

Gallbladder Perforation with Conventional Monopolar Diathermy Versus Harmonic Scalpel in Laparoscopic Cholecystectomy at Combined Military Hospital, Quetta

Ghufran Ahmed, Imran Ashraf*, Abdul Jabbar**, Muhammad Ali Muazzam, Umair Ahmed***, Amir Ali****

Combined Military Hospital Quetta/National University of Medical Sciences (NUMS) Pakistan, *Combined Military Hospital Kharian/National University of Medical Sciences (NUMS) Pakistan, **Combined Military Hospital Badin/National University of Medical Sciences (NUMS) Pakistan, ***Mountain Battalion, Pakistan, ****Combined Military Hospital Mangla/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To estimate the frequency of gallbladder perforation with conventional Monopolar Diathermy versus Harmonic scalpel in laparoscopic cholecystectomy.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Surgery, Combined Military Hospital, Quetta Pakistan, from Sep 2018 to Sep 2019.

Methodology: A total of 160 patients undergoing laparoscopic cholecystectomy for symptomatic gallstones were included in the study and were randomly allocated into two groups based on the surgical technique of dissecting gall bladder from the liver bed. In Group-A, Monopolar Diathermy was used, and in Group-B Harmonic scalpel was used. Frequency of gall bladder perforation and demographic details were recorded on predefined proforma.

Results: In our study, mean age was 48.21 ± 8.94 years and 49.14 ± 9.31 years in Group-A and Group-B respectively. Comparison of Gallbladder perforation in both groups showed 17(21.25%) cases in Group-A and 5(6.25%) cases in Group-B, (p -value < 0.001).

Conclusion: In laparoscopic cholecystectomy, the frequency of gallbladder perforation with conventional monopolar diathermy is significantly higher compared to the harmonic scalpel.

Keywords: Conventional monopolar diathermy, Gallbladder perforation, Harmonic scalpel, Laparoscopic cholecystectomy.

How to Cite This Article: Ahmed G, Ashraf I, Jabbar A, Muazzam MA, Ahmed U, Ali A. Gallbladder Perforation with Conventional Monopolar Diathermy Versus Harmonic Scalpel in Laparoscopic Cholecystectomy at Combined Military Hospital, Quetta. *Pak Armed Forces Med J* 2022; 72(5): 1540-1543. DOI: <https://doi.org/10.51253/pafmj.v72i5.3903>

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Gall stones disease is a prevalent health issue, and the incidence of gallstone disease is exceeding worldwide. About 10% to 15% of the adult population suffer from gallstone disease in developed societies, an important health issue. In Asian countries, the prevalence of gallstone disease ranges from 3% to 10%.¹ Cirrhotic have been known to be more affected by gallstones as compared to non-cirrhotic patients. Most patients having gallstones are asymptomatic.² Most evidence-based studies indicate that 10% to 18% of those with asymptomatic gallstone disease develop biliary colic, and 7% require operative intervention. The complications of gallstones disease, such as acute calculus cholecystitis, biliary pancreatitis, and stone in the common bile duct, occurs in about 1% to 4% of the patients having gallstones.³ The incidence of gallbladder disease increases with age which is why gallstone disease is a major health issue in the old age population. The prevalent male ratio is 18% in the sixth

decade, with an increase to 29% in the ninth decade. A lot of surgical procedures have been started for gallstone disease since 1950. Laparoscopic cholecystectomy was started in 1989, which further increased the cholecystectomy rate. Open cholecystectomy was one of the most prevalent surgical procedures for gallstone disease.^{3,4}

Nevertheless, the gold standard procedure for cholelithiasis is laparoscopic cholecystectomy and a favourite substitute to open cholecystectomy.⁵ Laparoscopic cholecystectomy became the first surgical innovation that altered the way of abdominal surgery. For 15 years, a laparoscopic approach has been considered convenient for most surgical techniques. The laparoscopic approach in most surgical procedures has provided many advantages to the patient. Four port entries are created in laparoscopic cholecystectomy to deal with gallbladder resection. Veres' needle is used to create Pneumoperitoneum by inflating carbon dioxide gas in the abdominal cavity at a pressure of less than 15mm of Hg. During surgery, gallbladder perforation and bile spillage are common problems for surgeons, disrupting the flow of surgery. At present,

