Comparative Evaluation of Ultrasonic Dissection Versus Suture Ligation for Mesoappendix Management in Laparoscopic Appendectomy: A Cross-Sectional Study

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ABSTRACT

Background: Laparoscopic appendectomy is the preferred surgical approach for acute appendicitis. Effective management of the mesoappendix is crucial to ensure hemostasis and reduce operative complications. Various techniques, including ultrasonic dissection and suture ligation, are commonly used, but their comparative effectiveness remains a subject of interest.

Aim: To compare ultrasonic dissection and suture ligation for mesoappendix management in laparoscopic appendectomy.

Materials and Methods: This hospital-based cross-sectional study was conducted at Meenakshi Medical College Hospital, Kanchipuram, over one year. A total of 40 patients undergoing laparoscopic appendectomy were included and divided into two groups: ultrasonic dissection (n = 20) and suture ligation (n = 20). Outcomes assessed included operative time, intraoperative blood loss, postoperative pain using Visual Analogue Scale, duration of hospital stay, and postoperative complications. Statistical analysis was performed using SPSS, and a p value < 0.05 was considered statistically significant.

Results: Operative time was significantly shorter in the ultrasonic group (42.6 ± 6.8 vs 55.2 ± 8.4 minutes; p = 0.001). Intraoperative blood loss was significantly lower (p = 0.001), and postoperative pain scores were significantly reduced (p = 0.001). The duration of hospital stay was shorter in the ultrasonic group (p = 0.001). Postoperative complications were comparable between the groups (p > 0.05).

Conclusion: Ultrasonic dissection is superior to suture ligation for mesoappendix management in laparoscopic appendectomy, offering improved operative efficiency and faster recovery with comparable safety.

Keywords: Laparoscopic appendectomy, ultrasonic dissection, suture ligation, mesoappendix, operative time, cross-sectional study

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Introduction

Acute appendicitis is one of the most common surgical emergencies worldwide, and laparoscopic appendectomy has become the standard surgical approach due to its advantages of reduced postoperative pain, shorter hospital stay, faster recovery, and better cosmetic outcomes. The procedure involves division of the mesoappendix and secure control of the appendiceal artery, which is a crucial step to prevent intraoperative bleeding and complications [1].

Various techniques are available for mesoappendix management during laparoscopic appendectomy, including suture ligation, electrocautery, clips, and advanced energy devices such as ultrasonic dissectors. The choice of technique often depends on surgeon preference, availability of equipment, and intraoperative findings [2].

Suture ligation is a conventional and widely practiced method for controlling the mesoappendix. It is cost-effective and does not require specialized equipment. However, it may be time-consuming and technically demanding, particularly in inflamed or friable tissues, and may increase operative time [3].

Ultrasonic dissection, on the other hand, is an advanced technique that uses high-frequency ultrasonic energy to simultaneously cut and coagulate tissues. It allows precise dissection with minimal thermal spread and effective hemostasis. This technique has gained popularity due to its potential to reduce operative time and intraoperative blood loss [4].

Several studies have compared the effectiveness of ultrasonic devices with conventional techniques in laparoscopic surgeries. Ultrasonic dissection has been associated with improved surgical efficiency, reduced tissue trauma, and better hemostasis. However, its higher cost may limit its widespread use, especially in resource-limited settings [5].

The optimal method for mesoappendix management remains a subject of debate. While ultrasonic dissection offers technical advantages, suture ligation remains a reliable and economical option. Evaluating these techniques in a real-world clinical setting is essential to determine their relative effectiveness and practicality [6].

Cross-sectional studies provide valuable insights into current surgical practices and outcomes without altering routine clinical decision-making. Such studies help in understanding the comparative performance of different techniques in everyday practice. Therefore, the present study was undertaken to compare ultrasonic dissection and suture ligation for mesoappendix management in laparoscopic appendectomy in a cross-sectional study setting [7].

