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Hand Assisted versus Intracorporeal Ligation of Appendicular Base During Laparoscopic Appendectomy

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ABSTRACT

Background: Laparoscopic appendectomy is one of the most common operations in surgical practice. It can be performed by open and laparoscopic methods. Laparoscopic appendectomy have the advantage of less pain time and early return to work. The current work aimed to evaluate the safety, and effectiveness of intracorporeal ligation versus extraction of the appendicular base during laparoscopic appendectomy.

Patients and Methods: This clinical trial involved 40 patients with acute appendicitis. They were selected from the surgery department, Al-Azhar Faculty of Medicine, Damietta, Egypt. They were scheduled for laparoscopic appendectomy and randomized to one of two groups; the first (A) for intracorporeal ligation of the based and the second (B) for hand assisted ligation of the stump. The collected data included operative time, postoperative outcome (duration of stay, back to usual oral feeding and postoperative complications (e.g., wound infection or leakage).

Results: Male patients were slightly predominating in both groups. The hand assisted ligation of appendicular stump had significantly shorter operative time (34.4 ± 3.05 vs 42.95 ± 8.21 minutes respectively). However, there was no significant differences in both groups regarding post operative complication, except significant increase of port-site infection in hand assisted than the intracorporeal group (45.0% vs 10.0%) which was mild and treated conservatively. No leakage was reported in both groups.

Conclusions: Hand assisted ligation of appendicular base during laparoscopic appendectomy is safe and effective method with shorter operative time. It encourages the surgeon to do more complex procedures.

Keywords: Laparoscopic appendectomy; Appendicular Base; Ligation; Intracorporeal; Extracorporeal.



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INTRODUCTION

Laparoscopic appendectomy introduced in 1980. Since then, it became the gold standard operation ⁽¹⁾. Laparoscopic appendectomy is more advantageous than open surgery, as it has less intraoperative time, shorter duration of hospital stay, earlier return to usual activities, lower pain scores, and good cosmesis. Laparoscopy permits inspection of all abdominal cavity with good exploration to all viscera ⁽²⁾.

Laparoscopic ligation of the appendix stump and choice of method of closure is crucial to avoid postoperative complications (e.g., fistula, peritonitis and sepsis). Different methods are existed and include clips, staples and hand assisted ligation. If there is any doubt about the stump another seromuscular suture is taken, ⁽³⁻⁵⁾. However, its methods had advantages and disadvantages. For example, stapling devices are very expensive. However, it is associated with the mildest inflammatory reaction with formation of least adhesions ^(6,7). In addition, tying intra-abdominal knots of the stump is challenging and difficult. This explained by limited space for movement, lack of twist movement at the wrist joint and the need for great manual dexterity. On the other side, extracorporeal knotting is a widely used alternative method. The knot is performed outside the body (extracorporeal), then sited to desired position. The knot must be secure, quick and easily applied ^(8,9).

The current work aimed to compare intracorporeal to hand-assisted extracorporeal ligation of the appendix base regarding operative time, overall hospital stay duration and postoperative complications

PATIENTS AND METHODS

Forty patients with acute appendicitis were eligible for inclusion and evaluated for operative and postoperative data. The study completed between December 2020 and June 2022. It was performed at the Department of General Surgery, Damietta Faculty of Medicine, Al-Azhar University, Damietta, Egypt. All operations were performed by the same surgeon, and this is the main inclusion criterion. On the other side, patients with appendicular mass or abscess, patients unfit for anesthesia and those who refused participation were excluded from the study. Patients were divided into two equal groups A and B. The randomization was performed by computer-generated numbers with odds for A and Even for B groups. Numbers were preserved in closed envelope that opened by the nurse in the theater (who's not included in the study). Group A was for intra-corporeal ligation and group B was for extra-corporeal hand assisted ligation. For each patient, the clinical evaluation was achieved by collecting detailed data of medical history, clinical examination, laboratory and radiological assessment.

