

# Comparison of Outcome of Monopolar Diathermy Versus Harmonic Scalpel in Terms of Gallbladder Perforation in Laparoscopic Cholecystectomy

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## Abstract

**Background :** To compare the outcome (in terms of gall bladder perforation) of monopolar diathermy versus harmonic scalpel use during laparoscopic Cholecystectomy (LC) .

**Methods:** In this randomized controlled trial 170 patients of both gender between age 20 to 60 years planned for undergoing laparoscopic cholecystectomy for symptomatic gallstones, were included. Patients were randomly allocated to Group A (harmonic scalpel) and Group B (monopolar diathermy). Outcome was measured in terms of gall bladder perforation during the procedure in both groups.

**Results:** Satisfactory outcome (non-perforated gallbladder) was significantly higher in patients who underwent LC with harmonic scalpel (90.6%, n=77/85) when compared to patients underwent LC with monopolar diathermy (77.6%, n=66/85). P-value found to be 0.021.

**Conclusion:** Use of harmonic scalpel is found to be a better a choice during laparoscopic cholecystectomy in terms of per operative gallbladder perforation as compared to monopolar diathermy.

**Key Words:** Laparoscopic cholecystectomy, Monopolar diathermy, Harmonic scalpel. ,

## Introduction

Laparoscopic cholecystectomy (LC) is a gold standard treatment modality for gallstones and replaced conventional cholecystectomy. The reason may be its well-recognized minimal invasiveness and expedited postoperative recovery.<sup>1</sup> The standard LC is normally performed with a monopolar electrocautery, usually an electrosurgical hook, especially for the coagulation and dissection of the Calot's triangle and gallbladder.<sup>2</sup> However, use of electrocautery in LC may cause excessive surgical smoke from cauterizing the tissues

and may compromise the precision of dissection.<sup>3</sup> Electrocauterization may cause iatrogenic injury of adjacent vessels and solid organs, such as the common bile duct and the small intestine via thermal side effects.<sup>4</sup>

The harmonic scalpel is the surgical device used for ultrasonic cutting and coagulation, minimal charring, desiccation, and lateral thermal damage to tissues. Harmonic scalpel technology reduces demand of ligature during simultaneous coagulation and cutting.<sup>5</sup> In conventional monopolar diathermy, patients are exposed to electric currents to complete the circuit of device, which increases the safety of harmonic scalpel instrument.<sup>6</sup> Precision of harmonic scalpel is greater and it improves visibility in surgical field as it produces minimal smoke during dissection.<sup>7</sup> Dissection of the gallbladder bed with harmonic scalpel in LC has improved the quality of surgery by decreasing the incidence of gallbladder perforation and its intra-operative complications.<sup>8</sup> A study showed a significantly higher frequency of gallbladder perforation (21.6% vs. 8.1%) in LC by using monopolar diathermy as compared to harmonic scalpel.<sup>9</sup> On the other hand, another study has shown no significant difference of monopolar diathermy versus harmonic scalpel i.e. 6.52% versus 4.35% respectively.<sup>10</sup>

## Patients and Methods

Patients (n=170) admitted in the Department of Surgery, , KRL Hospital Islamabad, for laparoscopic cholecystectomy, were included . After patients had given informed consent for participation in the study, all patients offered to pick up a slip from total mixed up slips (half-slips contained letter 'A' and other half slips contained letter 'B') and he/she was placed in that respective group. In the Group A, patients underwent laparoscopic cholecystectomy by using harmonic scalpel while in Group B patients, laparoscopic cholecystectomy by using monopolar diathermy. Patient was in a supine position, abdominal access was achieved through Hason's

