



TO TEST THE EFFICACY OF HARMONIC SCALPEL IN LAPAROSCOPIC APPENDECTOMY FOR SEALING THE BASE OF APPENDIX

Surgery

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ABSTRACT

Background- Appendicitis is a perception that urgent operation is essential to prevent the increased morbidity and mortality of peritonitis. In our study, laparoscopic appendectomy was done via conventional method except Harmonic Scalpel was used to coagulate the mesoappendix. Base of the appendix was sealed via harmonic scalpel in a stepwise manner at the setting of minimum just to occlude the lumen and just distil to previous site till the appendix is divided. The purpose of this study was to test the efficacy of harmonic scalpel in laparoscopic appendectomy for sealing the base of appendix. **Methodology-** Total 54 appendectomies were performed by harmonic during this period out of which 44 were done as elective and 10 were done as emergencies case. Statistical analysis was done by Chi-square test with Yates correction. **Results-** The mean age and standard deviation (SD) were 31.22SD13.35 years. Maximum number of patients belonged to age group 21-40 years. Mean operative time for 54 appendectomies by harmonics was 28.463SD7.19 min and maximum and minimum time taken was 48 min and 17 minute. **Conclusion-** Techniques of the appendicular stump closure by harmonic scalpel is effective and safe. Postoperative complications following appendectomy are relatively uncommon and it is recommended as the approach of choice in the management of appendicitis. There was no mortality occurred in this study.

KEYWORDS

Appendectomy; Harmonic scalpel; Appendicitis

INTRODUCTION-

Appendicitis is an inflammation of the vermiform appendix. It is mostly caused by obstruction of the lumen due to hyperplasia of the lymphoid follicles at a younger age or by obstruction of the lumen by faecoliths in older patients¹. Appendicitis is the most common surgical abdominal emergency. The lifetime risk of developing appendicitis is 8.6% for males and 6.7% for females, with the highest incidence in the second and third decades².

Since its introduction in 1894 by **McBurney**, open appendectomy is gold standard procedure for acute appendicitis. **Semm** first described laparoscopic appendectomy in 1983³. Laparoscopic appendectomy (a minimally invasive technique) was quickly adapted for appendectomy. Despite open appendectomy being associated with low morbidity and mortality rates², the popular minimally invasive approach showed more advantages such as less wound infection, less pain, and faster recovery in the cost of more operating time and hospital cost⁴. Laparoscopic appendectomy can have extra benefits for female patients, such as decreasing adhesions and fertility problems and improving cosmetic results.

In laparoscopic appendectomy, various techniques have been used for the management of the appendicular stump such as preformed suture loops (endoloops), endoscopic linear cutting staplers (endo GIA), the Ligasure system, the Harmonic Scalpel⁵ and even bipolar coagulation⁶. Recent use of alternative energy-based devices in surgery and their use in laparoscopic appendectomy shortened the duration of the operation, but these devices are generally used for mesodissection. These devices did not receive wide acceptance among surgeons as there is not enough evidence confirming their use in appendicular lumen operations⁷.

The harmonic scalpel has been used successfully in a number of open and laparoscopic procedures. The advantages of this technology include minimal thermal spread, decreased tissue charring and smoke formation when compared with traditional electrosurgical instruments, and no risk of electrical injury due to the absence of electrical current within the patient. It is also a versatile instrument, allowing the surgeon to dissect, cut and coagulate with one instrument. Several studies have compared laparoscopic appendectomy with the conventional open procedure regarding surgical time, hospital stay, return of the patient to normal life, and complications. Various techniques have been used for the ligation of the appendicular stump, such as preformed suture loops (Endoloops) and endoscopic linear cutting staplers (endo GIA), the Liga-Sure System, the Harmonic Scalpel, and even bipolar coagulation. Some series have used polymeric clips for occlusion of the appendicular stump⁸.

MATERIAL AND METHOD-

The study was conducted in the Department of General Surgery, G.S.V.M. Medical College, Kanpur, for a period of 24 months. This was a prospective interventional study. The study was included minimum of 54 consecutive patients undergoing laparoscopic appendectomy. Patients included in this study had simple, uncomplicated appendicitis, and the patient planned for an interval appendectomy. Exclusion criteria were an appendicular lump, an appendicular abscess, and an appendicular perforation.

All patients undergoing laparoscopic appendectomy fulfilling inclusion criteria will be kept under this study. The diagnosis will be made via means of clinical, radiological, and laboratory investigations. In all the patients, laparoscopic appendectomy will be done via conventional method except Harmonic Scalpel will be used to coagulate the mesoappendix.

