

# A Clinical Comparative Study of Bipolar Electrocautery vs Clips for Cystic Artery during Laparoscopic Cholecystectomy

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## ABSTRACT

**Introduction:** Since 1987, laparoscopic cholecystectomy has been regarded as the gold standard treatment for cholelithiasis. Surgical clips, harmonic scalpel and ligature, or bipolar cautery can be used to control the cystic artery during this treatment. In this paper, we examine the use of bipolar electrocautery vs clip ligation to control the cystic artery during laparoscopic cholecystectomy.

**Method:** This is a clinical comparative study that was carried out in total of 60 patients who underwent laparoscopic cholecystectomy conducted for 3 year duration (2016–2019). The patients were monitored for postoperative hemorrhage and bile leak, as well as differences in hospital stay length and postoperative sequelae.

**Results:** In our study, the cystic artery was controlled using bipolar electrocautery in 30 patients (group B) and by surgical clips in 30 patients (group A). In both groups, the length of stay in the hospital and the duration of surgery were similar. In Group A, no incidences of intraoperative hemorrhage or bile leak were documented, but Group B had two cases of bile leak and four cases of intraoperative cystic artery bleed.

**Conclusion:** We conclude that, especially in developing countries, bipolar diathermy and clip application are equally effective strategies for hemostatic control of the cystic artery during laparoscopic cholecystectomy.

**Keywords:** Bipolar electrocautery, Clips, Cystic artery, Laparoscopic cholecystectomy.

*World Journal of Laparoscopic Surgery* (2022): 10.5005/jp-journals-10033-1500

## INTRODUCTION

Mühe performed Germany's first endoscopic cholecystectomy in 1985. The National Institutes of Health (NIH) Consensus Development Conference in 1992 concluded that for most individuals with symptomatic gallstones, laparoscopic cholecystectomy provides a safe and effective treatment.<sup>1</sup> Since then, laparoscopic cholecystectomy has been regarded as the gold standard for cholelithiasis therapy.<sup>2</sup> This new procedure was initially linked to a large increase in morbidity, particularly iatrogenic biliary injury and arterial bleeding. The right hepatic artery is the most common source of cystic artery; however, it can also come from the common hepatic, celiac trunk, right gastric, superior mesenteric, and other arteries. Because the cystic artery's course and length in the Calot's triangle are variable,<sup>3,4</sup> hemostasis of the cystic artery is essential because it can cause torrential hemorrhage if not ligated adequately and is the most common cause of postoperative bleeding after laparoscopic cholecystectomy. Clip application, bipolar diathermy, monopolar diathermy, vascular sealing with ultrasonics, harmonics, and other techniques are available for cystic artery control. Clips can slip, dislodge, migrate, internalize, and cause cystic duct necrosis, which can lead to bile leakage and other complications.<sup>5</sup> Because it is both inexpensive and widely available, bipolar electrocoagulation can be utilized to regulate the cystic artery. However, most surgeons are still opposed to using bipolar electrocautery in the Calot's triangle. As a result, in laparoscopic cholecystectomy, we contrasted bipolar electrocautery with clip application to determine the safest and least complicated method for hemostasis of the cystic artery.

## MATERIALS AND METHODS

A retrospective observational study was carried out in SN Medical College and HSK Hospital, Bagalkot. A total of 60 patients (32 females and 28 males) who underwent elective laparoscopic

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**How to cite this article:** Emmi SM, Suhas DS. A Clinical Comparative Study of Bipolar Electrocautery vs Clips for Cystic Artery during Laparoscopic Cholecystectomy. *World J Lap Surg* 2022;15(1):74–76.

**Source of support:** Nil

**Conflict of interest:** None

cholecystectomy from April 2015 to July 2017 (27 months) were included in the study.

