



CLINICAL COMPARATIVE STUDY OF BIPOLAR ELECTROCAUTERY VS CLIPS OF CYSTIC ARTERY DURING LAPAROSCOPIC CHOLECYSTECTOMY

Hepatobiliary Surgery

Ayushi Sanjay Shah

Third Year Resident, Department Of General Surgery, Sbksmirc, Pipariya

Mohammad Farooque

Assistant Professor Department Of General Surgery, Sbksmirc, Pipariya

ABSTRACT

Background: Laparoscopic cholecystectomy is the gold standard for treating symptomatic gallstones, and the safe management of the cystic artery is crucial to prevent complications. This study aimed to compare the efficacy and safety of bipolar electrocautery versus clips for cystic artery control during laparoscopic cholecystectomy. **Methodology:** 120 patients with symptomatic gallstones were randomized into two equal groups. Group 1 underwent cystic artery clipping, while Group 2 underwent bipolar electrocautery. Outcome measures included age, gender, complaints, comorbidities, operative parameters (cystic artery coagulation/clipping time, operative time, intraoperative haemorrhage, cystic duct closure time), postoperative outcomes (hospital stay, drain output, cystic duct leakage, postoperative haemorrhage, port site infection), and return to work time. **Results:** Both techniques effectively managed the cystic artery. The clipping group had significantly shorter cystic artery coagulation/clipping time, operative time, intraoperative haemorrhage, cystic duct closure time, hospital stay, and lower drain output ($p < 0.05$). Complication rates were similar between the groups—the findings aligned with surgical society guidelines emphasizing patient safety and efficacy in achieving hemostasis. **Conclusion:** Bipolar electrocautery and clips are safe and effective for cystic artery control during laparoscopic cholecystectomy. The choice between the techniques should consider surgeon experience, patient factors, and adherence to surgical guidelines. The study provides valuable insights for surgical decision-making and patient care in laparoscopic cholecystectomy.

KEYWORDS

Laparoscopic cholecystectomy, cystic artery, bipolar electrocautery, clips, hemostasis, surgical outcomes.

INTRODUCTION:

"Laparoscopic cholecystectomy has emerged as the gold standard for the treatment of symptomatic gallstones and other gallbladder-related conditions, owing to its minimally invasive nature and numerous advantages over traditional open cholecystectomy." (Hassler et al., 2024)".

The first endoscopic cholecystectomy in Germany was performed by Mühe in 1985, and since then, the procedure has gained widespread acceptance." (Reynolds, 2001)" The National Institutes of Health (NIH) Consensus Development Conference 1992 concluded that laparoscopic cholecystectomy provides a safe and effective treatment for most symptomatic gallstones.

Today, laparoscopic cholecystectomy is often the second most performed intra-abdominal surgery in surgical practice, revolutionizing the management of gallbladder pathologies by reducing morbidity and mortality." (Holzheimer, 2001).

"The advent of minimally invasive surgery, including laparoscopic cholecystectomy, has maximized the benefits of intra-abdominal surgical procedures. Estimates show an increasing trend of cholecystectomy, which can be attributed to either an increase in the number of cases with gallstones or increased training of surgeons who are becoming more acquainted with the laparoscopic procedure." (Farhangmehr & Menzies, 2021; Jones et al., 2024)".

Laparoscopic cholecystectomy is one of the commonly performed procedures in general surgery departments, involving the removal of the diseased gallbladder through small incisions, typically 0.5-1 cm in size, using a laparoscope and specialized surgical instruments." (Mannam et al., n.d.) "During laparoscopic cholecystectomy, the safe and effective management of the cystic artery is of paramount importance to prevent intraoperative and postoperative complications. After fundal retraction, Calot's triangle is dissected, and the cystic artery is identified and secured." (Gupta & Jain, 2019) "In most cases, the cystic artery arises from the right hepatic artery; however, in a few cases, it may originate from the common hepatic, celiac trunk, right gastric, or superior mesenteric arteries. Proper hemostasis of the cystic artery is crucial because failure to ligate it properly may result in torrential haemorrhage, which is a common cause of postoperative bleeding after laparoscopic cholecystectomy." (Yakura et al., 2017).

"Several methods for cystic artery control are available, including clip application, bipolar diathermy, monopolar diathermy, vessel sealing with ultrasonics, and harmonics. Monopolar diathermy is generally

avoided due to the lateral dissipation of heat and potential injury to adjacent structures. Vessel sealers and harmonics, although practical, are often too costly for all hospitals to afford. Clip application and bipolar diathermy, on the other hand, are cost-effective and efficient techniques for managing the cystic artery." (Emmi & Ds, n.d.)

