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Original Article

Endo loop Ligation versus Clipping of Appendicular Stump in Laparoscopic Appendectomy

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ABSTRACT

Background: The current research sought to evaluate and contrast the effectiveness and complications of endo-loop ligation and clipping in securing the appendicular stump during laparoscopic appendectomy

Methods: This research involved 60 patients diagnosed as acute appendicitis, who were splitted into two groups: endoloop group and polymeric clipping group. Analysed data were the operative time, intraoperative problems, and post-operative outcomes and complications in both groups for comparative investigations.

Results: The surgical procedure duration was notably greater in the endo-loop ligation group compared to the clipping group. The groups did not show any notable disparities in terms of the average duration of the hospital stay, time taken to return to work, and post-operative problems. The overall cost of endoloop ligation was significantly greater than that of clipping.

Conclusions: The utilization of clips in surgery is faster to perform, and easier for surgeons compared to ligation technique, which require prior skill in dealing with a large, hard, and easily crumbled appendix.

Key words: Endo loop; Clipping; Appendicitis;Laparoscope.

INTRODUCTION

The identification of appendicitis as a medical condition dates back to the sixteenth century, and it is referred to as perityphlitis [1]. Appendicitis is the predominant intra-abdominal disease necessitating urgent surgical intervention. Appendectomy is a frequently performed technique in the field of general surgery, representing around 1% of all surgical operations [2].

Claudius Amyand, a surgeon at St. George's Hospital in London, UK, conducted the first appendectomy in 1736 [3]. In 1889, McBurney provided a description of the clinical characteristics of acute appendicitis. Appendectomy, performed by an open surgical approach, has been the established and widely used method of treatment for the past century [1].Laparoscopic appendectomy has been widely accepted globally and has become the established method of treatment in the years following the initial publication on laparoscopic appendectomy [4]. The laparoscopic appendectomy

was initially documented by gynecologist Kurt Semm in 1982 [5].

Laparoscopy has advantages such as reduced hospitalization duration, quicker resumption of employment, and decreased postoperative discomfort [6]. The documented occurrence of acute appendicitis has risen in recent decades, possibly due to the increased utilization of CT imaging. Among all cases, around 25% are classified as complex appendicitis [7]. In laparoscopic appendectomy, various enhancements have been made to improve and regulate the closure of the appendicular stump. These include the use of staplers, endoloops, titanium clips, non-absorbable polymer clips (Hemo lock clips), hand-made loops, and suture closure [8].

The Endoloop is a widely utilized commercial tool in the field of laparoscopic appendectomy. The material used for its construction can be either polyglactin, and it is available in several thicknesses [9]. Endoloop has been suggested by multiple

writers due to its safety in securing the appendicular stump and its cost-effectiveness compared to staplers [10]. The objective of the present study was to compare the techniques of endo-loop ligation and appendicular stump clipping during laparoscopic appendectomy.

METHODS

The search was carried out in the General Surgery Department at Zagazig University Hospital after acquiring a local institutional review board (IRB) approval. A total of sixty patients presented with acute appendicitis were allocated randomly using a computerized approach into two groups: the first group (A) consisting of 30 patients who underwent endoloop ligation, and the second group (B) consisting of 30 patients who underwent polymeric clip. The study aims and methods were explained to every participant. A written consent was gained from every participant. Inclusion criteria: All patients diagnosed with acute non-complicated appendicitis who underwent laparoscopic appendectomy were included in the study.

Exclusion criteria: The study excluded patients who had appendicular abscess or mass, appendicular base perforation or presented with generalized peritonitis detected by ultrasound, or inspection under anesthesia. Furthermore, patients who were deemed unsuitable for laparoscopic surgeries were also omitted.

All subjects had comprehensive history taking, meticulous clinical examination, including a general assessment of vital signs, and a localized abdominal examination. Comprehensive laboratory tests were conducted, which included a complete blood count (CBC), liver function tests (LFTs), kidney function tests (KFTs), coagulation profile, and hepatitis markers.

