

Laparoscopic Appendicectomy: Comparison of Monopolar Cautery and Harmonic Scalpel in Ligation of Mesoappendix

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Abstract

Background: To compare monopolar diathermy with harmonic scalpel in the ligation of mesoappendix while doing laparoscopic appendicectomy in terms of mean operative time and per-operative bleed.

Methods: In this randomized controlled trial patients between 15 to 50 years who were planned for laparoscopic appendicectomy were included. Patients were divided into two groups. Group 1 was operated using monopolar diathermy and in Group 2 harmonic scalpel was used for dissection of mesoappendix. Total time required to cauterize the mesoappendix using the monopolar diathermy or harmonic scalpel was measured in minutes. Per operative bleed was visualized at the time of cauterizing the mesoappendix and was estimated by the gauzes used for mopping when the field became obscure. Gauzes were placed on physical balance and weighed.

Results: Out of 60 patients enrolled for the study, 30 were put in group 1 and 30 in group 2. Comparison of mean operative time in both groups was calculated as 17.7 ± 3.35 in Group-1 and 17.6 ± 3.28 in Group-2, p value was calculated as 0.90 showing insignificant difference. Comparison of mean blood loss in both groups was calculated as 3.40 ± 2.45 in Group-1 and 3.30 ± 2.37 in Group-2, p value was calculated as 0.87, showing insignificant difference.

Conclusion: Monopolar cautery is equally effective in ligation of mesoappendix as compared to harmonic scalpel while performing laparoscopic appendicectomy.

Key Words: Acute appendicitis, Laparoscopic appendicectomy, Mesoappendix, Monopolar diathermy.

Introduction

Appendicitis is one of the most common causes of acute abdominal pain.¹ Minimal access surgery has

become the gold standard for almost all of the abdominal procedures. Laparoscopic appendicectomy has advantages over open approach in less postoperative pain, shorter hospital stay, faster postoperative rehabilitation and fewer postoperative complications.¹⁻⁴ Open approach of appendicectomy has prevailed as the gold standard treatment of acute appendicitis for over a century owing to the procedures' low morbidity and mortality.⁶

Unlike laparoscopic cholecystectomy (LC), laparoscopic appendicectomy has not yet universally gained the approval and acceptance as the gold standard for treatment of acute appendicitis owing to its higher operative time, liability of formation of post-operative intra-abdominal collection and increased cost as compared to the open approach. Laparoscopic appendicectomy did not attain popularity because the already small incision used in the open approach had practitioners in doubt and kept them pondering if the laparoscopic approach offered much advantage especially when considering the prolonged operating time and the higher cost incurred on laparoscopic technique. Various studies have concluded that the overall cost and duration of surgery in laparoscopic appendicectomy is significantly higher as compared to open appendicectomy.^{3,7}

Basic steps of doing laparoscopic appendicectomy are port positioning, performing diagnostic laparoscopy, identifying the appendix, handling the mesoappendix, handling the base of the appendix and the last step is retrieval of specimen. The highest cost is incurred on the steps of handling the mesoappendix and on appendiceal retrieval.

Appendiceal mesentery division via the laparoscopic scissors and intra corporeal suturing takes more time and requires the knowledge and experience of intracorporeal suturing. Different instruments, such as endoscopic GI stapler, endoscopic clip, monopolar hook cautery, harmonic scalpel, and vessel sealing instrument like ligasure, can be used in appendiceal mesentery dissection.⁸ The technique of laparoscopic

appendectomy by monopolar coagulation is very simple and economical. Monopolar diathermy is conveniently available in almost every operating room (OR) even in the developing countries, its utilization has several drawbacks such as production of smoke, contingency of thermal injuries and trouble in controlling bleeding.⁹ New instruments such as the harmonic scalpel and Ligasure have been introduced for most of the laparoscopic procedures. In order to reduce the lateral thermal spread caused by electrocautery and to decrease instrument interchange during performing laparoscopy, ultrasonically activated scalpel was created. Harmonic scalpel allows hemostasis by high energy ultrasonic waves. It uses high-frequency mechanical energy to cut and coagulate tissues at the same time.¹⁰ In laparoscopic appendectomy harmonic scalpel was introduced for complete coagulation and cutting of the mesoappendix. The harmonic scalpel usage in surgery results in shorter operative time, and less intra-operative blood loss. Its lateral thermal is less than half of that produced by electrocautery.^{11, 12} In this study two methods of dealing with mesoappendix in laparoscopic appendectomy are compared. Monopolar cautery is easily accessible whereas harmonic scalpel is the leading ultrasonically cutting coagulation device offering multiple functions, like cutting and coagulation, which have made it safe, handy, effective and reliable instrument. Recently published articles have concluded that the use of costly instruments like endostaplers, ligasure and harmonic scalpel are not required for division of mesoappendix while performing laparoscopic appendectomy and monopolar cautery is safe, effective and cost efficient in terms of handling the mesoappendix.^{13, 14}

Monopolar electrocautery is considered as the most cost-effective method and due to the fact that both harmonic scalpel and monopolar diathermy had an operative time of less than 60 minutes, monopolar diathermy can be recommended for mesoappendix dissection in laparoscopic appendectomy.¹¹ In developing countries laparoscopic approach can be employed to reduce the total cost incurred by using monopolar electrocautery as it is easily available and is less expensive.