Correspondence: Dr Ghufran Ahmed, Department of Surgery, Combined Military Hospital, Quetta, Pakistan

Received: 25 Feb 2020; revision received: 15 Jun 2020; accepted: 17 Jun 2020

electro thermal energy is widely used as monopolar diathermy during laparoscopic cholecystectomy for dissection. Monopolar diathermy is, however, safe, but occasionally there can be an unrecognized transfer of energy in the operating field, causing electro thermal injury, which enhances the chances of gallbladder perforation and prolongs the operation timing.^{3,4}

For the last ten years, the Harmonic scalpel, an ultrasonically activated scalpel, has been used in laparoscopic cholecystectomy.³ The harmonic scalpel is an advanced ultrasonic cutting and coagulation device which has some important clinical advantages such as minimal smoke production, minimal heat generated tissue damage because of its greater precise technique, reduced ligature demand, and absence of electric currents running through the patient.^{5,6} Harmonic scalpel effects are produced by vibration in tissues which dissect the structures and can divide the vessels. Monopolar diathermy is believed to be more traumatic than Harmonic scalpel, and studies show that chances of gallbladder perforation are more with monopolar (40% with monopolar diathermy v. 16.7% with a harmonic scalpel) 5 and a local study suggests (14.5% with monopolar v. 6.4% with harmonic) but still commonly used worldwide.⁷

Another study manifested that Harmonic assisted laparoscopic cholecystectomy is better than conventional laparoscopic cholecystectomy because of the decreased duration of the procedure, lesser surgical complications and shorter postoperative hospital stay.^{8,9} On the other hand, monopolar diathermy is frequently used in our setups compared to the harmonic scalpel. Therefore, this study will evaluate the magnitude of the problem (gallbladder perforation) with both techniques.¹⁰ The study aimed to calculate the incidence of gallbladder perforation as regards the result of multiple studies so that we can use the better surgical technique to curtail the per-operative complications.

METHODOLOGY

This quasi-experimental study was performed at the Surgical Department of Combined Military Hospital Quetta from September 2017 to September 2018. The sample size was calculated using the WHO sample size calculator. The calculated sample size was 160, with 40% anticipated population prevalence in Group-1 and 16.7% anticipated population proportion in Group-2.¹¹ After getting permission from the Ethical Committee (Ex-23-05/READ-IRB/016), 160 patients

fulfilling the inclusion criteria were assessed by the non-probability consecutive sampling technique.

Inclusion Criteria: The patients of either gender, aged 20 to 60 with symptomatic gall stones, were enrolled for the study.

Exclusion Criteria: The patients having a previous abdominal surgical scar, diabetes mellitus, and mass gall bladder were not considered in the study.

Informed consent was taken for surgery using personal data for research. By lottery, patients were randomly allocated into Group-A (Monopolar Diathermy) and Group-B (Harmonic). Patients in both Groups underwent laparoscopic cholecystectomy. In Group-A, gallbladder dissection from the gallbladder bed was performed with Monopolar Diathermy. While in Group-B, gallbladder dissection from the gallbladder bed was performed with a Harmonic scalpel.

The outcome variable, i.e., gall bladder perforation, was assessed and recorded. A proforma was used to document the findings, which included the patients' age, gender, and Gallbladder perforation.

Data was analyzed using computer software Statistical Package for Social Sciences (SPSS) version 21.0. The mean and standard deviation of the age was calculated. Frequency and percentage of gall bladder perforation in either gender were calculated in both groups. The frequency of gall bladder perforation between the two groups was compared by applying the Chi-square test. The *p*-values less than or equal to 0.05 was considered significant.