Ultrasonography was consistently conducted in all patients. The patient was suspected of experiencing problems, thus a contrast-enhanced CT of the abdomen and pelvis was requested.

Surgical techniques:

Three ports were utilized in all patients. An optic port, measuring 10 mm in diameter, was introduced somewhat above the umbilicus. A telescope with a 30-degree field of view was utilized. A second port, measuring 10 mm, was introduced into the left iliac fossa. Through this port, we inserted a non-traumatic grasper to handle the viscera for the purpose of performing a diagnostic laparoscopy. The additional functional port (5 mm) was introduced into the suprapubic area midway

between umbilicus and symphysis pubis in midline away from urinary bladder. Clipping necessitates insertion of 10 mm port and after that the sheath closed by vicryl 0 to prevent hernia. The patient was positioned in the Trendelenburg position with a slight left tilt to enhance visibility of the caecum and appendix. Any fluid or collections were aspirated at the beginning. The initial stage in all methods is the devascularization of the meso-appendix using bipolar diathermy. In the second stage, the stump is ligated using either an endoloop, as in group (A), or a polymeric clip, as in group (B). Ultimately, the abdominal cavity was scrutinized for the presence of any collections or haematomas. Drains were only placed in the specified instances. The appendix was extracted via the port located in the left iliac fossa or optic port.

The discharge criteria for the patient from the hospital consisted of three main factors: absence of fever, satisfactory intestinal sound, and regular follow-up at the outpatient clinic to monitor for any potential complications. The follow-up schedule involved visits after three days, then after one week for removal of the skin suture, followed by weekly visits for one month, and subsequently monthly visits for a duration of six months.

The outcome measurements for the two techniques consisted of the time taken for the operation, any complications that occurred during the operation (such as bleeding, slippage, or injury to other organs), and any complications that occurred after the operation (such as bleeding, missed intestinal injury, intestinal fistula, or adhesive intestinal obstruction).

STATISTICAL ANALYSIS:

The data that was gathered was analyzed using the Statistical Package of Social Services version 24 (SPSS), and the results are displayed in tables and graphs. Continuous quantitative variables, such as age, were presented as the mean \pm standard deviation (SD) and median (range). Categorical qualitative variables were presented as absolute frequencies (number) and relative frequencies (%). Appropriate statistical significance tests were conducted after verifying normality. Results were deemed statistically significant if the probability of significance was below 0.05 ($P < 0.05$). A P-value less than 0.001 was deemed highly statistically significant (HS), while a P-value greater than or equal to 0.05 was judged statistically insignificant (NS).

RESULTS:

The studied Endo loop Ligation group ages ranging from 13-40 years old with mean 24.9 years ± 5.42 SD and (40%) of them were male, as regards the Clipping group, their age ranged from 16-39 years with mean 27.3 years ± 5.6 SD and one third of them were male (33.3%), with no statistical difference between the two studied groups as regards the demographic data including age or sex. There were no observed significant differences between the two studied groups in terms of the base and gross pathology of the appendix intraoperatively.

The operative time was significantly higher in the endo-loop ligation group in comparison to the

clipping group (45–66 min, mean 53.56 ± 7.97 min versus 43.6 ± 8.67 min in clipping group.

The mean duration of hospital stay among in the endoloop ligation group was 3.8 days ±1.2 SD, while in clipping group it was 4.5 days ± 1.5SD, and these differences were not statistically significant (P >0.05).

There were no observed statistically significant differences between the two studied groups regarding post-operative complications such as intestinal injury, ileus, pelvic abscess, port site infection, port site hernia, intestinal fistula, peritonitis, adhesive intestinal obstruction, Conversion to open surgery and stump leakage.