The cystic artery was clipped with titanium clips in Group A to gain control. We have a standard practice of using two clips. Bipolar diathermy was used to cauterize the cystic artery in group B. All patients gave their informed consent. This study covered all patients with symptomatic gallstone disease. The study did not include patients with acute cholecystitis, empyema gallbladder, chronic renal failure, obstructive jaundice, choledocholithiasis, portal hypertension, pancreatitis, or suspected malignancies. In both groups, a single surgeon with at least 5 years of expertise in minimally invasive surgery conducted laparoscopic cholecystectomy under general anesthesia after a preoperative workup. The surgery was carried out using a four-port procedure. The surgeon stood to the left of the patient, the first assistant to the right of the patient, and the laparoscopic video camera operator to the left of the surgeon, according to the "American" procedure. Pneumoperitoneum was achieved with CO<sub>2</sub> gas via a Veress needle, which was then replaced with a blindly inserted laparoscopic port. The hepatocystic triangle, which is the ventral aspect of the area

surrounded by the gallbladder wall and cystic duct, the liver edge, and the common hepatic duct, was dissected; the cystic artery (and hence Calot's triangle) is located within this space. By retracting the gallbladder's infundibulum inferiorly and laterally while keeping the fundus under traction in a superior and medial orientation, the hepatocystic triangle was maximum expanded. The cystic duct was clipped with Ligaclip LT 300 in 30 cases after the Calot's triangle was dissected. On the cystic artery, one clip was placed distally and the other proximally. Between the proximal and distal clips, the cystic artery was separated. A bipolar cautery was used to coagulate the artery in 30 individuals. Just lateral to the Calot's lymph node, an artery was cauterized in spray mode. Any signs of bile leakage and bleeding were noted over divided stumps of cystic duct and artery. The gall bladder was evacuated through the umbilical port after the cholecystectomy was performed according to usual technique. Hemostasis was maintained during the procedure. The derbis and blood clots were removed using suction. Any bile leaks or hemorrhages in the cystic duct and artery stump were re-examined. Bupivacaine was infused into each port incision for postoperative analgesia. One large absorbable suture was used to seal the fascia of the umbilical incision. Xylon 3-0 was used to close the other skin incisions. Any cases of postoperative bleeding or bile leak were observed in the patients. A large bleed was defined as more than 100 mL of fresh blood in the drain bag or abdominal cavity. When all of the patients were deemed fit, they were discharged from the hospital. The length of stay in the hospital as well as any postoperative complications were observed and recorded. All patients were monitored for six months, daily until the seventh postoperative day, and thereafter once a month.

### Statistical Analyses

SPSS 16.0 was used to statistically analyze the results. The mean  $\pm$  standard deviation (SD) was used to express numerical data. All category data between both groups were compared using the Chi-square test. Independent student *t*-test was used to compare continuous variable data, such as operative time. A statistically significant *p*-value was less than 0.05.

### RESULTS

The study consisted of 60 patients who were planned for laparoscopic cholecystectomy. The mean age of the study group A was 50.73 + 11.09 years and group B was 54.13 + 13.2 years. The male:female sex ratio was 1:1 in group A with 15 females and 15 males; in group B it was 1.3:1 with 17 females and 13 males (Table 1).

Among the 60 patients who underwent successful laparoscopic cholecystectomy, hospital stay in group A and group B was similar, i.e., 2.9 + 0.75 days and 2.93 + 0.9 days, respectively, and no statistical significance was established. Mean duration of surgery in Group B with 50.9 + 15 minutes which was lesser when compare to group A was 56.5 + 13 minutes, however, not statistically significant. There was no reporting of intraoperative hemorrhage or bile leak in any of the cases in Group A. But in group B, out of 30 cases, 2 cases of bile leak and 4 cases of intraoperative cystic artery bleed was reported (Table 2).

