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Original Research Article

Is it safe to perform laparoscopic appendicectomy in a low volume rural setting? A retrospective non-comparative study

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ABSTRACT

Background: Inspite of the rapid adoption of laparoscopy as a technology for surgeries of the abdomen, its use is very limited in rural settings with limited resources in India. This study was carried out to find out whether performing laparoscopic appendicectomies (which is the commonest general surgery performed the world over) in a low volume rural hospital is feasible, safe and should it be the recommended procedure of choice. Also, the pattern of demographics, symptoms, signs, investigation reports of the patients who presented with acute appendicitis at the centre was studied.
Methods: Retrospective analysis of the data from electronic medical records in Bodeli General Hospital from March 2015 to February 2020 was done. Data of all laparoscopic appendicectomies performed (108 in numbers) in this rural centre with low volume work and a single surgeon, was analysed.
Results: Various cost-cutting local innovations were used, the age and sex distribution, presenting complaints, examination findings, investigation reports, operative time and complications were analysed and presented.
Conclusions: It is quite evident that performing laparoscopic appendicectomies in low volume, single surgeon setting is a safe procedure and should be the procedure of choice, whenever an appendicectomy is indicated.

Keywords: Laparoscopy, Appendicectomy, Rural hospital

INTRODUCTION

Appendicitis is one of the common surgical emergencies globally. Despite its ubiquitous nature, epidemiologic understanding of the disease remains incomplete. The lifetime risk of acute appendicitis in the United States has been estimated at 8.6% in men and 6.7% in women.[1] Among other parameters, the decision to perform surgical exploration in suspected appendicitis involves diagnostic accuracy, patient age and co-morbidity, patient's wishes, the surgeon's core medical values, expected natural course of non-operative treatment and priority considerations regarding the use of limited resources.[2] Laparoscopic appendectomy though widely practised has not gained universal approval.

Laparoscopic appendectomy in India is relatively new and literature is scant.[3]

Aim of study

In a rural, low resource, and a single surgeon setting, whether laparoscopic appendicectomy is a safe procedure and should be the procedure of choice whenever appendicectomy is indicated.

Also, we studied the pattern of clinical presentation of acute appendicitis in a rural part of India.

Pathophysiology

Classically, appendicitis is described as a dynamic disease process that comprises 5 stages occurring over a 24-36 hours period. The inciting event is the obstruction of the appendiceal lumen, which is unable to drain and, as a result, distends. The aetiology is multifactorial, but fecaliths, lymphoid hyperplasia, foreign bodies, malignancy and parasites have all been described.[4]

Management

Since its introduction, laparoscopy has evolved into an indispensable surgical tool. The clinical benefits are well-documented and include reduced blood loss, lower infection rates, shorter hospital stay, faster return to normal activity, improved cosmesis, and less pain and medication use compared to laparotomy.[5] For more than 100 years McBurney's appendectomy was the gold standard in the treatment of acute appendicitis, and right up until the recent development of laparoscopic surgery, little in the diagnosis and treatment of appendicitis has changed since then.[6] Laparoscopic appendectomy for a non-inflamed appendix was first reported in 1983 by the gynaecologist Semm.[7] McBurney's procedure represented the gold-standard for acute appendicitis until 1981, when Semen performed the first laparoscopic appendectomy in Germany, a 'culture shock' in general surgery since a revolutionary method was discovered by a gynaecologist. But a real 'laparoscopic revolution' took place only in 1985 with the first laparoscopic cholecystectomy performed by Erich Muhe, using Semen's technique and instruments. Laparoscopy was not easily accepted since it was not considered a safe procedure; nowadays laparoscopic surgery is gaining a primary role in many surgical settings. The number of laparoscopic appendectomies (LA) has progressively increased since it has been demonstrated to be a safe procedure, with excellent cosmetic results; furthermore, LA allows a shorter hospitalization, a quicker and less painful postoperative recovery.[8] But since then many studies have come up now which has described laparoscopic appendectomy as the procedure of choice, whenever an appendicectomy is diagnosed. Acute appendicitis is common in LMHDICs (low- and middle-human development-index countries), and if possible, laparoscopic appendectomy should be the procedure of choice.[1] But still, the procedure is not so widely accepted or performed in India and other developing countries, especially in low resource rural setting, where usually there is a single surgeon.

METHODS

The increasing use of electronic health record (EHR) systems and other information systems in clinical practice is increasing the volume of clinical data and provides further opportunities for research. This data, which is in digital form and is codified, also can be much more efficient to use compared to the traditional method of reviewing and abstracting data from patients' paper medical records or electronic notes.[9] Similarly in our study, we used the existing electronic medical records at our hospital. We accumulated retrospectively through Electronic medical records, data of 108 laparoscopic appendicectomies conducted at our rural hospital in a tribal place called Bodeli in the Chhotaudepur district of Gujarat from March 2015 to February 2020. Inclusion criteria were all cases of laparoscopic appendicectomies performed in the hospital. Exclusion criteria were few cases with incomplete medical records and open appendicectomies performed. The study was conducted by removing all patient identifiable data, therefore, approval from the ethical committee was not required. Results were analysed. We studied the pattern, distribution of males to females, commonest presenting symptoms, ultrasonography reports, difficulties faced during surgery, and post-operative complications if present, were documented.