RESULTS

We enrolled 160 patients in our study. The mean age in Groups A and B was 48.21±8.94 years and 49.14±9.31 years, respectively. 16(20%) patients in Group-A and 14(17.5%) patients in Group-B belonged to the 20-40 years age category, while 64(80%) patients in Group-A and 62(82.5%) patients in Group-B belonged to the 41-60 years age category (Table-I).

Table-I: Age and Gender Distribution (n=160)

Variables	Group-A (n=80) n(%)	Group-B (n=80) n(%)
Age		
Mean ± SD	48.21± 8.94 years	49.14 ± 9.31 years
20-40 years	16 (20.00)	14(17.50)
41-60 years	64 (80.00)	66(82.50)
Gender		
Male	29 (36.25)	33(41.25)
Female	51 (63.75)	47 (58.75)

Distribution according to gender was shown in the Table-II.

Table-II: Comparison of Gallbladder Perforation in Both Groups (n=160)

Gall bladder Perforation	Group-A (n=80) n (%)	Group-B (n=80) n (%)	p-value
Yes	17 (21.25)	5 (6.25)	<0.001
No	63 (78.75)	75 (93.75)	

A comparison of Gallbladder perforation in both Groups showed 17(21.25 %) patients in the Group-A and 5(6.25%) patients in the Group-B had gallbladder perforation. While 63(78.75 %) patients in the Group-A and 75(93.75%) patients in Group-B had no perforation, (p-value <0.001) (Table-III).

Table-III: Association of Gallbladder Perforation with Age Groups and Gender (n=160)

Variable	Groups	Gallbladder perforation		p-value
		Yes (n=22)	No (n=138)	
Age 20-40 years	A	1 (20.00)	15 (60.00)	0.100
	B	4 (80.00)	10 (40.00)	
Age 41-60 years	A	16 (94.10)	48 (42.30)	0.0001
	B	1 (5.90)	65 (57.70)	
Gender				
Male	A	3 (50.00)	26 (46.40)	0.86
	B	3 (50.00)	30 (53.60)	
Female	A	14 (87.50)	37 (45.10)	0.001
	B	2 (12.50)	45 (54.90)	

DISCUSSION

The purpose of our study was to calculate the frequency of gallbladder perforation in context with the previous studies so that we can adopt a better technique to curtail the per-operative complications. In our study, a comparison of Gallbladder perforation in both Groups showed 17 (21.25%) patients in the Group-A and 5(6.25%) patients in the Group-B had gallbladder perforation. While 63(78.75%) patients in the Group-A and 75(93.75 %) patients in Group-B had no perforation, (p-value <0.001).

In the comparison of our results with previous studies show that Monopolar diathermy is believed to be more traumatic than a harmonic scalpel.¹² Studies show that chances of gallbladder perforation are more with monopolar (40% with monopolar diathermy v. 16.7% with a harmonic scalpel).^{12,13} and a local study shows (14.5% with monopolar v. 6.4% with harmonic),⁴ but still commonly used worldwide.³

Another local study by Mirani *et al.*¹² compared the surgical outcomes of laparoscopic cholecystectomy

performed by conventional monopolar diathermy (electrocautery) to that performed by harmonic scalpel and concluded that harmonic scalpel is a new addition which has made it safe, handy, effective and reliable instrument in gallbladder surgery, it has multiple functions like cutting, coagulation, and cavitation.

The study published in the International Journal of surgery by Jiang and co-workers,¹³ suggested that an ultrasonic device is superior to an electrosurgical device. The study done at Mosul University Iraq by Nashwan *et al.*¹⁴ manifested that harmonic scalpel can replace monopolar diathermy in laparoscopic cholecystectomy as it is a very safe and effective instrument for dissection of gall bladder and hemostasis if available at the operative theatre. The study conducted by Asghar *et al.*¹⁵ in the resulted in satisfactory outcome (non-perforated gall bladder) was significantly higher in patients who underwent laparoscopic cholecystectomy with harmonic scalpel 77/85(90.6%) when compared to patients underwent laparoscopic cholecystectomy with monopolar diathermy 66/85(77.6%).

