

Safety and Efficacy of Monopolar Cautery in Dissection of Mesoappendix in Laparoscopic Appendectomy: a Multicentered Cross-Sectional Retrospective Study

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Abstract

Introduction: Different instruments are being used for appendiceal mesentery dissection in laparoscopic appendectomy. The effectiveness and versatility of monopolar cautery for the same makes it a commonly used option. This study aims to observe the safety and efficacy of monopolar cautery in laparoscopic appendectomy for the dissection of mesoappendix.

Methods: 424 cases who underwent laparoscopic appendectomy from November 2018 to April 2020 using monopolar cautery for mesoappendix dissection were included in this multi-centered cross-sectional retrospective study. The operating time, intra and post-operative complications and length of hospital stay were evaluated. Measures of central tendency were performed for data analysis.

Results: Acute appendicitis was the common indication (96.7%) for the laparoscopic surgery, with 99.1% success rate with a male to female ratio of 1.17:1 and mean age of 21.48+14.80 years. The median operating time and length of hospital stay were 30 mins (range: 15–130 mins) and 3 days (range: 1-15 days), respectively. Moderate intra-operative bleeding was noted in 0.5%. Post-operative complications of wound infection (3.4%) and prolonged ileus (1.7%) were noted.

Conclusion: Use of monopolar cautery for dissection of mesoappendix in laparoscopic appendectomy is still safe and efficient even with the advent of newer and more expensive instruments in the present world.

Keywords: Appendectomy; Cautery; Laparoscopy; Mesoappendix; Monopolar.

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Introduction

Appendicitis is the inflammation of the appendix and is mostly due to bacterial infection. Although not age-specific, appendicitis often occurs in the age group of 10 to 30 years. Appendectomy for acute appendicitis is a common emergency visceral surgical procedure, now mostly performed by laparoscopic method.¹⁻²

Different instruments like endoscopic linear cutting stapler, harmonic scalpel, bipolar and vessel sealing instruments have been described in appendiceal mesentery dissection and sealing of the appendicular artery.³ The effectiveness and versatility of monopolar electrosurgery makes it a common option.⁴ Several shortcomings such as thermal injury, difficulty in hemostasis, smoke production, and the need of additional tools including bipolar graspers, sutures and clips also occur.

In this study, we aim to observe the safety and efficacy of monopolar cautery in laparoscopic appendectomy for mesoappendix dissection based on the operating time, length of hospital stay and complications in intra and post-operative period.

Methods

A multi-centered cross-sectional retrospective study was conducted in two major hospitals, Manipal Teaching Hospital (MTH) and Fishtail Hospital and Research Center (FHRC), in western Nepal from November 2018 to April 2020.

The researcher had obtained the approval of the institutional technical review board and the ethics review committee from both the hospitals prior to implementing the study. Informed consent from the patients was waived for the retrieval of the medical records. Measures were taken to ensure the confidentiality and anonymity.

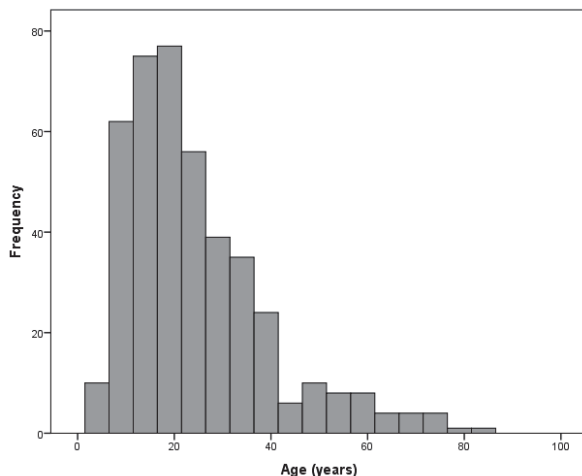


Figure 1. Age histogram of the patients that underwent laparoscopic appendectomy (n=424)

Inclusion criteria:

1. All patients of any age.
2. All patients diagnosed with acute appendicitis undergoing appendectomy.
3. Only patients undergoing laparoscopic appendectomy.

Exclusion criteria:

1. Patients undergoing open appendectomy.
2. Laparoscopic converted to open appendectomy.

The medical records of all patients who underwent laparoscopic appendectomy from November 2018 to April 2020 in the two hospitals fulfilling the inclusion criteria were studied.

