


Research Article

Impact of Resident Performed Laparoscopic Appendectomy on Patient Outcome and Safety

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Abstract

Objective: To evaluate the impact of resident performed laparoscopic appendectomy on patient's outcome and safety.

Methodology: This retrospective review included 120 individuals who underwent laparoscopic appendectomy (LA) for acute appendicitis between January 2022 and December 2023. Surgical consultants monitored laparoscopic surgery at our hospital. Clinical data, pathological results, and surgical notes were analysed retrospectively. Age, sex, histological findings, surgical time, requirement of conversion to open surgery, incidence of complications, Length of Stay in Hospital (LOS), and death were all recorded. Group A had residents with a less surgical experience than group B that had Senior Registrars (SRs). In order to offer each resident an equal opportunity of doing LA, the difficulty of each case was not taken into consideration. The patient outcomes were recorded.

Results: Comparison of post operative surgical outcome shows an operative time of 85 ± 8 min and 66 ± 3 min in group A&B respectively, p -value=0.024, length of hospital stay (LOS) of 2 (1-6) days and 2 (1-4) days in group A&B respectively, p -value=0.678, conversion to open instances of 4(6%) in group A and 3(6%) in group B, p -value=0.232, post operative complications of 14(19%); residual abdominal abscess in 2(3%) and SSI in 12(17%) in group A cases and 9(19%), 1(2%) and 8(16%) in group B with no significant difference, p -value=0.435.

Conclusion: We conclude that laparoscopic appendectomy performed by residents yields acceptable results and safety. Nonetheless, further multicenter studies are needed to verify these findings.

Keywords: Appendicitis; Residents; Laparoscopic appendectomy; Surgical impact

Introduction

Acute appendicitis is one of the most prevalent surgical abdominal emergencies [1-4] and appendectomy often is the first line of therapy [5]. Currently, helical CT scan and colour Doppler ultrasonography [6] are used for diagnosis. In the cases where right lower quadrant discomfort persists and an appendix is visible and measures more than 6 mm in diameter on imaging [7], a diagnosis may be established. For places where CT scans and ultrasound imaging are not readily available, various scores have been established to help assist in diagnosis.

For acute appendicitis, surgery has been the gold standard since McBurney's first appendectomy in 1864. Laparoscopic appendectomy has replaced

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laparotomy as the preferred method of appendectomy in the Western world. Both procedures are routine with extremely minimal operating risks. Although the differences between the two approaches are minimal, laparoscopic appendectomy is becoming the treatment of choice in the West. Technically, the laparoscopic method is preferable since it results in fewer wound infections, less discomfort on postoperative day 1, and a shorter hospital stay (LOS) [8]. Perhaps most crucially, it allows for a thorough examination of the abdominal cavity, which may help rule out other potential causes of Right Iliac Fossa pain and reduce the likelihood of both acute and chronic causes of adhesion bowel blockages [9,10]. While laparoscopy is becoming more common and more advanced, open surgery is still linked with fewer instances of intra-abdominal abscesses, a shorter operating time, and cheaper expenses.

Unfortunately, laparoscopic appendectomy is not being offered as a standard of care at majority of hospitals in Pakistan. No public sector hospital is offering universal laparoscopic services to its patients in Lahore. At Lahore General Hospital we managed to start laparoscopic services in 2020 [11]. The service was initially limited to diagnostic laparoscopies but slowly evolved to laparoscopic appendectomies, duodenal ulcer repairs and ileostomies for typhoid perforations.

The skills were gradually transferred from the consultant to the resident level with most of our R3 & R4 residents regularly performing laparoscopic appendectomies. We have done a retrospective review of our laparoscopic appendectomies to see if there was any difference in terms of post operative complications, operative time and hospital stay between the appendectomies performed by residents and by consultants. Studies have shown that surgical procedures done by residents had the same clinical results as those performed by attending or supervising surgeons [12]. However, no local data exists, so we aimed to record impact of resident performed laparoscopic appendectomy on patients' outcome and safety.

Methodology

This was a retrospective review of all the cases of laparoscopic appendectomy performed at our institute from January 2022 to December 2023. All the patients irrespective of age and gender were included. Patients' demographics were recorded. Operative details including surgeons' experiences, operative details and post operative outcomes were all recorded. All cases were performed either by Senior Registrar (consultant surgeon) or a Surgical Resident (Year 3 and 4). In order to become proficient in laparoscopic surgery, the residents were required to observe other procedures, practice with dry laparoscopic tools to develop video-eye-hand synchronization and serve as camera assistants in a number of actual surgeries. They were only allowed to perform an

independent laparoscopic appendectomy if they had assisted at least twenty laparoscopic appendectomies. The consultants were present in the operation theaters but were not directly scrubbed in the cases. If needed, the consultants were called in to help and this was subsequently recorded.

The outcomes were compared between two groups: Surgical Residents (Year 3 & 4) in Group A and Consultants (SRs) in Group B. Patients were randomly allocated in either of the groups. The randomization was not strict, and no patterns were followed.