"Clip ligation using titanium clips is popular due to their non-absorbable nature, effectiveness, and affordability. These clips do not exhibit ferromagnetic properties, enabling patients to undergo future MRI scans without concerns. However, using bipolar diathermy has advantages, such as precise cutting and coagulation of tissues, reduced risk of collateral tissue damage, and effective hemostasis of small blood vessels. The localized nature of the current flow between the two electrodes of the bipolar device minimizes the potential for unintended burns or injuries to surrounding structures, making it particularly suitable for delicate surgical procedures in confined anatomical spaces." (Delibegovic et al., 2022; Gold et al., 1989).

"Despite the availability of various techniques for cystic artery control, the current literature lacks a comprehensive comparison of bipolar electrocautery and clips in laparoscopic cholecystectomy, encompassing aspects such as safety profile, efficacy in achieving hemostasis, cost-effectiveness, and adherence to established surgical guidelines." (Singal et al., 2018).

This clinical study addresses this gap by thoroughly evaluating these two methods for cystic artery control during laparoscopic cholecystectomy.

The purpose of this clinical study is to offer a thorough assessment of the two frequently used methods for controlling the cystic artery during laparoscopic cholecystectomy: clips and bipolar electrocautery. In this commonly used minimally invasive procedure, we aim to produce evidence-based recommendations to guide surgical decision-making and improve patient care by carefully evaluating safety, efficacy, cost-effectiveness, and adherence to guidelines. The knowledge acquired from this study could influence the course of laparoscopic cholecystectomy by advancing surgical methods and the goal of the best possible patient outcomes.

Aims And Objectives:

- To compare bipolar electrocautery vs clips for cystic artery during laparoscopic cholecystectomy.
- To ascertain whether there is any difference in the outcomes of the two techniques in patients with symptomatic gall stone.

MATERIALS AND METHODS:

Study Population:

All eligible cases undergoing bipolar electrocautery for cystic artery in laparoscopic cholecystectomy and clipping of cystic artery in Department of surgery, Dhiraj General Hospital, Pipariya, Vadodra during December 2023 to June 2024.

Inclusion Criteria:

1. Patient signed informed consent to participate in study
2. Male or Female patient Age between 18-65 years.
3. A new diagnosed gallstone patient with symptoms.
4. No response to common medications and signing the written informed consent to participate in the study.

Exclusion Criteria:

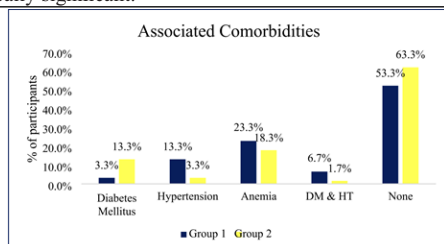
1. Patients having cholecystitis, choledocholithiasis, elevated liver enzymes, pancreatitis.
2. Patient having addiction history, psychiatric history.
3. Previous history of comorbidities.
4. Patient not giving informed to participate in the study.
5. Disturbed coagulation test.
6. Patient's will to exit the study

Patients were then randomized into 2 groups of 60 patients using Random Allocation Software. Group 1 underwent clipping of cystic artery and group 2 under bipolar electrocautery for cystic artery in laparoscopic cholecystectomy. All procedures were performed in both groups under general anesthetics and the supine position.

RESULTS:**1. Distribution of Associated Comorbidities Among Study Groups**

Associated Comorbidities	Group				Chi-square	p-value
	Group 1		Group 2			
	N	%	N	%		
Diabetes Mellitus	2	3.3%	8	13.3%	9.874	0.043*
Hypertension	8	13.3%	2	3.3%		
Anaemia	14	23.3%	11	18.3%		
Diabetes Mellitus & Hypertension	4	6.7%	1	1.7%		
None	32	53.3%	38	63.3%		

Values are expressed as frequency and percentage. A chi-square test measures the p-value, and a p-value of less than 0.05 is considered statistically significant.



Diabetes Mellitus was present in 3.3% of Group 1 (cystic artery clipping) and 13.3% of Group 2 (bipolar electrocautery) participants. Hypertension affected 13.3% in Group 1 and 3.3% in Group 2.