Another study conducted by Elshoura *et al.*¹⁶ suggested that the Harmonic scalpel provides decreased chances of gall bladder perforation, complete hemobiliary stasis safely and shorter time of surgery. The main drawback is the high cost and limited use in cystic ducts of more than 5mm. More or less similar results are shown in other studies.¹⁷ Utilizing ultrasonic vibrations at a frequency of 55 500Hz with a vibratory excursion of 50-100µm,¹⁸ ultrasonic dissection instrumentation denatures protein, unlike monopolar diathermy. Mechanical energy to the tissue is transferred by vibrations resulting in simultaneous coagulation and cutting. The coagulum of denatured protein and blood clot produced by vibrating ultrasonic dissector obstructs nearby blood vessels and decreases blood loss. The heat generated by monopolar diathermy is much higher than the vibratory movement of the dissector scalpel blade, and these vibrations can cause cavitation in potential spaces, which may help in the dissection of tissues.¹⁸ Only microaromized water droplets are generated, no smoke is produced, and in the surgical field, no electric current is detected; therefore, the harmonic scalpel is the ultimate safe option for usage in patients having pacemakers implanted.^{19,20} The peritoneum is a good source of absorption, it can easily absorb the mist produced by the harmonic scalpel, and it does not need to release the smoke produced during monopolar diathermy or

any other source like suctioning. However, the findings of our study are “Harmonic scalpel is better as compared to monopolar diathermy in terms of frequency of perforation in laparoscopic cholecystectomy”.

CONCLUSION

In laparoscopic cholecystectomy, the gallbladder perforation with conventional monopolar diathermy is much higher than with a harmonic scalpel.

Conflict of Interest: None.

Author’s Contribution

Following authors have made substantial contributions to the manuscript as under:

GA: Study design, interpretation of data, drafting the manuscript, critical review, approval of the final version to be published.

IA: Conception, drafting the manuscript, approval of the final version to be published.

AJ: Critical review, approval of the final version to be published.

MAM: Data acquisition, data analysis, interpretation of data, approval of the final version to be published.

UA & AA: Data analysis, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Ahmed W, Iqbal I, Ahmed I. Is there any change in demographic pattern of patients with Cholelithiasis? *Isra Med J* 2017; 9(2): 75.
2. Kassem MI, Hassouna EM. Short-term outcome of total clipless laparoscopic cholecystectomy for complicated gallbladder stones in cirrhotic patients. *ANZ J Surg* 2018; 88(3): E152-E156. doi: 10.1111/ans.13855.
3. Coccolini F, Catena F, Pisano M, Gheza F, Fagioli S, Di Saverio S. Open versus laparoscopic cholecystectomy in acute cholecystitis. Systematic review and meta-analysis. *Int J Surg* 2015; 18(1): 196-204. doi:10.1016/j.ijsu.2015.04.083.
4. Ali M, Akbar A, Khan MR. Comparison of Incidence of Gallbladder Perforation in Laparoscopic Cholecystectomy with Harmonic Scalpel Vs. Electrocautery, Department of surgery, Multan Medical and Dental College, Ibne Siena hospital and research institute Multan. *Pak J Med Health Sci* 2015; 9(1): 511-513.
5. Catena F, Saverio S, Ansaloni L, Coccolini F, Sartelli M, Vallicelli C. The HAC trial (harmonic for acute cholecystitis): a randomized, double-blind, controlled trial comparing the use of harmonic scalpel to monopolar diathermy for laparoscopic