### DISCUSSION

Mühe conducted the first laparoscopic cholecystectomy in 1986.<sup>6</sup> The gold standard treatment for cholelithiasis is now regarded laparoscopic cholecystectomy.<sup>2</sup> This new procedure

**Table 1:** Demographic data of patients

Variables	Group A	Group B	<i>p</i> value
Age (years)	50.73 + 11.09	54.13 + 13.2	0.285
Gender			
Male	13 (43.3%)	15 (50%)	
Female	17 (56.7%)	15 (50%)	

**Table 2:** Intraoperative and postoperative parameter in both groups

Variables	Group A	Group B	<i>p</i> value
Intraoperative blood loss	0	4 (13.3%)	0.039
Bile leak	0	2 (7.7%)	0.155
Duration of operation (minute)	56.50 + 12.9	50.90 + 15.1	0.128
Hospital stay (days)	2.93 + 0.75	2.93 + 0.9	

was initially linked to a large increase in morbidity, particularly iatrogenic biliary injury and arterial bleeding. To avoid injury to the extrahepatic biliary tree, the surgeon must rely on his thorough understanding of Calot's triangle modifications and perform meticulous dissection.<sup>7</sup> Various methods, such as clip application, monopolar and bipolar cautery, vascular sealers, and ultrasonic devices, can be used to manage the cystic artery during the process.

We compared the results of electrocautery ligation of the cystic artery to those of surgical clip (Ligaclip) application in this study. In both groups, female preponderance was observed in the ratios of 1:1 and 1.3:1, which closely matched the demographic data reported by Hugh et al.<sup>8</sup> in their research of laparoscopic anatomy of the cystic artery. In both groups, the length of stay in the hospital and the duration of surgery were similar. In Group A, no incidences of intraoperative hemorrhage or bile leak were documented, but Group B had two cases of bile leak and four cases of intraoperative cystic artery bleed.

Our findings were consistent with those of Das et al.,<sup>9</sup> Katrina et al.,<sup>10</sup> and Anurag Chauhan et al.,<sup>11</sup> who investigated the use of monopolar cautery for cystic artery management. In terms of postoperative mortality and complications, they observed no difference between the two treatments.

In a research involving 160 patients undergoing laparoscopic cholecystectomy, Redwan<sup>12</sup> compared harmonic scalpel to clips/cautery. They determined that the harmonic scalpel is equally successful as the clip/cautery technique in attaining hemobiliary stasis with a shorter surgical time but is not cost-effective when compared to cautery in laparoscopic cholecystectomy.

In our study, both groups had similar outcomes, particularly in terms of hospital stay and intraoperative complications. There was no extra risk of intraoperative hemorrhage or bile leak when bipolar electrocautery was used instead of surgical clips. Postoperative problems such as clip slippage, dislodgement, ulceration, migration, internalization, and necrosis of the cystic duct with the danger of bile leakage were not a concern with electrocautery. Electrocautery is a more affordable and accessible solution than surgical clips, especially in developing nations.

Because the depth of burn with bipolar electrocautery is unpredictable, simple precautions such as staying close to the gall bladder wall during dissection, avoiding diathermy near metal clips on the cystic duct and control of the cystic artery, preferably lateral to the cystic lymph node, can help to prevent injury.<sup>13</sup> It is critical to

use only short bursts of the bare minimum of energy required to maintain homeostasis.

The fact that this is a retrospective study means that there are issues with incomplete and/or inconclusive data. The number of patients is likewise insufficient to draw any significant conclusions. Regardless, it should be emphasized that the cautious application of electrocautery to regulate the cystic artery results in a shorter operative time. In other words, in the hands of a trained professional, bipolar electrocautery is a safer alternative to surgical clips.

## CONCLUSION

We conclude that bipolar diathermy and clip application are equally effective in hemostatic control of the cystic artery during laparoscopic cholecystectomy, particularly in resource-constrained settings where the harmonic scalpel raises concerns about cost and accessibility. To back up our findings, we will need to conduct more randomized control trials.

## CLINICAL SIGNIFICANCE

Use of bipolar diathermy is efficacious in terms of cost factor and affordability compared to harmonics and clips in developing countries.

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