technique, pneumoperitoneum was created with CO<sub>2</sub> and maintained at 12-14 mmHg pressure. Thereafter, other three ports were placed under direct vision at standard sites and patient placed in reverse trendelenburg position during surgery. Cystohepatic triangle was dissected with the Harmonic scalpel in the group A and monopolar electrocautery hook was used for Calot's triangle dissection in group B patients. Cystic duct and cholecystic artery were sealed with titanium clips in both groups. The gallbladder dissection was performed with Harmonic scalpel in group A and gallbladder mobilized from the gallbladder bed by monopolar electrocautery hook in group B patients (Figure 1 &2). Gallbladder was extracted via epigastric port and hemostasis secured. CO<sub>2</sub> exsufflate, linea alba closed with vicryl 1 suture and skin closed with polypropylene 2/0 suture. Patient were called for follow up at the outpatient clinic 1 week, after surgery. Frequency and percentage were calculated for gender, diabetes mellitus and hypertension. P value ≤0.05 was considered as statistically significant. Effect modifiers like age, duration of disease, gender, diabetes mellitus and hypertension and BMI were controlled by stratification. Post-stratification chi square test was used to see their effect on outcome. P-value ≤0.05 was taken as significant



Figure1: Gallbladder bed dissection with harmonic scalpel



Figure 2: Gallbladder bed dissection with electrocautery

### Results

Outcome (non-perforated gallbladder) was significantly higher in patients underwent LC with

harmonic scalpel (90.6%, n=77/85) when compared to patients underwent LC with monopolar diathermy (77.6%). P-value found to be 0.021 (Table 1). Satisfactory outcome was higher in females patients (p=0.025), shorter duration of disease (p=0.013), lower BMI (p=0.033), non-hypertensives (p=0.040) and non-diabetics (p=0.006). No other significant difference were observed (p>0.05)(Table 2-7).

**Table 1: Outcome in both groups**

Outcome	Groups		Total	p-value Chi-square
	Harmonic scalpel	Monopolar Diathermy		
Satisfactory	77(90.6)	66(77.6%)	143(84.1%)	0.021
Unsatisfactory	8(9/4%)	19(22.4%)	27(15.9%)	
Total	85(100%)	85(100%)	170(100%)	

**Table 2: Outcome in both groups (age-based stratification)**

Age Groups	Outcome	Groups		Total	P-value Chi-square
		Harmonic scalpel	Monopolar Diathermy		
21-40 Years	Satisfactory	23(88.5%)	32(71.1%)	55(77.5)	0.092
	Unsatisfactory	3(11.5)	13(28.9%)	16(22.5%)	
	Total	26(100.0%)	45(100.0%)	71(100.0%)	
41-60 Years	Satisfactory	54(91.5)	34(85.0%)	88(88.9%)	0.331
	Unsatisfactory	5(8.5%)	6(15.0%)	11(11.1%)	
	Total	59(100.0%)	40(100.0%)	99(100.0%)	

**Table 3: Outcome in both groups (gender-based stratification)**

Gender	Outcome	Groups		Total	P-value Chi-square
		Harmonic scalpel	Monopolar Diathermy		
Males	Satisfactory	17(85.0)	32(78.0%)	49(80.3%)	0.521
	Unsatisfactory	3(15.0%)	9(22.0%)	12(19.7%)	
	Total	20(100.0%)	41(100.0%)	61(100.0%)	
Females	Satisfactory	60(92.3%)	34(77.3%)	94(86.2%)	0.025
	Unsatisfactory	5(7.7%)	10(22.7%)	15(13.8%)	
	Total	65(100%)	44(100.0%)	109(100%)	

**Table 4: Outcome in both groups (duration of disease-based stratification)**

Duration of Groups	Outcome	Groups		Total	P-value Chi-square
		Harmonic scalpel	Monopolar Diathermy		
≤5years	Satisfactory	28(96.6%)	22(73.3%)	50(84.7%)	0.013
	Unsatisfactory	1(3.4%)	8(26.7%)	9(15.3%)	
	Total	29(100.0%)	30(100.0%)	59(100.0%)	
>5 years	Satisfactory	49(87.5%)	44(80.0%)	93(83.8%)	0.314
	Unsatisfactory	7(12.5%)	11(20.0%)	18(16.2%)	
	Total	5(100.0%)	55(100.0%)	111(100.0%)	

