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## Harmonic scalpel versus monopolar electrocauterization in laparoscopic cholecystectomy

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### Abstract

**Introduction:** Laparoscopic cholecystectomy has revolutionized the treatment of symptomatic gallstone disease. It is now the gold standard for cholecystectomies. The aim of study is to this study compared the effectiveness of monopolar electrocauterization vs harmonic scalpel in Laparoscopic Cholecystectomy. **Method:** This study at Ibn Sina Training Hospital compares monopolar and harmonic methods for laparoscopic cholecystectomy in patients with symptomatic gallstones. Exclusion criteria included age above 65, coagulopathy, acute cholecystitis, and multiple comorbidities. Data were collected prospectively during postoperative follow-up and outpatient observation.

**Results:** Out of 152 patients, 75 were in the Monopolar group and 77 in the Harmonic group. The study found no statistically significant difference in postoperative bleeding rate, operative time, and hospital stay between the two groups ( $p > 0.05$ ). Primary failure of cystic artery control occurred in one Monopolar patient and three Harmonic patients, with minimal early postoperative bleeding in both groups.

**Conclusion:** The research found no significant difference in safety and outcomes between using a Harmonic Scalpel and Monopolar Electrocauterization for laparoscopic cholecystectomy, suggesting both methods can be used with equal assurance of favourable patient outcomes and safety.

**Keywords:** Laparoscopic cholecystectomy, gallstones, monopolar, harmonic

### Introduction

Laparoscopic cholecystectomy has revolutionized the treatment of symptomatic gallstone disease. It is now the gold standard for cholecystectomies <sup>[1]</sup>. However, several different methods of instrument dissection have been used during laparoscopic cholecystectomies, such as harmonic scalpel and monopolar electrocauterization. In this study we sought to compare the two instrument dissection techniques, harmonic scalpel versus monopolar electrocauterization in laparoscopic cholecystectomy and determine which was more effective in terms of operative outcome <sup>[2]</sup>. Current practices in laparoscopic cholecystectomies vary significantly across the globe and there is no consensus on which instrument dissection technique is superior. We decided to evaluate the two common techniques: harmonic scalpel versus monopolar electrocauterization <sup>[3]</sup>. We performed a comparative, prospective evaluation of the two techniques with respect to their effect on operative outcomes following cholecystectomy <sup>[4]</sup>. Our research involved selection of patients undergoing laparoscopic cholecystectomy followed by comparison and evaluation based on different criteria such as surgical time, intraoperative and postoperative complications, amount of blood loss and length of hospital stay <sup>[5, 6]</sup>. The results showed no statistically significant difference between harmonic scalpel versus monopolar electrocauterization in terms of operative outcomes for laparoscopic cholecystectomy <sup>[7]</sup>. This means that either technique is applicable for performing safe, successful and quick laparoscopic cholecystectomies. The results strongly suggest that there is benefit in personally deciding on what instruments best suit your requirements when performing such delicate procedures where safety and speed are paramount <sup>[8, 9]</sup>. The aim of study is to this study compared the effectiveness of monopolar electrocauterization vs harmonic scalpel in Laparoscopic Cholecystectomy.

### Method

This study is a single-center, prospective comparative study conducted at Ibn Sina Training Hospital from March 2022 to May 2023. It aims to compare monopolar and harmonic methods for primary control hemostasis and dissection during elective laparoscopic cholecystectomy.

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Patients with symptomatic gallstones who were referred for elective laparoscopic cholecystectomy and had an ASA score of less than 4 were included in the study. Exclusion criteria included age above 65 years, primary coagulopathy or anticoagulant use, acute cholecystitis, multiple comorbidities (ASA 4), conversion to open surgery, and vascular anomalies of the gallbladder. Data was collected using a standardized form, and the population of patients, vascular control method, and postoperative variables were prospectively collected throughout the postoperative follow-up and outpatient observation. Patients were advised to continue taking oral antibiotics for a total of 10 days and contact the hospital if they experienced pain, vomiting, or fever. Successful non-operative treatment was defined as the patient being discharged without the need for surgery during a 2-month follow-up. The Harmonic group used the Ethicon Endo-Surgery LLC device for cystic artery control in the MIN mode. Ethical approval was obtained from the institutional review board at Ibn Sina Training Hospital, and informed consent was acquired from all patients before their inclusion in the study. Statistical analysis was performed using IBM-SPSS software. Categorical data were compared using the Chi-square and Fisher's exact tests, while continuous variables were compared using the Mann-Whitney U test, as most data were not normally distributed. A p-value of less than 0.05 indicated statistical significance.

