies comparing single-incision laparoscopic cholecystectomy (SILC) and conventional multiport laparoscopic cholecystectomy (CMLC). *Journal of gastrointestinal surgery*. 2012;16(9):1790-801.
12. Karanikas M, Bozali F, Vamvakierou V, Markou M, Chasan ZT, Efraimidou E, et al. Biliary tract injuries after lap cholecystectomy-types, surgical intervention and timing. *Annals of Translational Medicine*. 2016;4(9):19-23.
13. Chandrasinghe PC, De Silva A, Deen KI. Novel use of Absorbable Modified Polymer (AMP®); Endo Clot™ as an adjunct in the management of bleeding from the liver bed during laparoscopic cholecystectomy. *Springer Plus*. 2015;4(1):249.
14. Bansal SK, Chhabra UK, Goyal SK, Goyal PK, Bhayana S, Sharma C. A retrospective analysis of complications in 2348 cases of laparoscopic cholecystectomies. *Journal of Advanced Medical and Dental Sciences Research*. 2015;3(6):S36.
15. Chan D, Bishoff JT, Ratner L, Kavoussi LR, Jarrett TW. Endovascular gastrointestinal stapler device malfunction during laparoscopic nephrectomy: early recognition and management. *The Journal of urology*. 2000;164(2):319-21.
16. Karne M, Shakeel M, Tyagi A, Gaur S, Thakur SK. Laparoscopic Cholecystectomy: Causes, detection, management & prevention strategy in bleeding complications. *International Journal of Contemporary Surgery*. 2014;2(2):33-7.
17. Sahu SK, Agrawal A, Sachan PK. Intraoperative difficulties in laparoscopic cholecystectomy. *Jurnalul de chirurgie (Iași)*. 2013;2(1):149-55.
18. Kandil T, El Nakeeb A, El Hefnawy E. Comparative study between clipless laparoscopic cholecystectomy by harmonic scalpel versus conventional method: a prospective randomized study. *Journal of Gastrointestinal Surgery*. 2010;14(2):323-8.
19. Liao G, Wen S, Xie X, Wu Q. Harmonic scalpel versus monopolar electrocauterization in cholecystectomy. *JSLS: Journal of the Society of Laparoendoscopic Surgeons*. 2016;20(3):213-8.
20. Singh K, Gupta S, Kumar V, Garg V. Comparison of laparoscopic cholecystectomy performed using harmonic scalpel as the sole instrument or by using standard clip and electrocautery Technique. *International Journal of Contemporary Medical Research*. 2016;3(10):3043-6.
21. Katri KM, Bessa SS, Elnagah GA, El-Kayal ES. Is monopolar electrocautery safe and effective for control of the cystic artery during laparoscopic cholecystectomy?. *Journal of Laparoendoscopic & Advanced Surgical Techniques*. 2012;22(6):557-60.
22. Redwan AA. Single-working-instrument, double-trocar, clipless cholecystectomy using harmonic scalpel: a feasible, safe, and less invasive technique. *Journal of Laparoendoscopic & Advanced Surgical Techniques*. 2010;20(7):597-603.
23. Das RS, Talukdar M, Shaan AR. Monopolar electrocautery vs surgical clips in control of cystic artery in laparoscopic cholecystectomy: a comparative study. *Journal of Evolution of Medical and Dental Sciences*. 2016;5(33):1790-4.
24. Suliman E, Palade R?, Suliman E. Importance of cystic pedicle dissection in laparoscopic cholecystectomy in order to avoid the common bile duct injuries. *Journal of medicine and life*. 2016;9(1):44.
25. Strasberg SM, Gouma DJ. 'Extreme'vasculobiliary injuries: association with fundus-down cholecystectomy in severely inflamed gallbladders. *HPB*. 2012;14(1):1-8.