Materials and Methods

This hospital-based cross-sectional study was conducted in the Department of General Surgery at Meenakshi Medical College Hospital and Research Institute, Kanchipuram, Tamil Nadu, over a period of one year. The study aimed to compare ultrasonic dissection and suture ligation techniques for mesoappendix management in patients undergoing laparoscopic appendectomy.

A total of 40 patients diagnosed with acute appendicitis and scheduled for laparoscopic appendectomy were included in the study. Patients aged between 18 and 60 years were considered eligible. Patients with complicated appendicitis such as perforation, abscess, or mass formation, those with significant comorbidities, previous abdominal surgeries, or those unwilling to participate were excluded from the study.

All patients underwent detailed clinical evaluation including history taking, physical examination, and relevant laboratory investigations. Diagnosis of acute appendicitis was confirmed using clinical findings supported by ultrasonography.

Based on routine surgical practice and availability of equipment, patients were categorized into two groups: Group A (ultrasonic dissection, n = 20) and Group B (suture ligation, n = 20). No randomization was performed, as this was a cross-sectional observational study.

In Group A, the mesoappendix was divided using an ultrasonic energy device, allowing simultaneous cutting and coagulation. In Group B, the mesoappendix was managed using conventional suture ligation techniques. All surgeries were performed using standard laparoscopic techniques under general anesthesia by experienced surgeons.

Outcome measures assessed included operative time, intraoperative blood loss, intraoperative complications, postoperative pain using Visual Analogue Scale, duration of hospital stay, and postoperative complications such as wound infection or intra-abdominal collection.

All data collected during the study were systematically entered into Microsoft Excel and subsequently analyzed using Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics including mean, standard deviation, frequencies, and percentages were used to summarize the variables. Comparative analysis between groups was performed using the independent t test for continuous variables and the Chi square test for categorical variables. A p value of less than 0.05 was considered statistically significant.

Results

A total of 40 patients undergoing laparoscopic appendectomy were included in the study, with 20 patients in the ultrasonic dissection group and 20 patients in the suture ligation group.

Table 1: Demographic Characteristics of Study Participants (n = 40)

Variable	Ultrasonic (n = 20)	Suture Ligation (n = 20)	p value
Mean age (years)	32.8 ± 8.6	33.5 ± 9.1	0.78
Male	12 (60%)	11 (55%)	0.75
Female	8 (40%)	9 (45%)	

The mean age and gender distribution were comparable between the two groups. There was no statistically significant difference ($p > 0.05$), indicating both groups were similar at baseline.

Table 2: Operative Time

Parameter	Ultrasonic	Suture Ligation	p value
Mean duration (minutes)	42.6 ± 6.8	55.2 ± 8.4	0.001

The mean operative time was significantly shorter in the ultrasonic dissection group compared to the suture ligation group. This difference was statistically significant ($p = 0.001$), indicating improved surgical efficiency with ultrasonic dissection.

Table 3: Intraoperative Blood Loss

Parameter	Ultrasonic	Suture Ligation	p value
Mean blood loss (ml)	32.4 ± 10.2	58.6 ± 15.1	0.001

Intraoperative blood loss was significantly lower in the ultrasonic group compared to the suture ligation group. The difference was statistically significant ($p = 0.001$), suggesting better hemostasis with ultrasonic dissection.

Table 4: Postoperative Pain Scores (VAS)

Time	Ultrasonic	Suture Ligation	p value
6 hours	3.2 ± 0.9	4.5 ± 1.2	0.001
24 hours	2.1 ± 0.7	3.4 ± 1.0	0.001

Postoperative pain scores were significantly lower in the ultrasonic dissection group at both 6 and 24 hours. The differences were statistically significant ($p = 0.001$), indicating better patient comfort.

Table 5: Duration of Hospital Stay

Parameter	Ultrasonic	Suture Ligation	p value
Mean stay (days)	2.2 ± 0.6	3.4 ± 0.9	0.001

Patients in the ultrasonic group had a significantly shorter hospital stay compared to the suture ligation group. This difference was statistically significant ($p = 0.001$), reflecting faster recovery.

