Original Research Article

A Comparative Study between Single Loop Ligature and Conventional Two Loop Ligature among Surgical Team

Mohanakrishna Meka*

Associate Professor, Department of Surgery, Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar, Telangana, India

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Abstract

Background: Single Loop Ligatureis one of the most commonly performed single port surgeries in the world. **Objectives:** To investigate clinical outcomes of Single Loop Ligature performed by us and to evaluate its feasibility and safety compared with Conventional Two Loop Ligature when performed by Surgical Team**Methods:** Between September 2018 and August 2019, clinical data were retrospectively collected for Single Loop Ligature and Conventional Two Loop Ligature cases performed at the tertiary care hospital. Three surgical residents who have assisted at least 50 cases of Conventional Two Loop Ligature and 30 cases of Single Loop Ligature performed by gastrointestinal surgery specialists performed the surgeries. The indication of Single-incision laparoscopic appendectomy (SILA) by us was non- complicated appendicitis with no comorbidity.**Results:** In total, 50 patients underwent Single Loop Ligature by surgical residents, 100 patients underwent Conventional Two Loop Ligature by surgical residents and 140 patients underwent Single Loop Ligature by surgical staff. In comparing Single Loop Ligature and Conventional Two Loop Ligature performed by surgical residents, the mean age was the youngest in the Single Loop Ligature group; the operative time and hospital stay were shorter in Single Loop Ligature group. When comparing Single Loop Ligature performed by surgical residents and SILA performed by surgical staff, there were no significant differences in operation time, and postoperative complications.
Conclusion: Surgical residents safely performed Single Loop Ligature with good postoperative outcomes after a short learning curve.

Keywords: Appendicitis, Appendectomy, Laparoscopy, Single Loop Ligature, Abdominal Abscess.

Introduction

Acute appendicitis is one of the most common emergency surgeries and presently laparoscopic appendectomy has developed the treatment of choice.[1,2] On the basis of the improvement of laparoscopic techniques and instruments, single-loop laparoscopic surgery has been proposed.[3] Presently, Single Loop Ligature is one of the most commonly performed single- loop laparoscopic surgeries. Its wide acceptance in the surgical community raised the need of surgical training programs to include safe teaching methods of this technique to enable the new generation of general surgeons to confidently perform the procedure.[4] Since there is lacunae in literature this study was conducted to evaluate early experience of residents in Single Loop Ligature and to investigate the surgical feasibility and safety of SILA and Conventional Two Loop Ligature clinical outcomes during the learning period by comparing Single Loop Ligature performed by surgical residents and surgical staff.

Materials and Methods

Between September 2018 and August 2019, total 290 consecutive patients underwent laparoscopic appendectomy in Tertiary care Hospital. Among them, 50 patients underwent Single Loop Ligature performed by surgical residents, 140 patients underwent Single Loop Ligature performed by gastrointestinal surgical staff. The other 100 patients underwent Conventional Two Loop Ligature per- formed by surgical residents. Residents of the surgery were in their third year of residency. During their clerkship, they were encouraged to learn basic laparoscopic techniques on the laparoscopic trainer panel, and performed the laparoscopic technique on a pig at the training center each year. During the second year of residency, the residents performed > 30 cases of Conventional Two Loop Ligature by the operator, and helped with at least 30 cases of SILA performed by a gastrointestinal surgeon. Gastro- intestinal surgical staff performed SILA for all patients who needed an appendectomy and surgical residents performed SILA for selected patients who were relatively healthy, young patients. Patient demographic data, operation time, length of postoperative hospital stay, and perioperative complications were collected prospectively. Data and outcomes were compared between patients who received Single Loop Ligature performed by surgical residents and Conventional Two Loop Ligature performed by surgical residents. Data and outcomes were compared between patients who received Single Loop Ligature performed by surgical residents and SILA performed by surgical staff. The institutional review board approved this study, and the participants received written informed consent.

Surgical Procedure

To briefly describe the Single Loop Ligature procedure, using the open loop method, a 1.5 to 2-cm vertical skin loop was made through the centre of umbilicus into the peritoneum. A glove port (Nelis, Bucheon, Korea) with 3-trocar channels was placed into the created loop. Standard 5 mm laparoscopic devices, such as a laparoscope with an angle of 30 degrees, as well as straight, rigid instruments similar to those used for traditional laparoscopy, including Babcock clamp, grasped, scissors, and electrocautery. The appendiceal base was ligated with 2 applications of Vicrylendo-loop (Sejong Medical, Paju, Korea). Conventional Two Loop Ligature was performed using 3-trocar techniques with an 11-mm infraumbilical trocar placed by needle insufflations and 2 additional 5-mm torcars placed in the

*Correspondence
Dr. Mohanakrishna Meka
Associate Professor, Department of Surgery, ChalmedaAnandRao Institute of Medical Sciences, Karimnagar,Telangana, India.
E-mail: anupamberwal@gmail.com

suprapubic area and left lower quadrant, respectively. The remaining details of the appendectomy procedure were the same as those for Single Loop Ligature.

All patients with a computerized intravenous patient-controlled analgesia device (Automed 3300; Ace- Medical Co., Seoul, Korea) were given a standard postoperative order package for appendicitis. The patient-controlled analgesia consisted of 15mg/kg of fentanyl, with or without 1mg/kg of ketorolac tromethamine, diluted in saline to a 100-mL volume. Each patient started drinking sips of water 6 hours after surgery, advanced to a soft blended diet, and to a regular diet when tolerated. Patients were discharged when tolerating a regular diet without other problems. This usually occurred on the second postoperative day.

Statistical Analysis

Continuous variables were compared using the Student t test and expressed as mean ± SD values. Categorical variables were analyzed by the chi square test. Significance was defined as a $P < 0.05$. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 18.0.