Technique of the procedure

- Most of the patients were admitted from the emergency department as a case of acute abdomen, some were also admitted from the outpatient clinic.
- They were clinically examined; pertinent investigations were sent, including total count, differential count, blood sugar and serum creatinine.
- Ultrasound of the abdomen was used as an adjunct for diagnosis and in a few cases plain Computed tomography (CT) scan of the abdomen was performed.
- After confirmation of diagnosis as acute appendicitis, patient counseling was done for appendectomy, majority with laparoscopic method. The operation was scheduled after consultation with the operating surgeon, the anesthetic consultants and the operating team.
- The operations were performed with the standard three ports, that is, one 10 mm port in the umbilicus for the camera, a second five mm port in the right groin for the Maryland forceps with monopolar cautery (MEDITOM electrosurgical unit- Dai Wha, South Korea) and another five mm port in the supra-pubic region slightly towards the left for Babcock forceps.
- After pneumoperitoneum was created with CO₂ at 10 mm Hg pressure, Maryland forceps and monopolar cautery were used for isolating the appendix. The Meso-appendix was dissected up to the base of the appendix using the monopolar cautery only and then the base was tied with catgut endoloop (ETHICON) and then divided with the help of scissors and monopolar cautery.
- Specimen was retrieved through the umbilical port after exchanging the scope into the five mm port from the right trocar.
- Peritoneal lavage was done when needed. Wound closure was done with skin stapler for the side ports and polyglactin suture for the umbilical port.
- Complications, if any, were observed in the intra-operative and post-operative periods including bleeding, stump infection, adhesions or bowel obstruction.
- External drainage was only kept in cases with gangrenous appendicitis.
- Most of the patients were willing to be discharged and were safely discharged by the third postoperative day.

Statistical analysis: Measures of central tendency were used for descriptive data analysis. Statistical Package for the Social Sciences (SPSS) version 20 software was used for computation of data.

Results

Out of 628 patients that underwent appendectomy during the study period, 424 (67.5%) had laparoscopic appendectomy, hence included in the study and analyzed further. Rest of the patients either underwent open surgery or were converted from laparoscopic to open; hence excluded. Monopolar cautery was used for dissection of the mesoappendix during appendectomy in all the patients. The median age of the patients was 21 years (Range: 4 – 84 years). A majority of the patients (193, 45.5%) were <20 years of age. (**Figure 1**) There was a single patient (0.3%) who was above 80 years. The male to female ratio was 1.17:1, with 229 (54.0%) males and 195 (46.0%) females (**Table 1**).

Acute appendicitis (410, 96.7%) was the commonest indication for performing appendectomy. Tumors of the appendix, including both benign and malignant, were rare (4, 0.9%) in our study group as these cases would rather undergo open surgery after being diagnosed preoperatively. A vast majority of the patients (412, 97.2%) had appendectomy on emergency basis. Only 07(1.6%) underwent elective appendectomy.

The median operating time was 30 minutes (Range: 15–130 mins). Only 02(0.5%) had intraoperative complications, in the form of moderate bleeding (~100 ml). Twenty one

Table 1. Sociodemographic and clinical characteristics of the study population (n =424)

Variable	Frequency	Percentage (%)
Category based on age (years)		
<20	193	45.5
20-39	173	40.8
40-59	40	9.4
60-80	17	4.0
>80	1	0.3
Gender		
Male	229	54.0
Female	195	46.0
Surgical Indication		
Acute appendicitis	410	96.7
Chronic appendicitis	10	2.4
Tumor of appendix	4	0.9
Mode of procedure		
Emergency	412	97.2
Interval	5	1.2
Elective	7	1.6

(5.0%) patients developed post-operative complications, they being surgical site infection and paralytic ileus. The median length of hospital stay was 03 days (Range: 1-15 days) (**Table 2**).

Regarding the post-operative complications, surgical site infection (3.4%) and paralytic ileus (1.7%) were noted and were resolved before the patients were discharged. External drainage for gangrenous appendicitis was removed on the second postoperative day.

Table 2. Intra-operative and post-operative characteristics of the study population (n = 424)

Variable	Summary statistics
Duration of surgery in minutes, median (range)	30 (15 – 130)
Intra-operative complications, n (%)	
Moderate bleeding	2 (0.5)
Post-operative complications, n (%)	
1. Surgical site infection	14 (3.4)
2. Paralytic ileus	7 (1.7)
Length of hospital stay in days, median (range)	3 (1 – 15)

Discussion

Appendix becomes inflamed, mostly due to infection with bacteria and subsequently developing pus, within the lumen of the appendix. Mechanical blockage of the appendix by hard stool, a foreign body, or thick mucus may also lead to bacterial infection and inflammation. The diagnosis is mostly based upon the patients' symptoms and findings during physical examination. Early recognition and prompt treatment of the condition is necessary. Delaying the diagnosis and treatment increases the risk of complications. One potential complication is perforation, which can lead to an infection that spreads throughout the abdomen causing peritonitis. The risk of perforation 36 hours after appearance of symptoms is 15% or more.⁵