Operation Details

General anaesthesia was used for the procedure (Propofol for induction, Isoflurane for maintenance and Atracurium for the Muscle Relaxation). At the time of induction, a urinary catheter was placed, and an intravenous antibiotic (3rd Generation Fluoroquinolones) was administered to all patients. The use of nasogastric tube was selective. The decision to continue the Antibiotic post-operatively was dependent upon the Intraoperative Findings of Appendix. The patient was positioned supine such that the video screen was on his or her right. The camera assistant was stationed on the surgeon's right, while the surgeon was on the patient's left. Using the open Hasson method, a 10-mm supra umbilical optical port was inserted. Carbon dioxide insufflation produced a pneumoperitoneum at a pressure of 12 mmHg. The patient's left iliac fossa and hypogastrum had a 10 mm and 5-mm functional ports implanted respectively. The Trendelenburg left-tilt posture was used for the patient. A camera was inserted, and a diagnostic laparoscopy was performed. The appendix was located. Laparoscopic coagulating shears (Ligasure) were used to dissect the mesoappendix and the appendicular artery. The appendix base was ligated with an extracorporeal self-made endo-loop. The knot was tightened with a knot pusher. Appendix was then divided with Ligasure device 5mm above the knot. And appendix was removed from the LIF port.

Results

A total of 480 appendectomies were performed in 2 years. Out of these, 120 were performed laparoscopically (LA), out of which 72 (60%) were performed by residents (Group A) and 48 (40%) by senior registrars (Group B). The median age recorded was 29 years in Group A and 23 years in Group B. Complicated appendicitis was recorded as 11 (Perforated 5 and Abscess 6) in Group A and 8 (Perforated 5 and Abscess 3) in group B. Demographic details can be seen in table 1. No statistical difference was noted among both the groups.

Surgical outcomes were similar in both the groups. Operative time was 85±8 mins and 66±3 in Group A&B respectively, p-value=0.024, length of hospital stay (LOS) in days was 2 (1-6 days) and 2(1-4 days), p-value=0.678,

conversion was recorded in 4 (6%) in cases treated in Group A and 3 (6%) in Group B, p-value=0.232, post operative complications were recorded as 14 (19%), residual abdominal abscess in 2 (3%) and SSI in 12 (17%) in group A cases, whereas these findings in Group B were 9 (19%), 1(2%) and 8 (16%) with no significant difference (Table 2).

Table 1: Comparison of patients' characteristics

	Group A	Group B	P value
	Residents	Senior Registrar	
Age	29 (12-56 years)	23(8-62 years)	0.278
Male	34	18	0.445
Female	38	30	
Uncomplicated	61	40	0.087
Complicated	1a1	8	
Perforated	5	5	0.386
Abscess	6	3	0.677

Table 2: Comparison of post operative surgical outcome

Outcome	Group-A		Group-B		P value
Operative time(mins)	85±8		66±3		0.024
Length of hospital stay (LOS) (days)	2 (1-6 days)		2(1-4 days)		0.678
Call for senior help	18	25%	0	0%	0.001
Senior did not scrub	11	15%			
Senior scrubbed and finished the operation	7	10%			
Conversion to open	4	6%	3	6%	0.232
Complications	14	19%	9	19%	0.435
SSI	12	17%	8	16%	
Intraabdominal Abscess	2	3%	1	2%	

Discussion

Only 20% of the Appendectomies have been performed Laparoscopically in our setup which is in accordance with the trend worldwide. With the LA fast becoming the standard of care, there has been a similar development in Pakistan but not on a large scale. Consequently, there is a great opportunity for the residents to learn the fundamentals of laparoscopy. Although LA is a safe procedure that may be done by residents, the learning curve is still quite steep. And so far, however, there has been an insufficient data to determine how many of these procedures must be performed before a beginner surgeon may be considered proficient and safe.

In our study, 60% of the Laparoscopic Appendectomies were performed by the residents and this is significantly more than the SRs. Unfortunately, our study innately had a bias of being a nonrandomized and an unblinded study. This is primarily caused by the relative inability to design a randomized trial for comparison of LA performed by Residents' vs SRs because of Ethical and Financial considerations [13,14] In comparison to our data, 87% of appendectomies were done by residents according to Singh et al. [15] which is significantly more than our review indicative of a greater exposure for the residents. In a study by Graat et al. [16] a retrospective comparison was made among the residents, where the cases were performed by the residents with variable surgical experience. With a data from 1538 appendectomy patients, the senior Residents Operative outcomes were compared with the relative junior ones. In another study by Advani et al. the impact of involvement of residents in the LA was analysed. In the 68% of the LA carried out with the involvement of the Residents, there was no morbidity difference between the two groups: with and without the residents [17].