Results

Table 1: Comparison of Clinical Outcomes of Single Loop Ligature between Group A and B

Variable	Group A (n=50)	Group B (n=100)	p-value
Age	25.2	40.5	0.001*
Sex (M:F)	1:2	1:1.5	0.11
BMI	22.3	25.2	0.43
Pathology Perforated	25	53	0.311
Non-perforated	25	47	
Operation time	46.2±12.4	60.5±22.6	0.01*
Conversion time	0	0	
Drain insertion	4	17	0.124
Hospital stay	2.4±0.5	2.7±1.6	0.001*
Complication	4	5	0.131
Wound dehiscence	2	3	
Abdominal abscess	2	2	

As per table 1 clinical outcomes were compared between surgical residents who Single Loop Ligature and who performed Conventional Two Loop Ligature as seen operation was completed in less time in single loop as compared to two port which was significant ($p<0.05$). While the other clinical outcomes were not significant this means that they are comparable. When groups A and B were compared, the mean age was significantly younger (25.2 vs. 40.5y, $P < 0.001$) in group A. Mean hospital stays (2.4 vs. 2.7d, $P = 0.001$) was significantly shorter in group A. In group A, 2 patients were readmitted due to postoperative wound dehiscence collection. Both were successfully treated with intravenous antibiotics and did not require drainage. In group B, 2 patients were readmitted due to postoperative intra-abdominal abscess and underwent percutaneous drain insertion.

Table 2: Comparison of Clinical Outcomes of Single Loop Ligaturebetween Group A and C

Variable	Group A (n=50)	Group C (n=140)	p-value
Age	25.2	32	0.001*
Sex (M:F)	1:2	1:1.5	0.11
BMI	22.3	23.4	0.25
Pathology Perforated	25	80	0.216
Non-perforated	25	60	
Operation time	46.2±12.4	47.4±11.5	0.23
Conversion time	0	0	0
Drain insertion	4	14	0.33
Hospital stay	2.4±0.5	2.9±1.4	0.01*
Complication	4	12	0.46
Wound dehiscence	2	8	
Abdominal abscess	2	4	

As per table 2 Mean age was significantly younger (25.2 vs. 32.0y, $P = 0.001$) and mean hospital stay was significantly shorter (2.3 vs. 2.9d, $P=0.01$) in group A those surgical residents who performed Single Loop Ligature. In group B more complications were seen but it was not significant as it means they are comparable.

Discussion

Acute appendicitis is one of the most common gastro- intestinal surgical diseases and laparoscopic appendectomy has become a gold standard procedure. Surgical procedures and tools have advanced, requiring less postoperative pain management, leading to better cosmetic outcomes for patients. Single Loop Ligature surgery has been described as the next evolution of minimally invasive surgery. In this study, third-year residents proficient in conventional laparoscopic appendectomy performed a relatively simple procedure, appendectomy, using conventional laparoscopic instruments and technique through a Single Loop Ligature, showing comparable clinical outcomes to Conventional Two Loop Ligature.No cases had to be converted to an open procedure or Conventional Two Loop Ligature, although 3 cases necessitated additional trocar insertion to place an intra- abdominal drain. Operation time and hospital stay were significantly shorter for patients that underwent Single Loop Ligature performed by surgical residents compared with stays for patients who underwent Conventional Two Loop Ligature by surgical residents. In comparison with Single Loop Ligature by surgical staff, there was no significant difference in operation time and postoperative complication. Suggesting surgical residents perform Single Loop Ligature with satisfactory safety level. Notably, after about 10 cases of Single Loop Ligatures, the mean operation time was achieved and if residents have already performed Conventional Two Loop Ligature, they quickly and easily overcame

the Single Loop Ligature learning curve. Drain placement is a matter of consideration in Single Loop Ligature and we inserted an additional 5-mm trocar around Mcburney's point to place a drain. Some randomized controlled trials[1,3,5]showed the mean Single Loop Ligature operative time was significantly longer than that of Conventional Two Loop Ligature. However, in our study, operative time of Single Loop Ligature was significantly shorter than that of Conventional Two Loop Ligature. This may be due to using the ready-made glove port in the Single Loop Ligature procedure. Thus, less time was spent on adding trocars and removing trocars. Further, we closed the fascia layer of umbilical loop in the same manner in both Single Loop Ligature and Conventional Two Loop Ligature. Last, the subcutaneous layer of the umbilical loop in Single Loop Ligature was not sutured but compressed by gauze.[1,3,5,6]Wound infection has been reported as the most common postoperative complication of Single Loop Ligature and our study demonstrated the same result. Although wound infection does not prolong hospital stay or require reoperation, thorough preoperative cleaning of the umbilicus and postoperative application of disinfectant decrease this phenomenon.[7] In this study a glove port, a double-ringed wound retractor, was used and further research is required in the role of wound retractor in wound defence. Some authors suggest umbilical hernia as a long-term complication of SILA.[8]Among previously reported patients who underwent Single Loop Ligature at our institution, 4 none developed loopal hernia during a 2-year follow-up period.[9] Single Loop Ligature is likely to become a standard operation for acute appendicitis soon and single-loop laparoscopic surgery for other organs will gradually become a surgical option. Active training and involving of the residents in single-loop laparoscopic surgery should be included in the resident's education program hereafter.[10,11]

Conclusion

Single Loop Ligature using conventional laparoscopic instruments by surgical residents is a technically feasible and safe procedure after a short learning curve. Soon, Single Loop Ligature will become a surgical option alternative to Conventional Two Loop Ligature. Now is the time to establish a systematic training system for Single Loop Ligature surgery.

Conflict of Interest: Nil
Source of support:Nil

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