Appendectomy for acute appendicitis is a common emergency visceral surgical procedure performed by most surgeons. At present, a majority of the operation is performed by laparoscopic method with excellent cosmetic results, reduced postoperative pain, wound infection, easier peritoneal lavage and rapid functional recovery.¹⁻²

Electro-cautery is done by high frequency electrical current that is passed from a single electrode where the cauterization occurs on the patients' body serving as a ground.⁶⁻⁷ The monopolar instrument called active electrode, when energized, requires the application of another monopolar instrument called a dispersive electrode elsewhere on the patients' body that functions to de-focus and disperse the radio frequency current; thereby preventing thermal injury to the underlying tissue. Using a pencil instrument, the active electrode is placed in the entry site and can be used to cut tissue and coagulate bleeding.

Even if high voltage and low current is used by monopolar cautery, no complications in this regard occurred in this study. As most of the thermal injuries related to the cautery is from the return electrode, hence caution needs to be taken whether the return electrode is well applied and in good contact with the patient skin or not. Direct coupling to another metallic instrument, direct sparking or smoke production should be kept in mind during the use of monopolar cautery.³ Failure to maintain hemostasis with single use of monopolar cautery was comparable to bipolar cautery (25% vs. 30 %); however after one or more further application of the same cautery, the failure rate was decreased to 10%.⁸ The effectiveness and versatility of monopolar electrocautery makes it a commonly used option improving the quality of life in a lower cost.⁴ Availability and affordability of other methods of cauterization is quite impossible in all parts of developing country like ours. The long term outcome of leaving foreign bodies like stapler or clip in the abdominal cavity is unknown and also it costs higher compared to use of cautery.³ Monopolar cautery when used in other surgical procedures, like cholecystectomy and contained and/or free perforation of adjacent structures like gastric wall have been noted in experimental study; and other methods like bipolar cautery are mentioned to be safer.⁸ Such complications were not seen in this study. Laparoscopic removal of the appendix is less frequently associated with increased risk of major long-term complications like incisional hernia (can be seen if open appendectomy is done), stump infection, adhesions or bowel obstruction.⁹

Limitations of the study:

1. Retrospective chart review.
2. A randomized control trial comparing monopolar cautery with other advanced instruments like bi-polar cautery, harmonic scalpel usage would have been better.

Conclusion

In conclusion, even with the use of newer and more expensive devices like endoscopic stapler, clip, bipolar cautery, harmonic scalpel, vessel sealing instruments, etc., the use of monopolar cautery for dissection of mesoappendix in laparoscopic appendectomy is still safe and efficient in terms of intra and post-operative complications, length of operating time and period of hospital stay; especially in the context of developing countries when used with caution and in experienced hands. Hands on training to the newly bud surgeons with monopolar cautery in regular period is a must to help them do basic surgeries in every part of the country.

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References

1. Liu GB, Mao YY, Yang CP, Cao JL. Sealing of the Cystic and Appendix Arteries with Monopolar Electrocautery during Laparoscopic Combined Cholecystectomy and Appendectomy. *Medicine (Baltimore)*. 2018 Mar;97(13):e0206.
2. Hsieh CS, Chen YL, Lee MH, Chang HC, Chen ST, Kuo SJ. A Lower Costly Laparoscopic Appendectomy: Our Experience of More than 2000 Cases. *Int J Surg*. 2010;8(2):140–43.
3. Senel E, Akbiyik F, Atayurt HF, Tiryaki HT. Dissection of mesoappendix in laparoscopic appendectomy: a comparison of monopolar cautery and bipolar vessel sealing system. *Turk J Med Sci*. 2010;40(5):757-60.
4. Hainer BL. Fundamentals of Electrosurgery. *J Am Board Fam Pract*. Nov-Dec 1991;4(6):419-26.
5. Ghimire P, Thapa P, Yogi N, Ghimire P. Role of Serum Bilirubin as a Marker of Acute Gangrenous Appendicitis. *Nep J Med Sci*. 2012;1(2):89–92.
6. Hainer BL, Usatine RB. Electrosurgery for the Skin. *American Family Physician*. 2002Oct;66(7):1259–66.
7. Boughton R S, Spencer SK. Electrosurgical Fundamentals. *J Am Acad of Dermatol*. 1987 Apr;16(4):862–7.
8. Diamantis T, Kontos M, Arvelakis A, Syroukis S, Koronarchis D, Papalois A, et al. Comparison of monopolar electrocoagulation, bipolar electrocoagulation, ultracision, and ligasure. *Surg Today*. 2006;36(10):908–13.
9. Kapischke M, Pries A, Caliebe A. Short term and long term results after open vs. laparoscopic appendectomy in childhood and adolescence: a subgroup analysis. *BMC Pediatr* 13, 154 (2013).