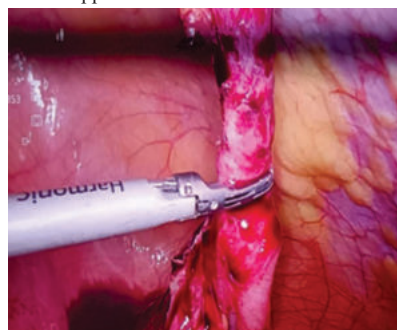


Figure- 1: Approach at the base of appendix

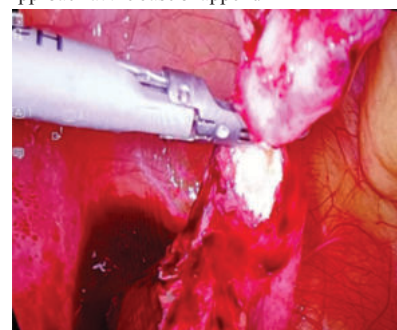


Figure- 2: Cut the base of appendix using harmonic

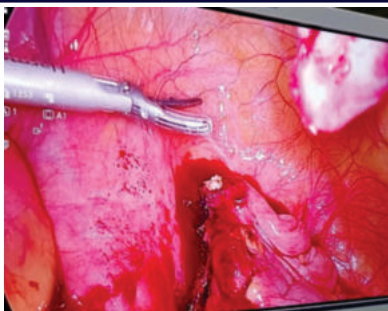


Figure- 3: Appendix separate from it's stump



Figure- 4: Sealed remaining stump by using harmonics



Figure- 5: Put a drain to assess postop leaks

Base of the appendix will be sealed via harmonic scalpel in a stepwise manner (figure-1, 2, 3, 4 & 5) at the setting of minimum just to occlude the lumen and just distal to previous site till the appendix is divided. Postoperatively, all patients will be given antibiotics according to hospital protocol. Patients will be kept nil per orally until the return of bowel movements and discharged after 24 hours of full feed.

RESULTS-

The maximum age was 65 years and the minimum age was 12 years. The mean age and standard deviation (SD) were 31.22 ± 13.35 years. Out of 54 patients 31 (57.41%) patients were male and rest of 23 (42.59%) patients were female (table-1). Appendectomies were done in all patients by harmonics.

Table- 1- Gender distribution

	Harmonic	Percentage (%)
Male	31	57.41
Female	23	42.59
Total	54	100

The maximum age was 65 years and the minimum age was 12 years. The mean age and standard deviation (SD) were 31.22 ± 13.35 years. Maximum number of patients (26 patients) belonged to age group 21-40 years. Minimum number of patients (2 patients) was in age group >60 years (table-2).

Table- 2- Age wise distribution

Age groups(yrs)	No.	Percentage (%)
≤20	14	25.93
21-40	26	48.15
41-60	12	22.22
>60	2	3.70
Total	54	100.00

Out of 54 appendectomies were performed by harmonic during this

period out of which 44 case done as elective and 10 were done as emergencies case (table-3).

Table- 3- Type of surgery

Type	Case(Harmonic)	Percentage (%)
Emergency	10	18.52
Elective	44	81.48
Total	54	100

We did not consider return of bowel sound on day 3 as we consider it as post operative paralytic ileus. Therefore we check bowel sound on post op day 4 and it occur in 4(07.41%) cases, and we allow oral soft diet on next day of return of bowel sound and discharge the patient on same day in evening (table-4).

Table- 4- Return of bowel sound

Return of bowel sound	Cases (Harmonic)	Percentage (%)
D1	42	77.78
D2	8	14.81
D3	0	0
D4	4	7.41

Mean operative time for 54 appendectomies by harmonics was 28.463 ± 7.19 minutes and maximum and minimum time taken was 48 min and 17 minute (table-5).

Table- 5- Operating time taken in patients

Operation Time In Minute	Frequency Of Patients(Harmonic)	Percentage Of Patients(%)
16-20	9	16.7
21-25	9	16.7
26-30	15	27.8
31-35	12	22.2
36-40	5	09.2
41-45	3	05.6
>45	1	1.8
TOTAL	54	100

Complication include in both per operative and post operative periods. Out of 54 appendectomies no complication occurs in 47 cases. Per operatively haemostatic clip was used in 1(1.8%) cases and in post op period surgical site infection occur in 2(3.7%) case and post operative ileus occur in 4(7.4%) cases (table-6).