Patients and Methods

This randomized controlled trial was conducted in Surgical Unit II, Holy Family Hospital, Rawalpindi from December to May, 2015. Inclusion criteria was patients between 15 to 50 years, ASA I and patients

willing to undergo laparoscopic appendectomy. Exclusion criteria was ileocaecal tuberculosis, pelvic inflammatory disease, malrotated gut, any other intra-abdominal pathology other than acute appendicitis, contraindication to laparoscopy, patients with bleeding diathesis and on anticoagulant treatment. Group 1 was operated using monopolar diathermy and in Group 2 harmonic scalpel was used for dissection of mesoappendix. Assessment of operating time was started at the initiation of dissection of the mesoappendix and stopped till reaching the base of the appendix. Total time required to cauterize the mesoappendix using the monopolar diathermy or harmonic scalpel was measured in minutes. Per operative bleed was visualized at the time of cauterizing the mesoappendix and was estimated by the gauzes used for mopping when the field became obscure. Student's t test was calculated as a test of significance to study difference in mean operation time and per operative bleeding. P-value of < 0.05 was considered significant. Effect modifiers like age and gender were controlled by stratification. For post stratification student's t test was applied. Operation time was taken as the time required for the ligation of appendicular artery present in the mesoappendix. Time is calculated from the start of handling mesoappendix till reaching the base of the appendix. Total time required to cauterize the mesoappendix is measured in minutes. Per operative bleed was defined as the amount of blood loss while dealing the appendicular artery with harmonic scalpel and monopolar electrocautery and was estimated by the gauzes used for mopping blood when the field was obscured. The soiled gauzes were placed on physical balance and weighed. The difference in weights is the weight of blood lost in gauze. It was converted into milliliters by dividing the weight by specific gravity which is 1.055.

Results

A total of 60 cases fulfilling the inclusion/exclusion criteria were enrolled to compare monopolar diathermy with harmonic scalpel in the ligation of mesoappendix in laparoscopic appendectomy in terms of mean operative time and per-operative bleed. Age distribution of the patients was done showing that 73.33% (n=22) in Group-1 and 73.33% (n=22) in Group-2 were between 15-25 years of age while 26.67% (n=8) in Group-1 and 26.67% (n=8) in Group-2 were between 26-50 years of age, mean±SD was calculated as 23.2±4.47 and 23.83±5.61 years in Group-1 and 2 respectively. Patients were distributed according to

gender showing that 40%(n=12) in Group-1 and 36.67%(n=40) in Group-2 were male while 60%(n=18) in Group-1 and 63.33%(n=11) in Group-2 were females. Comparison of mean operative time in both groups was calculated as 17.7±3.35 in Group-1 and 17.6±3.28 in Group-2, p value was calculated as 0.90 showing insignificant difference (Table 1). Comparison of mean blood loss in both groups was calculated as 3.40±2.45 in Group-1 and 3.30±2.37 in Group-2, p value was calculated as 0.87 showing insignificant difference (Table 1). 2).Stratification for mean operative time and blood loss with regards to age and gender was calculated. Comparison of mean operative time in both groups was calculated as 17.7±3.35 in Group-1 and 17.6±3.28 in Group-2, p value was calculated as 0.90 showing insignificant difference, comparison of mean blood loss in both groups was calculated as 3.40±2.45 in Group-1 and 3.30±2.37 in Group-2, p value was calculated as 0.87 showing insignificant difference (Table 3).

Table 1:Comparison of mean operative time and bleeding in both groups

	Operative time (minutes)	Blood loss (ml)
Group 1	17.7± 3.35	3.4± 2.45
Group 2	17.6 ± 3.28	3.30± 2.45
p-value	0.90	0.87

Table 2:Stratification for mean operative time with regards to age and gender

	Group 1	Group 2	p-value
Age (years)			
15-25	17.18± 2.13	17.27± 2.27	0.89
26-50	19.13± 5.46	18.50± 5.26	
Sex			
Male	17.67± 4.58	17.27± 2.49	0.80
Female	17.72± 2.37	17.79± 3.71	

Table 3: Stratification for mean blood loss with regards to age and sex

	Group 1	Group 2	p-value
Age (years)			
15-25	3.27± 2.43	3.59± 2.49	0.67
26-50	3.75±2.62	2.5± 1.91	0.29
Sex			
Male	3.58±2.25	2.82± 1.83	0.38
Female	3.28± 2.63	3.58±2.64	0.73