Procedure and technique

Most acute appendicitis cases were operated immediately on diagnosis if the patient was willing. Few cases who presented late and were diagnosed clinically as well as on ultrasonography as appendicular mass was first treated conservatively and later interval appendicectomy was performed after 2 months, whoever came for follow up and were willing for surgery. There was only a single surgeon in the rural centre who managed and operated all the cases.

Operative technique

Standardised at the centre. The laparoscopy system consisted of a single chip camera system and a regular 14 inch's television as a monitor. It was connected to a personal computer to record the videos. A halogen light source was used. A locally manufactured carbon dioxide insufflator was used. Locally made reusable hand instruments were used, which were sterilized in the hospital by ethylene oxide sterilization. Position of the patient was supine. Camera assistant on the left side shoulder standing on the right side of the surgeon. Surgeon standing on the left side of the patient. The monitor is placed on the right side of the patient, towards the legs. Three trocar technique was used (Figure 1). 10mm 30 degrees optical port (supraumbilical) using open Hasson's technique was performed for entry of primary optical port. Another two, 5mm trocars, one in left lower quadrant and one in right upper quadrant, forming a perfect triangulation with optimum ergonomics for appendicectomy (Figure 2). All complicated cases were easily managed by these standard port positions. Adhesiolysis, when required, was performed first, followed by appendicectomy. The mesoappendix was cauterised using bipolar coagulation and serially cut till its base. The base was confirmed by the appearance of the caecum and taenia coli. The base was doubly ligated on the caecal side and once on the specimen side with on

table 'hand-made' chromic catgut Roeder's loop. The appendix was then cut with scissors between the 2nd and 3rd tie. The appendix then removed using an ETO sterile condom through the umbilical port site thereby avoiding contaminating the port site.

Figure 1: 3 port technique 10mm supraumbilical optical port, two 5mm hand instruments port in llq and ruq.

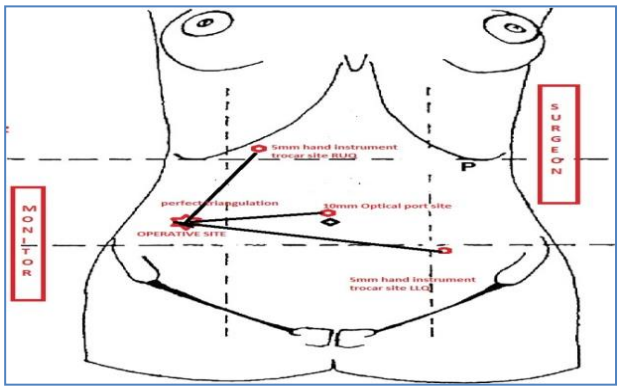

Figure 2: Perfect triangulation of telescope and two working ports producing optimum ergonomics.

Figure 3: ETO sterilized condoms used as retrieval Endobags.

Few special cost-cutting measures used were Roeder's loop was created on the table with chromic catgut 1-0, using only 1 foil of chromic catgut instead of using 3 numbers of ready-made catgut loops. ETO sterilized condoms were used as retrieval Endobags to take out the specimen (Figure 3). A specific type of atraumatic tip forceps (Figure 4) having 2 ridges in it on the inner aspect of the tips used to catch hold of the ring of the condom very easily and then by railroading the specimen was taken out from the umbilical port site. Re-usable ETO sterilized trocars were used. Bipolar forceps were used to coagulate and dissect the mesoappendix instead of expensive ultrasonic dissectors.

Figure 4: A specific type of atraumatic tip forceps having 2 ridges in it on the inner aspect of the tips used to catch hold of the ring of the condom.

A thorough diagnostic laparoscopy was done in all cases, especially all were checked for absence of Meckel's diverticulum, and the hernial sites checked for the absence of any hernia. The pelvic organs like uterus and adnexa were examined in all female patients. Any accessory procedure when needed was done if not too extensive like ovarian cystectomy, rupture of small ovarian cyst. Always trolley for open surgery was kept ready, in case conversion is required in urgency. Always prior consent for conversion was taken before surgery, after proper counselling of the patient and the relatives.

Special precautions for being in a rural place with a single surgeon

The extra stock of CO_2 cylinders. One extra stand by CO_2 insufflator. One extra stand-by light source. Antibiotics were used pre-operatively as well as post-operatively in all cases. The average length of stay was 4.3 days. The maximum stay was of 7 days and the minimum stay was of 3 days.