Table- 6- Complications Found In Patients

Complication	Case(Harmonic)	Percentage (%)
Ileus	4	7.4
Intraoperative bleeding	1	1.8
Infection	2	3.7
Normal	47	87.1
Total	54	100

DISCUSSION-

Appendicitis is an inflammation of the vermiform appendix. It is mostly caused by obstruction of the lumen due to hyperplasia of the lymphoid follicles at a younger age or by obstruction of the lumen by faecoliths in older patients. Appendicitis is the most common surgical abdominal emergency. Appendicitis has a lifetime risk of 8.6% for men and 6.7% for women, with the highest incidence in the second and third decades².

Abdominal pain is one of the most common symptoms for which patients seek medical attention. Acute appendicitis is the most common cause of acute abdominal pain, and distinguishing appendicitis from other disorders is sometimes difficult, particularly in young, preverbal children. The acceptance of laparoscopic appendectomy among surgeons is increasing⁹. Laparoscopic appendectomy has been shown to be advantageous compared to open appendectomy in regard to early postoperative parameters such as postoperative pain and recovery of the bowel functions, and is also associated with a lower wound infection rate¹⁰. Despite the lack of a clear outcome benefit of laparoscopic appendectomy, most studies have confirmed a substantially higher cost of laparoscopic appendectomy compared to open appendectomy, due to expensive disposable equipment used during the procedure. The closure of the appendiceal stump is an important step during a laparoscopic appendectomy, because most of the postoperative complications are caused by its inappropriate management. The development of life

threatening events such as stercoral fistulas, postoperative peritonitis and sepsis are included in these complications. Currently two techniques are used for laparoscopic appendectomy: Division of the mesoappendix with the harmonic scalpel and ligation of the appendix with an endoloop, or division of the mesoappendix and appendix with an endostapler¹¹.

All alternatives have advantages and disadvantages for the different clinical stages of acute appendicitis, but endoloops and endostaplers are used most frequently. In some studies sometimes harmonic used to divide and coagulate the mesoappendix and base of appendix was sealed by another above mentioned technique. We recommend the use of the harmonic scalpel for both division of mesoappendix and also for the management of appendicular stump, although the results did not show a significant difference between the harmonic scalpel and loop knots techniques with respect to intra abdominal abscess formation¹².

Controversy arises out of the above-mentioned technique as to which technique is the best choice for management of the appendicular stump. In our study, we used harmonics for the division of the mesoappendix and also to coagulate and cut the appendix at its base. The major benefit of our study is that the duration of surgery was significantly reduced because the same instrument was used to divide the mesoappendix and cut the appendix from the base. Initially time required for surgery was more because we put drain in 9 cases to check the stump leak at the base of appendix but there was no leak at appendicular base in any case so in further case we did not put the drain.

Study done in department of paediatric surgery in AIIMS, New Delhi in year 2013. In three patients one female and two males aged 5, 7 and 11 years mean operating time was less than 30 min and without any complication in follow up¹³. All patients are in follow-up with no complications, which is comparable to our study's mean operating time of 28.46 minutes with no complications in follow-up.

A similar study was done in 2018 in the General Surgery Department, Al Azhar University, Egypt. In the study laparoscopic appendectomy was done on 40 patients and divided in two groups in 20 patient harmonic scalpel was used and rest 20 patient loop knots were used to seal the base of appendix. Mean operating time for harmonic scalpel group was 38.95±3.55 min with average hospital stay 3.45±0.83 days and for loop knots group was 49.95±3.63 minutes with average hospital stay 3.5±1.00 days and without any complication in follow up¹⁴. Comparing to our study, mean operating time 28.46±7.20 minute with average hospital stay 2.83±0.83 days and without any complication in follow up.

In our study total 54 appendectomies was done by harmonics out of which 31(57.41%) patient were male and 23(42.59%) patient were female from age 12 years to 65 year with mean age 31.22±13.34 years. Out of 54 appendectomies 10(18.52%) cases done in emergency and 44(81.48%) case were elective surgeries. Mean Operative time for surgery is was 28.46±7.20 min with maximum and minimum operative time was 48 min and 17 min.

Return of bowel sound occurs on POD1 in 42 (77.78%) cases, on POD2 in 8 (14.81%) cases, and is considered postoperative ileus. We did not check bowel sound on POD 3, and postoperative ileus occurs in 4 (7.41%) cases (i.e., return of bowel sound occurs on day 4). And we allow oral soft diet on next day of return of bowel sound and patient was discharged. Complications include both the peri-operative and postoperative periods. Out of 54 appendectomies, no complication occurred in 47 cases. Total 7 complication occur in our study i.e. per operatively haemostatic clip was used in 1(1.8%) cases and in post op period surgical site infection occur in 2(3.7%) case and postoperative ileus occur in 4(7.4%) cases.