- cholecystectomy in cases of acute cholecystitis. *World J Emerg Surg* 2014; 9(1): 53. doi:10.1186/1749-7922-9-53.
6. Ramzanali SA, Zia-ul-Islam, Shah SS. Monopolar electrocautery versus ultrasonic dissection of the gallbladder from the gallbladder bed in laparoscopic cholecystectomy. *J Ayub Med Coll Abbottabad* 2013; 25(3-4): 16-18.
7. Sharma N, Chaun A, Sharma V. Harmonic scalpel, the tool for new age laparoscopic cholecystectomy. *Int Surg J* 2018; 5(6): 2327-2330. doi: 10.18203/2349-2902.isj20182247.
8. Jabbar A, Qasim M, Qadir I. Intraperitoneal and Local infiltration of Bupivacaine for pain relief after laparoscopic cholecystectomy *Pak Armed Forces Med J* 2018; 68(3): 510-514.
9. Liao G, Wen S, Xie X, Wu Q. Harmonic Scalpel versus Monopolar Electrocauterization in Cholecystectomy. *JSLs* 2016; 20(3): e2016.00037. doi: 10.4293/JSLs.2016.00037.
10. Altuntas YE, Oncel M, Haksal M, Kement M, Gundogdu E, Aksakal N, et al. Gallbladder perforation during elective laparoscopic cholecystectomy: Incidence, risk factors, and outcomes. *North Clin Istanb* 2018; 5(1): 47-53. doi: 10.14744/nci.2017.88155.
11. Janssen IM, Swank DJ, Boonstra O, Klinkenbijn JH, van Goor H. Randomized clinical trial of ultrasonic versus electrocautery dissection of the gallbladder in laparoscopic cholecystectomy. *Br J Surg* 2003; 90(7): 799-803. doi: 10.1002/bjs.4128.
12. Mirani SH, Rafique M, Muhammad K. Role of harmonic scalpel in laparoscopic cholecystectomy. *Med Channel* 2012; 19(1): 81-84.
13. Jiang HP, Liu YD, Li YS, Shen ZL. Ultrasonic versus electro-surgical device for laparoscopic cholecystectomy: A systematic review with meta-analysis and trial sequential analysis. *Int J Surg* 2017; 40(1): 24-32. doi: 10.1016/j.ijsu.2017.02.020.
14. Nashwan K, Tahir E, Harmonic versus electrocautery in the dissection of gall bladder in laparoscopic cholecystectomy. *Ann Coll Med Mosul* 2013; 39(2): 107-112. doi:10.33899/mmed.2013.81304.
15. Asghar A, Ghazanfar A. Comparison of outcome of monopolar diathermy versus harmonic scalpel in terms of gall bladder perforation in laparoscopic cholecystectomy. *J Rawalpindi Med Coll* 2019; 23(1): 43-46.
16. Elshoura AA, Saber SA, Elshoura OA. Efficacy of Harmonic Scalpel in total clipless laparoscopic cholecystectomy. *Int J Med Res Health Sci* 2016; 2(1): 29-35.
17. Kandil T, El Nakeeb A, El Hefnawy E. Comparative study between clipless laparoscopic cholecystectomy by harmonic scalpel versus conventional method: a prospective randomized study. *J Gastrointest Surg* 2010; 14(2): 323-328. doi: 10.1007/s11605-009-1039-8.
18. Lee SJ, Park KH. Ultrasonic energy in endoscopic surgery. *Yonsei Med J* 1999; 40(6): 545-549. doi: 10.3349/ymj.1999.40.6.545.
19. Strate T, Bloechle C, Broering D, Schuchert A, Izbicki JR, Rogiers X. Hemostasis with the ultrasonically activated scalpel. Effective substitute for electrocautery in surgical patients with pacemakers. *Surg Endosc* 1999; 13(7): 727. doi: 10.1007/s004649901084.
20. Mahabaleshwar V, Kaman L, Iqbal J. Monopolar electrocautery versus ultrasonic dissection of the gallbladder from the gallbladder bed in laparoscopic cholecystectomy: a randomized controlled trial. *Can J Surg* 2012; 55(5): 307-311. doi: 10.1503/cjs.000411.