**Table 5: Outcome in both groups (BMI based stratification)**

BMI groups	Outcome	Groups		Total	P-value Chi-square
		Harmonic scalpel	Monopolar Diathermy		
≤27 Kg/m <sup>2</sup>	Satisfactory	47(92.2%)	44(77.2%)	91(84.35)	0.033
	Unsatisfactory	4(7.8%)	13(22.8%)	17(15.7%)	
	total	51(100.0%)	57(100.0%)	108(100.0%)	
>27 Kg/m <sup>2</sup>	Satisfactory	30(88.2%)	22(78.6%)	52(83.9%)	0.303
	Unsatisfactory	4(11.8%)	6(21.4%)	10(16.1%)	
	Total	34(100.0%)	28(100.0%)	62(100.0%)	

### Discussion

There is always a debate for choosing the best method for gall bladder dissection in laparoscopic cholecystectomy (LC). Results of the present study

showed satisfactory outcome (non-perforated gallbladder) was significantly higher in patients underwent LC with harmonic scalpel (90.6%, n=77/85) when compared to patients underwent LC with monopolar diathermy (77.6%, n=66/85). P-value found to be 0.021.

**Table 6: Outcome in both groups (Hypertension based stratification)**

Hypertension	Outcome	Groups		Total	P-value Chi-square
		Harmonic scalpel	Monopolar Diathermy		
Present	Satisfactory	13(92.9%)	11(78.6%)	24(85.7%)	0.280
	Unsatisfactory	1(7.1%)	3(21.4%)	4(14.3%)	
	Total	14(100.0%)	14(100.0%)	28(100.0%)	
Absent	Satisfactory	64(90.1%)	55(77.5%)	119(83.8%)	0.040
	Unsatisfactory	7(9.9%)	16(22.5%)	23(16.2%)	
	Total	71(100.0%)	71(100.0%)	142(100.0%)	

**Table 7: Outcome in both groups (Diabetes based stratification)**

Diabetes	Outcome	Groups		Total	P-value Chi-square
		Harmonic scalpel	Monopolar Diathermy		
Present	Satisfactory	14(82.4%)	14(87.5%)	28(84.8%)	0.680
	Unsatisfactory	3(17.6%)	2(12.5%)	5(15.2%)	
	Total	17(100.0%)	16(100.0%)	33(100.0%)	
Absent	Satisfactory	63(92.6%)	52(75.4%)	115(83.9%)	0.006
	Unsatisfactory	5(7.4%)	17(24.6%)	22(16.1%)	
	Total	68(100.0%)	69(100.0%)	137(100.0%)	

Results of present study are similar with the already published data on the subject. Our study is comparable to already published data.<sup>11,12</sup> Out of total number of GBP in our study, 22.4% (19/85 patients) had perforations by monopolar diathermy which is

much smaller than 49.5% reported in Janssen et al study.<sup>13</sup> In our study, comparison of the two instruments used for dissection of gallbladder showed that 9.4% patients had GBP with Harmonic scalpel while GBP with Monopolar diathermy was found in 22.4% patients which is comparable to other studies.<sup>14,15</sup>

Saleem MR, et al compared the conventional monopolar electrocautery hook with harmonic scalpel in terms of frequency of gallbladder perforation and mean time of operation in LC. They enrolled 74 diagnosed patients of gallstones undergoing elective LC and randomly divided patients into two equal groups. In Group "A" patients underwent dissection of gallbladder by harmonic scalpel. Patients in Group "B" underwent LC by using monopolar diathermy. They reported frequency of gallbladder perforation 21.6% in LC by using monopolar diathermy which is significantly higher as compared to ultrasonic scalpel 8.1% (22.4% vs. 9.4% compared).<sup>9</sup>

In summary, results of the present study and studies already published in the literature favors harmonic scalpel for GB dissection during LC as it results in smaller percentages of gall bladder perforations. We recommend further large scale randomized and blinded trials for clinical validation purpose in our settings.

## Conclusion

Use of harmonic scalpel is found to be better a choice during laproscopic cholysectomy in terms of per operative gallbladder perforation as compared to monopolar diathermy.

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**Key for Contribution of Authors :** A= Conception/ Study/ Designing /Planning; B= Experimentation/Study conduction C=Analysis/Interpretation/ Discussion; D= Manuscriptwriting; E= Critical review;F= Facilitated for reagents/Material/Analysis