After discharge all the patients operated by laparoscopic appendectomy by harmonics was followed in opd after 7 days of discharge to look for surgical site infection and suture removal. In group laparoscopic appendectomy by harmonic surgery, surgical site infection occurred in 2 (3.70%) cases, which was managed by cleaning and dressing and secondary suturing when granulation occurred. These patients also followed in OPD after 30 and 90 days of discharge to look for stump leakage and any abdominal adhesion, intestinal obstruction distention. But there was none of patients develop abdominal distention or any other complication.

We observed no mortality in our study. The postoperative complication rates observed in our study were also similar to other reports. The small percentage of surgical site infections indicates that the techniques for appendicular stump closure are safe. In our opinion, just a few surgical wound infections and no intra-abdominal abscess formation in our patients are associated with the intraoperative suction and lavage of the peritoneal cavity, routinely used drains, and the proper administration of antibiotics.

CONCLUSION-

Data from the literature and our results indicate that the management of the appendicular base with harmonics during laparoscopic appendectomy appears to be a simple, safe alternative. It is associated with a low complication rate. Because of these advantages, laparoscopic appendectomy by harmonics is most frequently used in our department. Our technique of appendicular stump closure by harmonic scalpel is effective and safe.

Limitation-

This study includes small sample size, the results could have been more promising if a large sample was taken. This study is based on single institution. This study include simple uncomplicated appendicitis and patients planned for interval appendectomy.

REFERENCES-

1. Kevin PL, Charles SC, Richard JA. Appendix. In: Townsend CM, Beauchamp RD, Evers BM, Mattox KL, Editor. Sabiston DC. Textbook of Surgery, 15th ed. Philadelphia, Pennsylvania: WB Saunders; 1997.p. 965-6
2. Addiss DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the United States. *Am J Epidemiol* 1990;132:910-25.
3. Jaffe BM, Berger DH, Anderson RE, Liang MK. The Appendix. In: Brunicaudi FC, editor. *Schwartz's Principle Of Surgery*, 10th ed. New York: McGraw-Hill; 2005. p.1119-38.
4. Connell PR. The vermiform appendix. In: Russell RCG, Williams NS, editor. *Bailey and Love's Short Practice of Surgery*, 25th ed. London: Hodder Arnold; 2008. p.1204-18.
5. Daniell JF, Gurley LD, Kurtz BR, Chambers JF. The use of an automatic stapling device for laparoscopic appendectomy. *ObstetGynecol* 1991;78(4):721-3.
6. Khanna S, Khurana S, Vij S. No clip, no ligature laparoscopic appendectomy. *SurgLaparoscEndoscPercutan Tech* 2004;14(4):201-3.
7. Yavuz A, Bulus H, Tas A, Avdin A. Evaluation of Stump Pressure in Three Types of Appendectomy: Harmonic Salpel, Ligasure, and Conventional Technique. *J Laparoendoscadv Surg Tech A* 2016;26(12):950-3.
8. El Nakeeb A, Askar W, El Lithy R, Farid M. Clipless laparoscopic cholecystectomy using the harmonic scalpel for cirrhotic patients: a prospective randomized study. *SurgEndosc* 2010; Epub ahead of print.
9. Sahn M, Kube R, Schmidt S, Ritter C, Pross M, Lippert H (2011): Current analysis of endoloops in appendiceal stump closure. *SurgEndosc.*, 25:124-9.
10. Rashid A, Nazir S, Kakroo SM, Chalkoo MA, Razvi SA, Wani AA. Laparoscopic interval appendectomy versus open interval appendectomy: a prospective randomized controlled trial. *SurgLaparoscEndoscPercutan Tech* 2013;23:93-6.
11. Lukish J, Powell D, Morrow S, Cruess D, Guzzetta P. Laparoscopic appendectomy in children: Use of the endoloopvs the endostapler. *Arch Surg* 2007;142:58-61.
12. Beldi G, Muggli K, Helbling C, Schlumpf R. Laparoscopic appendectomy using endoloops: a prospective randomized clinical trial. *SurgEndosc* 2004;18:749-50.
13. Bajpai M. Technique of 'suture less' appendectomy by laparoscopy in children: Preliminary communication. *J. Indian assoc. Pediatr.Surg* 2014;19(1):28-30.
14. Hamdy AA, Ayoub MF, Elsayed AA. Loop Knots Versus Harmonic Scalpel in Laparoscopic Appendectomy. *Egypt. J. Hosp. Med.* 2018;72(3):4109-12.