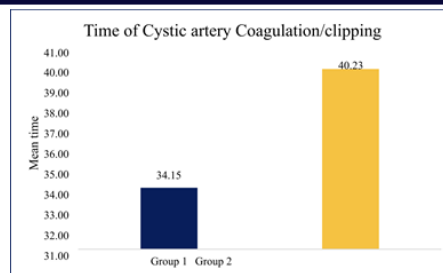
Anaemia was observed in 23.3% of Group 1 and 18.3% of Group 2 participants. Combined Diabetes Mellitus & Hypertension were found in 6.7% of Group 1 and 1.7% of Group 2.

No comorbidities were reported in 53.3% of Group 1 and 63.3% of Group 2 participants. Statistical analysis resulted in a chi-square value of 9.874 and a p-value of 0.043, indicating a significant difference in the distribution of comorbidities between the two intervention groups.

2. Comparison of Cystic Artery Coagulation/Clipping Time

Time of Cystic artery Coagulation/clipping	Group 1		Group 2		Mean difference	t-value	p-value
	Mean	SD	Mean	SD			
	34.15	2.5	40.23	3.3	-6.08	-11.42	<0.001

Values are expressed as mean and SD. An independent sample t-test determines the p-value; a p-value of less than 0.05 is considered statistically significant.

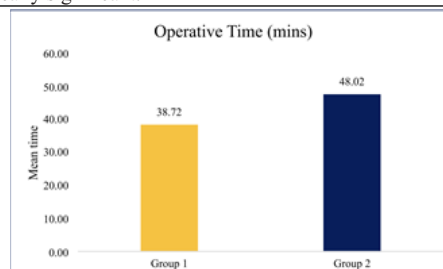


The mean time for cystic artery intervention was 34.15 seconds (SD 2.5) in Group 1 (cystic artery clipping) and 40.23 seconds (SD 3.3) in Group 2 (bipolar electrocautery) with a mean difference of 6.08 seconds, with a t-value of -11.42 and a p-value <0.001, indicating a statistically significant difference in intervention time between the two groups.

3. Comparison of Operative Time Between Study Groups

Operative Time (mins)	Group 1		Group 2		Mean difference	t-value	p-value
	Mean	SD	Mean	SD			
	38.72	1.9	48.02	2.3	-9.30	-23.92	<0.001

Values are expressed as mean and SD. An independent sample t-test determines the p-value; a p-value of less than 0.05 is considered statistically significant.



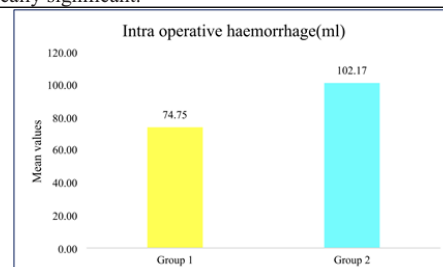
Group 1 (cystic artery clipping) had a mean operative time of 38.72 minutes (SD 1.9), while Group 2 (bipolar electrocautery) averaged 48.02 minutes (SD 2.3).

The mean difference was -9.30 minutes, with a t-value of -23.92 and a p-value <0.001, demonstrating a significant difference in operative time between the two techniques.

4. Comparison of Intraoperative Hemorrhage Between Study Groups

Intraoperative haemorrhage (ml)	Group 1		Group 2		Mean difference	t-value	p-value
	Mean	SD	Mean	SD			
	74.75	13.1	102.17	16.1	-27.42	-10.22	<0.001

Values are expressed as mean and SD. An independent sample t-test determines the p-value; a p-value of less than 0.05 is considered statistically significant.



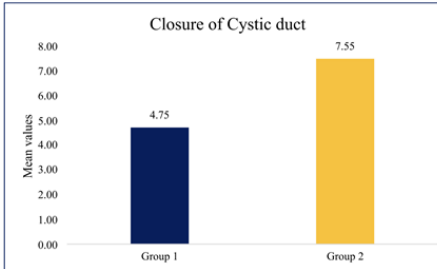
The mean intraoperative haemorrhage was 74.75 ml (SD 13.1) in Group 1 (cystic artery clipping) and 102.17 ml (SD 16.1) in Group 2 (bipolar electrocautery).

Statistical analysis showed a mean difference of -27.42 ml, with a t-value of -10.22 and a p-value <0.001, indicating a significant difference in intraoperative bleeding between the groups.

5. Comparison of Cystic Duct Closure Time

Closure of Cystic	Group 1		Group 2		Mean difference	t-value	p-value
	Mean	SD	Mean	SD			

duct	4.75	1.0	7.55	1.3	-2.80	-13.17	<0.001
Values are expressed as mean and SD. An independent sample t-test determines the p-value; a p-value of less than 0.05 is considered statistically significant.							