Table (1): Demographic characteristics of the studied groups

Item	Endo loop Ligation group (N=30)		Polymeric Clipping (N=30)		P-value
Age (years)					
Mean ± SD	24.9 ± 5.42		27.3 ± 5.6		0.099
Sex	No.	%	No.	%	
Male	12	40.0%	10	33.3%	0.789
Female	18	60.0%	20	66.7%	
Comorbidities	No.	%	No.	%	
DM	2	6.7%	3	10%	0.641
Hypertension	2	6.7%	1	3.3%	0.554
Cardiac diseases	1	3.3%	0	0%	0.313

Table (2): Clinical presentation and US findings of acute appendicitis in the studied groups

Item	Endo loop Ligation group (N=30)		Clipping group (N=30)		P-value
	No.	%	No.	%	
Clinical presentation					
Abdominal pain	30	100 %	30	100%	1.00
Anorexia	22	73.3%	20	66.7%	0.6
Nausea & vomiting	15	50%	18	60%	0.4
Constipation	10	33.3%	8	26.7%	0.6
Elevated temperature	16	53.3%	14	46.7%	0.6
Rt iliac fossa tenderness	30	100%	30	100%	1.00
Rebound tenderness	28	93.3%	27	90%	0.6
US findings					
Dilated base	11	36.7%	9	30%	0.56
Peritoneal free fluid	10	33.3%	8	26.7%	
Not-visualized	9	30 %	13	43.3%	

Chi-Square test P < 0.05 is significant. NS: Not significant

Table (3): Outcomes among the studied groups

Item	Endoloop Ligation group (N=30)	Clipping group (N=30)	P-value
Time of operation (min)	60.33 ± 5.77	43.6 ± 8.67	0.000*
Hospital stay duration (Days)	3.8±1.2	4.5±1.5	0.145
Total cost (Egyptian pounds)	6000 ± 100.27	5000 ± 112.74	0.002
Return to work (Days)	6.46 ± 1.59	5.9 ± 1.32	0.169

Table (4): Post-operative complications in the studied groups

Item	Endo loop Ligation group (N=30)		Clipping group (N=30)		P-value
	No.	%	No.	%	
Intestinal injury	0	0.0	0	0.0	1.00
Ileus	3	10.0	0	0.0	0.075
Pelvi abscess	0	0.0	0	0.0	1.00
Port site infection	3	10.0	0	0.0	0.075
Port site hernia	0	0.0	0	0.0	1.00
Intestinal fistula	0	0.0	0	0.0	1.00
Pertontitis	2	6.7%	2	6.7%	1.00
Adhesive intestinal obstruction	0	0.0	0	0.0	1.00
Conversion	2	6.7%	2	6.7%	1.00
Stump leakage	3	10%	2	6.7%	0.64

DISCUSSION:

The utilization of laparoscopic appendectomy is anticipated to progressively rise and establish itself as the preferred method for treating acute appendicitis due to its comparable benefits to laparoscopic cholecystectomy. The primary focus of laparoscopic appendectomy, regardless of the specific technique used, is ensuring the safety of the approach employed to close the appendicular stump. Consequently, there are numerous well-established techniques that are more effective than others. Operative duration, duration of hospitalization, and postoperative problems are commonly employed to assess and compare the advantages of these techniques.

Our study showed that there was a highly statistically significant difference between both groups. With regard to the operative time, Endo loop Ligation was 60.33 ± 5.77 min and Clipping was 43.6 ± 8.67 min.

These findings align with Ibrahim et al. [11], who observed a large and statistically meaningful disparity in operative time between the two groups. The duration of the procedure was 55.62±6.04 minutes in the ligation group and 46.44±6.83 minutes in the clips group. Abbas et al. [11]

demonstrated a statistically significant disparity in operative time between the two groups, with the ligation group experiencing a lengthier duration. In the study conducted by Abbas et al. [11], the average duration of the surgical procedure was 40 minutes for patients who had ligation, while it was 25 minutes for patients who underwent polymeric clip application. Abou-Sheishaa et al. conducted a study where the average duration of the operation was found to be 54.6 minutes [13].