Operative methods:

All operations were performed under general anesthesia, in supine position. After complete sterilization

of surgical sites, a supraumbilical 10 mm port was assigned for camera. Then, another 10mm port was inserted in the right iliac fossa (McBurney point) and 5 mm port in suprapubic region (midway between umbilicus and symphysis pubis) slightly to the left. Pneumoperitoneum was induced by the use of carbon dioxide for insufflation with a range pressure of 12-14mmHg. When pneumoperitoneum was settled, the 30° 10mm telescope was inserted inside the umbilical port.

The recognition of the appendix was done and the diagnosis was confirmed. Then, the appendix was mobilized and holding was achieved by atraumatic grasper with traction towards anterior abdominal wall. The harmonic scalpel was used to lyse any adhesions between the appendix and the surrounding structures. Then mesoappendix was cauterized starting from the tip of the appendix to its base.

The intracorporeal knot (group -A) was performed by the 20cm vicryl-2/0-suture. Three knots were used around the appendix base using square knot and surgeon's knot (Figure 1). Lastly the specimen was removed through the port with the valve held open. Peritoneal lavage was done and drain was inserted according to the need. Caecum and stump were visualized using the camera to check hemostasis and security.

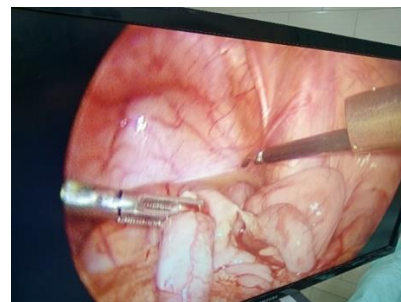


Figure (1): Grasping appendicular tip for intracorporeal ligation

In group B (extracorporeal), appendix was grasped from the tip, air was deflated and the appendix was grasped from the abdomen through the port in the right iliac fossa. Ligation of the base, and appendectomy was completed (Figure 2). Appendicular stump was reduced to the abdominal cavity. The abdomen was inflated again and the stump was visualized for any bleeding. The port was extracted closure of the port site was done. Histopathological study was ordered for all specimens.



Figure (2): Hand assisted ligation of appendicular stump

Data collected included patient demographics, intraoperative data and postoperative complications.

Data analysis: The collected data were treated by the statistical package for social science (SPSS) version 16 (SPSS Inc., Chicago, Illinois, USA). Numerical data were presented by the mean and standard deviation (SD) and both groups compared by the student “t” test. Otherwise, the categorical data were presented by the frequency and percentages. Groups were compared by Chi square test. P value < 0.05 was considered significant.

RESULTS

Table 1 compares demographic distribution in two groups: intracorporeal ligation of the appendix base (n=20) and hand-assisted ligation of the appendix base (n=20). The mean age was 33.15 (SD=10.1) years and 31.80 (SD=7.03) years, with no significant difference (p=0.628). Male patients made up 55.0% (n=11) and 65.0% (n=13) of the respective groups, with no

statistically significant difference (p=0.748).

Table (2) compares operation time and hospital stay between two groups: intracorporeal ligation of the appendix base (n=20) and hand-assisted ligation of the appendix base (n=20). The mean operating time was 42.95 minutes (SD=8.21) and 34.4 minutes (SD=3.05), with a significant difference (p=0.000) between the two groups. The average hospital stay was 1.35 days (SD=0.48) and 1.45 days (SD=0.60), with no statistically significant difference (p=0.569).

The postoperative complications of intracorporeal ligation versus hand-assisted ligation of the appendix base are compared in Table (3). With a significant difference (p=0.013), port site infection occurred in 10% (n=2) of Group A and 45% (n=9) of Group B. There were no reports of leakage in either group. Fever occurred in 10% of Group A (n=2) and 25% of Group B (n=5), with no significant difference (p=0.212).