**Results**

Out of the final recruited number (152 patients), 75 patients were in the Monopolar group and 77 in the Harmonic group. In the Monopolar group, there was 20 males and 50 females while

in Harmonic group there was 15 males and 62 females. The Mean age of the Monopolar group was 39.95±13.86 years (15-65 years) while in the harmonic group was 39.25±12.59 years (15-62 years). Mean Operative time in the Monopolar group and harmonic group was 52.2±4.6 minutes (43- 62) and 52.3±4.6 (40-64) minutes respectively, table (1). Mean hospital stay in Monopolar group was 24 hours while in the harmonic group was 24.83±4.42 (24-48) hours, table (1). Primary failure of cystic artery control was reported in one patient of the Monopolar group and three patients of the harmonic group, table (2). In the immediate and early postoperative period, the early postoperative bleeding rate was minimal in both groups. Four patients developed bleeding postoperatively, one from the Monopolar arm and three from the harmonic one. No injury to surrounding structures was recorded for both groups, table (2). There was no statistically significant difference in the mean of the postoperative bleeding rate, operative time and the hospital stay between the harmonic and Monopolar arm (p Value > 0.05). Measurement of the p-value for the Injury to surrounding structures was not applicable.

**Table 1:** mean and standard deviation of (age, hospital stay and operative time) with level of significance.

	Type of control	Mean	Std. Deviation	P Value
Age	Monopolar	39.95	13.86	0.732
	harmonic	39.25	12.59	
Hospital stay(hours)	Monopolar	24	0	0.072
	harmonic	24.83	4.42	
Operative time (Minutes)	Monopolar	52.20	4.6	0.851
	harmonic	52.31	4.62	

**Table 2:** Distribution of cases according to (Gender, perioperative bleeding, and injury to surrounding structures) with a level of significance.

	Monopolar group n=75	Harmonic group n=77	P Value
Gender (M/F)	20	15	0.205
Bleeding intra-op (Primary failure of control)	1 (male)	3 (male)	0.354*
Bleeding post-op	1 (n=91) (male)	3 (n=83) (female)	0.349*
Injury to surrounding	0	0	N/A

\*Fisher's exact used.

**Discussion**

The present study examined 152 patients who were divided into Monopolar and Harmonic groups (75 and 77 patients, respectively). Its objective was to compare the safety and effectiveness of two commonly used hemostatic techniques: the harmonic scalpel and the monopolar cautery. The study population had a relatively homogeneous distribution of gender and age, which enhanced the internal validity of the study. The results indicated that there were no statistically significant differences between the two groups in terms of operational time and postoperative hospital stay, suggesting comparable outcomes. Both groups also demonstrated low rates of postoperative bleeding and primary failure in managing the cystic artery, although the p-values did not show a significant difference. These findings emphasize the safety and effectiveness of the harmonic scalpel in controlling major flow in the cystic artery. Previous investigations focusing on the Monopolar approach for cystic artery and gallbladder dissection outside the gallbladder plate have also yielded positive results. These investigations typically involved 70 to 100 participants per trial and were prospective single-center observational studies [10-17]. Regarding gender distribution, our study observed a higher number of females compared to males in both the Monopolar (50 females, 20 males) and Harmonic groups (62 females, 15 males), with a p-value greater than 0.05. This

finding aligns with the results reported by Venkatapuram and Sateesh [18]. Similarly, no statistically significant difference was found in the mean age of patients between the two groups, as supported by Venkatapuram and Sateesh [18]. The operative time was also similar between the groups (p=0.82), with mean times of 52.20 ± 4.60 minutes in the Monopolar group and 52.31 ± 4.62 minutes in the Harmonic group. This outcome is consistent with the findings of Venkatapuram and Sateesh [18] and Mohamed Samir *et al.* [19], who also reported no statistically significant differences (p> 0.05). In contrast, Safdar Hussain *et al.* [20] (n=86) found a significant difference (p=0.002), which could be attributed to their smaller sample size and the use of the harmonic scalpel in dissecting the gallbladder from the hepatic bed. The duration of postoperative hospital stay did not show a noticeable difference (p=0.072), which is consistent with the results reported by Safdar Hussain *et al.* [20] and Mohamed Samir *et al.* [19]. Regarding injury to surrounding structures, no significant differences were found between the two groups (p-value not applicable), and no relevant studies were found in the literature investigating this complication in the context of these two techniques. The primary failure rate in controlling the cystic artery was one patient in the Monopolar group and three patients in the Harmonic group (p=0.354). Similar results were reported by Venkatapuram and Sateesh [18]. However, Al-Aubiadi T *et al.* [21] found a significant difference between the groups, possibly

due to the use of the harmonic scalpel in gallbladder dissection and cystic artery control. In terms of postoperative bleeding, one patient in the Monopolar group and three patients in the Harmonic group experienced bleeding, with drainage volumes below 300 milliliters in each case. These instances resolved spontaneously and did not require intervention. This finding was not significant in our study ( $p=0.349$ ), which is consistent with the results reported by Safdar Hussain *et al.* [20] ( $p=0.163$ ). No injuries to surrounding structures were observed in either group ( $p$ -value not applicable), and no relevant studies were found in the literature examining this complication between the two techniques.

### Conclusion

This research has established that there is no significant difference in safety and outcomes for laparoscopic cholecystectomy when using a Harmonic Scalpel compared to a Monopolar Electrocauterization. This finding is of great importance to the field of minimally invasive surgery as it suggests that both modalities can be used with equal assurance of favourable patient outcomes and safety.

### Conflict of Interest

Not available

### Financial Support

Not available

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