In order to quantify the Learning Curve (LC) of the Residents, their Operative Time was compared to that of the SRs, and it was on average 85 min compared to their 66 min respectively, which was representative of their lack of speed and/or experience. The results of appendectomies done by General Surgeons (61%) were compared to those of Paediatric Surgeons (39%) in a study including 403 paediatric patients under 16 yrs. of age by Mizrahi et al [18]. The General surgeons regularly used to perform the LA and hence had a better experience than the Paediatric Surgeons. Therefore, this study showed a confidence on Surgical Residents to perform appendectomy by laparoscopy because their Operative Time was shorter on average that is 54 min for General Surgeons versus 60 min for the Paediatric Surgeons, Yap Yan Lin and colleagues [19] shared the experience of the impact of the learning curve on the success rate of laparoscopic appendectomies done by 6 Surgical Residents only. The residents performed laparoscopic appendectomy on 306 individuals who were diagnosed with acute appendicitis. They evaluated the Learning Curve by making each of the 6 residents operate upon 2 groups, each of 20 patients, and their individual Operating Time was compared between the groups. The total average Operation Time was 83.8 minutes and it kept on decreasing for them which is indicative of their developing Surgical Experience. Likewise, as part of their surgical residency training, Chang Woo Kim and colleagues [20] wanted to map out the different stages of the Learning Curve for LA. With the exception of age and appendix placement, all the three groups had identical baseline characteristics and perioperative results. There was no significant difference in the duration of the procedure amongst the three (P = 0.392), with the surgery taking between 43.9

and 45.3 minutes for Residents A and C, and 48.4 minutes for Resident B. By taking an average over a period of time, it can be seen that the amount of time it takes to complete an operation has been reducing overall. The CUSUM analysis of operational time showed that residents A, B, and C each reached their peak performance around the 24th, 18th, and 31st instances of performance of LA, respectively.

In our study, there were 18 instances where the residents were unable to safely proceed and complete the Appendectomy on their own and consequently the SRs were called; in 7 cases they had to scrub along and in the remaining 11 they guided only by verbal assistance. This ensured patient safety and relatively a smooth conduction of the operations. In a study by Cioffi [21] et al. it was observed that a BMI >30 kg/m², preoperative CT scans and AIR scores were used to calculate the odds ratio to quantify the need for call of help. A lot of studies have quoted problems with difficult appendectomies for Residents where the help was called especially in the earlier phase of the training and learning. The preoperative identification of technically demanding LA could be helpful in optimizing the preoperative planning, maximizing the surgeons' preparedness and outcomes.

There were 7 conversions (5.8%), 4 by Residents 3 by SRs. The reason for conversion was perforated in 4 cases and failure to proceed in 3 cases. This is similar to the Study by Eszter Man et al where in group A, conversion was required in 18 cases (5.6 %) (adhesions due to prior surgeries (6), perforated, gangrenous appendix, the stump of which could not be treated safely with laparoscopy (12)), while this number was 21 (7.4 %) in Group B (adhesions (13), the stump could not be treated safely due to severe inflammation (6), extreme obesity (1), mesenteric injury during insufflation (1); $p=0.321$) [22]. In Yap Yan Lin and colleagues study the conversion to open surgery occurred in 14.6% of patients among the residents. However, this was a comparison between the Residents in the different groups with variable experiences in contrast to our study where this comparison was made between the Residents and SRs. The conversion was fewer for the residents (8%) than the experienced surgeons (17%) in the study by the Bencini et al [23]. These were overall more than our study.

The average duration of Hospital Stay was 2 days. This was the same in both the groups. This is because being a public sector hospitals patients are only discharged after the morning rounds, and we do not offer Day Case surgery facilities for LA. This is on average less than what Hiramatsu et al. [24] reported where their average hospital stay for the both the Senior and junior Residents group was 4 days each.

Complications were seen in our patients but with similar incidence in both the groups. SSIs were seen in 17% in group A vs 16% in group B and intrabdominal abscess/collection was seen in 3% in group A vs 2% in group B. Bencini et

al reported 1% intraabdominal collection was diagnosed in the SR group (requiring readmission) and 1.5% in the Residents group, while wound infections (SSIs) were found only in patients converted to open surgery 3% in either of the groups. This was again in concordance with our study with no significant difference in both of the groups.

Acute appendicitis was the diagnosis for 174 patients in 2018 research study conducted in Japan, with 90 of those patients undergoing laparoscopic appendectomy surgery performed by senior residents. Patient demographics, conversion rates, operation timeframes, complication rates, and hospital stays all showed no significant differences between the two groups (4 days vs. 4 days). It was determined that surgical residents with little exposure to either animal models or open appendectomy may safely conduct laparoscopic appendectomy. Laparoscopic appendectomy is a crucial teaching tool for surgical residents who lack expertise with open surgery in today's age of laparoscopic surgery.

Finally, we are of the view that under the watchful eye of surgeons with extensive competence in laparoscopic surgery, surgical residents with little surgical experience with open appendectomy or training with animal models are able to achieve satisfactory operational outcomes while doing LA. For surgical residents who have little exposure to laparoscopic procedures, Laparoscopic Appendectomy assistance and gradual performance can be a great learning experience.

Conclusion

We conclude that laparoscopic appendectomy performed by residents yields acceptable results and safety. Nonetheless, further multicenter studies and randomized, nonbiased and blinded trials are needed to verify these findings.

Conflict of interest

In our study there was no conflict of interest.

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