The mean time for cystic duct closure was 4.75 minutes (SD 1.0) in Group 1 (cystic artery clipping) and 7.55 minutes (SD 1.3) in Group 2 (bipolar electrocautery).

Analysis revealed a mean difference of -2.80 minutes, with a t-value of -13.17 and a p-value <0.001, showing a significant difference in closure time between the two techniques. This indicates that the time for the cystic duct closure is significantly shorter in Group 1 compared to Group 2.

6. Hospital Stay Duration Between Group 1 and Group 2

Hospital stay duration	Group 1		Group 2		Mean difference	t-value	p-value
	Mean	SD	Mean	SD			
	1.83	0.7	2.20	1.0	-0.37	-2.35	0.020
Values are expressed as mean and SD. An independent sample t-test determines the p-value; a p-value of less than 0.05 is considered statistically significant.							

The mean hospital stay was 1.83 days (SD 0.7) for Group 1 (cystic artery clipping) and 2.20 days (SD 1.0) for Group 2 (bipolar electrocautery).

The mean difference was -0.37 days, with a t-value of -2.35 and a p-value of 0.020, indicating a statistically significant difference in hospital stay duration between the groups. This suggests that the hospital stay duration is significantly shorter in Group 1 compared to Group 2.

7. Comparison of Cystic Duct Leakage Between Group 1 and Group 2

Cystic Duct Leakage	Group				Chi-square	p-value
	Group 1		Group 2			
	N	%	N	%		
Yes	0	0.0%	3	5.0%	3.077	.079
No	60	100.0%	57	95.0%		
Values are expressed as frequency and percentage. A chi-square test measures the p-value, and a p-value of less than 0.05 is considered statistically significant.						

Cystic duct leakage occurred in 0.0% of Group 1 (cystic artery clipping) participants and 5.0% of Group 2 (bipolar electrocautery) participants. The chi-square value was 3.077 with a p-value of 0.079, suggesting no statistically significant difference in cystic duct leakage between the groups.

8. Incidence of Post-operative Hemorrhage Between Group 1 and Group 2

Post op Haemorrhage	Group				Chi- square	p- value
	Group 1		Group 2			
	N	%	N	%		
Yes	0	0.0%	1	1.7%	1.008	0.315
No	60	100.0%	59	98.3%		
Values are expressed as frequency and percentage. The p-value is calculated using the chi-square test, and a p-value of less than 0.05 is considered statistically significant.						

Post-operative haemorrhage was observed in 0.0% of Group 1 (cystic artery clipping) participants and 1.7% of Group 2 (bipolar electrocautery) participants. The chi-square test resulted in a value of 1.008, with a corresponding p-value of 0.315, which shows the difference in post-operative haemorrhage between the two groups is not statistically significant.

CONCLUSION:
This study demonstrates that both bipolar electrocautery and clips are safe and effective methods for cystic artery control during laparoscopic cholecystectomy. The choice between the two techniques should be based on surgeon experience, patient-specific factors, and adherence to established surgical guidelines. The findings contribute to the growing body of evidence supporting the use of these techniques in laparoscopic cholecystectomy and provide valuable insights for surgical decision-making and patient care.

REFERENCES:

- Hassler KR, Collins JT, Philip K, Jones MW. Laparoscopic Cholecystectomy. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 [cited 2024 Jul 18]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK448145/>
- Reynolds W. The First Laparoscopic Cholecystectomy. JSL. 2001;5(1):89–94.
- Holzheimer RG. Cholecystitis and Cholelithiasis. In: Surgical Treatment: Evidence-Based and Problem-Oriented [Internet]. Zuckschwerdt; 2001 [cited 2024 Jul 18]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK7010/>
- Farhangmehr N, Menzies D. Laparoscopic cholecystectomy: from elective to urgent surgery. Laparosc Surg [Internet]. 2021 Jan 25 [cited 2024 Jul 18];5(0). Available from: <https://ls.amegroups.org/article/view/6169>
- Jones MW, Guay E, Deppen JG. Open Cholecystectomy. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 [cited 2024 Jul 18]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK448176/>
- Mannam R, Sankara Narayanan R, Bansal A, Yanamaladoddi VR, Sarvepalli SS, Vemula SL, et al. Laparoscopic Cholecystectomy Versus Open Cholecystectomy in Acute Cholecystitis: A Literature Review. Cureus. 15(9):e45704.