In the study conducted by Bhabhor et al. [14], it was determined that a polymer clip is a more practical method for closing the appendicular stump compared to an endoloop, based on the surgeon's assessment. This finding was statistically significant in the study. The operating surgeon provided an assessment of the simplicity of application, taking into account factors such as the duration of stump closure, adequate coverage of the appendicular stump, and the intraoperative manipulation of the endoloop or polymer clips. In the study conducted by Bhabhor et al. [14], the operating time was defined as the duration starting with the removal of the appendix's surrounding tissues to the final closure of the appendicular stump. The duration of the surgical procedure, from the first insertion of the

first port to the final closure of the appendicular stump, was measured in the research conducted by Polat et al. [15] and Şimşek et al. [16]. According to Lucchi (17), the duration of the procedure was considerably greater in the ligation group compared to the clipping group. Abounozha (2018) discovered that patients in the HemoLok clip group had a significantly reduced surgical length, with a mean of 37.92 minutes, compared to the Endoloop group, which had a mean surgical time of 46.42 minutes.

The present investigation revealed no statistically significant disparity between the groups in terms of post-operative problems. In line with our findings, Omar et al. [19] demonstrated that there were no statistically significant disparities ($p < 0.05$) in postoperative complications among the groups under examination. Group B saw a mere three incidences (15 percent) of ileus and port site infections. Soll conducted a retrospective observational research on 813 patients who underwent laparoscopic appendectomy to analyze the outcomes. HemoLok was utilized to secure the appendiceal stump in 435 patients, whilst Endoloop sutures were employed in 378 patients. The objective of this study was to determine the frequency of intra-abdominal abscesses following the use of HemoLok clips and to compare them with endoloop ligatures. The researchers determined that utilizing the non-absorbable HemoLok ligation device to close the appendiceal stump led to a lower incidence of intra-abdominal surgical abscesses compared to using the Endoloop.

Our current research findings indicate that there was no statistically significant disparity in the duration of hospitalization between the two groups being studied. Consistent with our research, Abbas et al. [12] demonstrated a statistically insignificant disparity in hospital duration between the two methods. Contrary to our findings, Ibrahim et al. [11] discovered a substantial and statistically significant disparity between the two groups in terms of the duration of hospital stay after the operation. The duration of hospitalization is directly linked to the occurrence of postoperative problems, as demonstrated by JE et al. [20]. Similarly, Bhabhor et al. [14] observed comparable outcomes in these two variables. Nevertheless, the research conducted by Vinod et al. [21] did not reveal any statistically significant disparity in the duration of hospitalization after surgery among the various groups. Our research revealed that the overall expense of endo-loop ligation was significantly greater than that of the clipping group, with an

average cost of 6000 ± 100.27 Egyptian pounds, compared to 5000 ± 112.74 Egyptian pounds in the clipping group.

The current study found no statistically significant variations between the groups tested in terms of the period it took for individuals to return to work after surgery. In both the Endo loop Ligation group and the Clipping group, there was a statistically significant positive association between operative time and return to work. The correlation coefficient (r) was 0.737 with a p-value of 0.000 in the Endo loop Ligation group, and 0.459 with a p-value of 0.011 in the Clipping group. Our findings were consistent with a study conducted by Lucchi et al. [17], which indicated that the duration of hospitalization was much longer in the ligation group compared to the clipping group. However, there was no statistically significant difference between the two groups ($p > 0.05$). The average duration for patients with titanium clips to resume regular activities was shorter compared to those without titanium clips (5.45 days versus 6.30 days). In contrast to our findings, Ibrahim et al. [11] observed a substantial and statistically significant disparity between the two groups in terms of the duration it took for individuals to resume employment. The duration of the ligation group was 6.30 ± 1.78 days, while the duration of the clips group was 5.45 ± 1.50 days.

CONCLUSIONS

The appendicular stump was secured utilising ligation and clipping techniques, which proved to be safe and effective, resulting in minimal adverse events. Clips have several advantages over ligation procedures in surgery. They save time, are faster to administer, and are easier for trainees to understand. Ligation techniques, on the other hand, need prior skill in dealing with a large, hard, and easily crumbled appendiceal stump. Our research revealed that the overall cost of endo-loop ligation was significantly greater than that of cutting.

Recommendations:

According to the findings of our research, we suggest utilizing polymeric clips for closing the appendicular stump in laparoscopic appendectomy.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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