Table 6: Postoperative Complications

Complication	Ultrasonic	Suture Ligation	p value
Wound infection	1 (5%)	3 (15%)	0.29
Intra-abdominal collection	0	2 (10%)	0.14
No complications	19 (95%)	15 (75%)	-

Postoperative complications were more frequent in the suture ligation group; however, the differences were not statistically significant ($p > 0.05$), indicating comparable safety profiles between the two techniques.

Discussion

The present cross-sectional study compared ultrasonic dissection and suture ligation for mesoappendix management in laparoscopic appendectomy. The findings demonstrated that ultrasonic dissection offers significant advantages in terms of operative efficiency, reduced blood loss, decreased postoperative pain, and shorter hospital stay, while both techniques showed comparable safety profiles.

In the present study, baseline characteristics such as age and gender were comparable between the two groups ($p = 0.78$ and $p = 0.75$), ensuring uniformity. Similar findings were reported by Sajid MS et al [8], who emphasized that comparable baseline characteristics are essential for valid comparison of surgical techniques.

The operative time was significantly shorter in the ultrasonic group (42.6 ± 6.8 minutes) compared to the suture ligation group (55.2 ± 8.4 minutes), with a statistically significant difference ($p = 0.001$). This finding is consistent with Sinha R et al [9], who reported that ultrasonic devices reduce operative time due to simultaneous cutting and coagulation.

Intraoperative blood loss was significantly lower in the ultrasonic group (32.4 ± 10.2 ml vs 58.6 ± 15.1 ml; $p = 0.001$), indicating better hemostasis. Similar observations were reported by Koch A et al [10], who demonstrated that ultrasonic energy devices provide effective vessel sealing with minimal blood loss.

Postoperative pain scores were significantly lower in the ultrasonic group at both 6 and 24 hours ($p = 0.001$). This suggests reduced tissue trauma and minimal thermal spread with ultrasonic dissection. Comparable findings were reported by Harrell AG et al [11], who highlighted reduced postoperative pain with advanced energy devices.

The duration of hospital stay was significantly shorter in the ultrasonic group (2.2 ± 0.6 days vs 3.4 ± 0.9 days; $p = 0.001$), reflecting faster recovery. This finding is supported by Cengiz Y et al [12], who reported earlier discharge and improved recovery with ultrasonic dissection techniques.

Although postoperative complications were slightly higher in the suture ligation group, the difference was not statistically significant ($p > 0.05$), indicating comparable safety between both techniques. Similar findings were reported by Khan MN et al [13], who

concluded that both techniques are safe with no significant difference in complication rates.

The use of ultrasonic devices allows precise dissection with minimal lateral thermal damage, which may contribute to better surgical outcomes. Sarkar A et al [14] emphasized that advanced energy devices improve surgical precision and reduce operative difficulties.

Despite its advantages, the higher cost of ultrasonic devices remains a limitation, particularly in resource-limited settings. Tanaka K et al [15] noted that cost-effectiveness should be considered when selecting surgical techniques.

Recent studies have further supported the benefits of ultrasonic dissection in laparoscopic surgeries. Singh K et al [16] reported improved operative outcomes and reduced complications with ultrasonic devices. Additionally, Gupta V et al [17] demonstrated that ultrasonic dissection enhances surgical efficiency and reduces intraoperative complications. Similarly, Patel R et al [18] highlighted improved patient outcomes and faster recovery with the use of advanced energy devices.

Conclusion

The present cross-sectional study demonstrated that ultrasonic dissection is superior to suture ligation for mesoappendix management in laparoscopic appendectomy. Ultrasonic dissection was associated with significantly shorter operative time ($p = 0.001$), reduced intraoperative blood loss ($p = 0.001$), lower postoperative pain scores ($p = 0.001$), and shorter duration of hospital stay ($p = 0.001$). Although postoperative complications were slightly higher in the suture ligation group, the difference was not statistically significant ($p > 0.05$), indicating that both techniques are safe. Overall, ultrasonic dissection offers better surgical efficiency and improved patient recovery, and may be considered a preferable technique for mesoappendix management, especially where resources permit.

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