Table (1): Comparison of demographic distribution of patients in both groups

Variable		Intra-corporeal ligation	Hand assisted ligation	Total	P value
Age	mean ± SD	33.15 ±10.1	31.80 ± 7.03	32.48 ± 8.66	0.628
	Min.-Max.	18-50	19-43	18-50	
Sex	Male	11 (55.0%)	13 (65.0%)	24(60.0%)	0.748
	Female	9(45.0%)	7 (35.0%)	16(40.0%)	

Table (2): Comparison between two groups as regards operative time and hospital stay

Variable		Intra-corporeal ligation	Hand assisted ligation	Total	P value
Operative time (min)	Mean ± SD	42.95 ± 8.21	34.4 ± 3.05	38.68 ± 7.49	<0.001*
	Min.- Max.	30-60	30-40	30-60	
Hospital stay (day)	Mean ± SD	1.35 ± 0.48	1.45 ± 0.60	1.40 ± 0.54	0.569
	Range	1-2	1-3	1-3	

Table (3): Comparison between Intra-corporeal ligation and Hand assisted ligation techniques as regarding postoperative complications

Variable		Intra-corporeal ligation	Hand assisted ligation	Total	P value
Port-site Infection	Yes	2 (10.0%)	9 (45.0%)	11 (27.5%)	0.013*
	No	18 (90.0%)	11 (55.0%)	29 (72.5%)	
Leakage	Yes	0 (0.0%)	0 (0.0%)	0 (0.0%)	-----
	No	20 (100%)	20 (100%)	40 (100%)	
Fever	Yes	2 (10.0%)	5 (25.0%)	7 (17.5%)	0.212
	No	18 (90.0%)	15 (75.0%)	33 (82.5%)	

DISCUSSION

Technique for appendicular stump ligation is a controversial topic among surgeons. However, it can be performed safely with extracorporeal knot, intracorporeal clips and hand assisted technique (10). The current work aimed to compare intracorporeal to extracorporeal hand assisted ligation of the appendicular stump regarding safety and effectiveness. The results revealed that, hand assisted

extracorporeal ligation was associated with significantly shorter operative time. However, the post-operative port site infection was significantly higher among this group than intracorporeal ligation (45% vs 10% respectively). Otherwise, no other significant differences were recorded. All complications were managed conservatively and no need for further surgical intervention. **Nadeem et al.** (11) included 68 cases, 36 in the first and 32 in the second group. Their results showed non-significant differences

between groups regarding patient age (as in the current work). However, the groups were significantly different regarding sex distribution (in contradiction to the current work). Different inclusion criteria and the unequal distribution of patients in both groups could explain the contradiction regarding sex distribution. However, **Arakeeb et al.** ⁽¹²⁾ reported non-significant differences between their groups regarding patient age, sex and body mass index distribution. This confirmed in the current work. The same authors reported that, the operative time was significantly shorter among extracorporeal than intracorporeal groups (46.07±11.70 vs 61.73±11.33 minutes, p value =0.001). This is also in line with the current work. However, the surface wound infection was reported among one case in extracorporeal and two in the intracorporeal groups with no significant differences. **Elshoura and Hassan** ⁽¹³⁾ reported shorter operative time in the extracorporeal than intracorporeal group (71.5 vs 84.3 minutes, respectively).

Results of the current work favors the extracorporeal hand assisted ligation due to its shorter operative time and comparable postoperative complications and total duration of hospital stay, irrespective of higher superficial wound infection in this group, as these infections were treated conservatively and need not extra-intervention. These results could be explained by the inherent disadvantages of intracorporeal knot. These limitations included limited space for movement, reduced sensation of the applied tension to the tissues and difficulties in knotting due to shortages in technical needs. On the other side, extracorporeal, hand assisted ligations are easier to create, and the tension is controlled while advancing the knot. The majority of extracorporeal knots are sliding knots, and this raises concerns about the safety of the ligatures. Due to numerous difficulties and challenges to intracorporeal knot tying, the surgeons try to avoid intracorporeal ligations and make use of extracorporeal one ^(14, 15).

Conclusion: Hand assisted ligation of appendicular base during laparoscopic appendectomy is safe and effective method. It could replace the standard intracorporeal ligation. However, the small sample size is a limiting step of the current work and thus, results must be treated cautiously and future studies are warranted.

Conflict of interest: None.

Financial disclosure: None

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