Discussion

Procedure of appendicectomy has evolved from open appendicectomy to laparoscopic approach, then to single incision laparoscopic appendicectomy and now to natural orifice transluminal endoscopic surgery. After the introduction of laparoscopic appendicectomy, the laparoscopic approach has remained controversial with the effect that open appendicectomy is still considered the procedure of choice in many centers around the world.¹⁵ Recent studies endorse laparoscopic appendectomy as the gold standard treatment for acute appendicitis owing to the obvious advantages offered to clinical practitioners as well as patients.¹⁶ Laparoscopic appendicectomy offers the added benefits of less per operative bleeding, less post-operative pain, shorter hospital stay, earlier return to daily activities and work and lesser hospital stay.^{17,18} Laparoscopic appendicectomy is associated with increased cost as compared to the open approach.¹⁹ The cost is incurred on the steps of division of mesoappendix, handling the base of the appendix and on appendiceal retrieval. The cost that is incurred on handling the base of the appendix can be minimized by using a simple Roeder's knot.²⁰ Various methods can be used for division of the mesoappendix. Mesoappendix can be handled laparoscopically by endostapler, Ligasure vessel sealing device, harmonic scalpel, monopolar electrocautery, endoclips and by intra or extracorporeal knots.²¹⁻²³

In this study the two methods of appendiceal ligation during laparoscopic appendicectomy were compared. Cauterization with monopolar electrocautery which is easily available and cost effective method was compared with one of the new vessel sealing devices i.e harmonic scalpel. Results of present study showed that the two methods of dealing with mesoappendix were comparable in terms of operating time and per-operative bleeding. The mean time for monopolar electrocautery group was 17.70 ± 3.35 and the time for harmonic scalpel group was 17.6 ± 3.28. The bleeding while dissecting the mesoappendix was 3.40 ± 2.45 ml in the monopolar diathermy group whereas the per operative bleeding in harmonic scalpel group was 3.30 ± 2.37 ml. Being the most cost efficient and easily accessible method, monopolar electrocautery can be recommended for dissection of the mesoappendix. In a recent study the mean operating time by using monopolar cautery was 46.24 minutes ± 5.86 as compared to 42.08 minutes ± 2.64 by using harmonic scalpel while for intraoperative blood loss this was

15.10 ml \pm 5.25 in electrocautery group as compared to 5.35ml \pm 2.53 in harmonic scalpel group.¹⁵

Newer vessel sealing devices have improved the laparoscopic technique by making it more safe, reliable and also by cutting short the operating times. Some of the vessel sealing devices are Harmonic Ace, ligasure V, thunderbeat and enseal devices. There is no doubt regarding the efficacy of newer vessel sealing devices while performing laparoscopic appendectomy. Literature supports the fact that both ligasure and harmonic scalpel are safe, effective and reliable ways of dealing with the mesoappendix.²²

In a study conducted at Ain Shams University Faculty of Medicine, Cairo, Egypt, Osama M.Elattar et al concluded that harmonic scalpel is an effective method of dissection of mesoappendix. The use of harmonic scalpel decreased the operative time. The mean operative time for laparoscopic appendectomy while using vessel sealing device i.e harmonic scalpel was 45.6 \pm 11.6 minutes.²³

In another study, published in 2010, carried out at Department of Surgical Pediatrics, Berne, Switzerland, the properties of ultrasound activated scalpel (UAS) were assessed while performing dissection of the mesoappendix during laparoscopic appendectomy. The time spent on dissection of mesoappendix was of the range 25 to 900 seconds, with the average time being 228 seconds. This study concluded that the use of harmonic scalpel is a fast, safe, effective and reliable method of handling the mesoappendix.²⁴

Newer vessel sealing devices like harmonic scalpel and stapling technique while being effective are expensive. In order to reduce the cost of laparoscopic appendectomy simple ligature technique²⁵ or monopolar electrocautery can effectively and safely be used,

In a study carried out at the Armed Forces Capital Hospital, Seongnam, Korea, three methods of appendiceal dissection i.e harmonic scalpel, endoclip and monopolar electrocautery were compared. The results of this study showed that the operating time in endoclip group was 58.0 \pm 24.9 minutes and the average time for monopolar electrocautery group was 57.7 \pm 25.7 minutes, which was not statistically significant. The operating time was decreased significantly while using harmonic scalpel. In this study, dissection of mesoappendix with monopolar diathermy was endorsed as it was the most economical method and its results were comparable with the endoclip group.²⁶ In an international study carried out at Department of Pediatric Surgery, Rocky Mountain Hospital for Children, Denver, Colorado, the use of

monopolar diathermy for dissection of mesoappendix was evaluated. It was concluded that appendiceal dissection with monopolar diathermy was a reliable, practical and cost effective method.¹³

Conclusion

Monopolar electrocautery is equally effective in handling the mesoappendix while performing laparoscopic appendectomy in terms of operating time and per-operative bleeding.

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