RESULTS

In our study, a total of 108 patients were studied. There were 78 males 73%, and 30 females 27%, the mean age of the patients was 28.5 years in males, 31.3 years in females and 29.3 years overall. The minimum age was 13 years, and a maximum age of 65 years (Table 1).

The most common presenting symptoms were pain abdomen 100%, vomiting 55%.

Table 1: Age distribution.

Age group (in years)	N
10-20	27
20-30	34
30-40	24
40-50	19
50-60	3
60-70	1

Table 2: Cost-cutting local innovations.

S. no.	Local innovations/modifications	Cost (INR)	Original method/equipment cost (INR)
1	Hand-made Roeder's loop (3 loops)	130	1000
2	ETO sterilized condoms as Endobag	10	1000
3	Laparoscopy system main setup single-chip camera system, halogen light source, TV monitor	500,000*	2,000,000* (3 chip HD system, xenon light, medical monitor)
4	Simple bipolar system (cautery)	150,000*	1,200,000* (ultrasonic dissector)

*Approximate indicative price.

Average operative time was 78 minutes. The maximum operative time required was 180 minutes and the fastest done surgery was completed in 33 minutes. It was a more when the surgery was complicated with either peritonitis, perforation, abscess or adhesions (average operating time was 85 minutes) than the operating time in straight forward cases which was 71 minutes). The complicating factors were in the order of frequency, adhesions 35 (32%), peritonitis 7 (6.5%), associated ovarian cyst 3 (2.8%), abscess 2 (1.8%), broad base of appendix 1 (0.9%). Patients with complicating factors were. 60 (56%), and uncomplicated cases were 48 (44%).

General anaesthesia was given for 94% of the patients. Only 6% of patients were operated in regional anaesthesia (spinal or epidural) due to being unfit for general anaesthesia. Number of cases operated immediately on diagnosis (acute appendicitis) 101 (93%). Number of interval appendectomy 7 (7%), associated other pathologies found in diagnostic laparoscopy ovarian cyst 4 (3.7%). Cost-cutting local innovations resulting in the reduction of overall operative cost (Table 2).

Post-operative complications

Mortality was zero, other complications included wound infection of umbilical port sites in 3 patients 2.7%. These patients had one of the complicating factors such as peritonitis, or perforated appendicitis. All were managed by a few days of antibiotics on an outdoor patient treatment basis.

The maximum number of patients were males 73% compared to females 27%. The most common presenting symptom was pain abdomen 100%, followed by vomiting 55%. The commonest sign on clinical examination was tenderness in right iliac fossa 97%. The diagnosis was confirmed by ultrasonography 93%, and histopathology 100%. Various cost-cutting local innovations were used which reduced the operative cost significantly (Table 2). Intra-operative and post-operative complication rate, morbidity 2.7% was minimal and mortality was zero, proving it to be a very safe method of treatment.

DISCUSSION

Laparoscopic access to appendix produces less collateral damage to the body when compared to open appendicectomy. For example, access to the appendix by cutting open the abdominal wall (skin, fascia, muscle) is additional trauma to the body which is caused in an open appendicectomy. It not only acts as an additional physical injury but also increases the inflammatory response of the body and also causes more post-operative pain to the patient. Moreover, it remains a potential site of incisional hernia in future. Also, open appendicectomy gives a large permanent scar on the abdomen. All these unnecessary injuries and its consequences can be avoided if the laparoscopic access to the appendix is adopted in performing appendicectomy. In our series of patients, we did not encounter a single case of post-operative incisional hernia.

A reduced inflammatory response has been considered an advantage of laparoscopy compared with open surgery. A reduced inflammatory response has been found following minimally invasive colorectal surgery, cholecystectomy, appendectomy, perforated ulcer repair, and lung resection, when compared with open procedures. Decreased interleukin 6 (IL-6) after laparoscopic surgery was the most consistent finding in these studies. A reduced inflammatory response has also been associated with better-preserved immune competence in the postoperative period.[10] Other advantages of laparoscopy include; it allows a diagnostic laparoscopy for the whole abdominal cavity which can diagnose and treat other

associated conditions. In our study, we found many patients also suffering for associated ovarian cysts, adhesions, which were also managed in the same sitting.[1]

As found in our study, another study also had similar male to female ratio with a male predominance 57% which was found to be 73% in our study.[11] Right lower quadrant (RLQ) abdominal pain is the most reliable symptom in the diagnosis of acute appendicitis. This pain is reported in nearly all confirmed cases and is 81% sensitive and 53% specific.[12] In our series also the most common symptom found was abdominal pain 100%. Right lower quadrant tenderness is the most common clinical sign which occurs in a great majority of patients with acute appendicitis. It has an 85% sensitivity and a 90% specificity.[13] In our study also we found similar results. In our series the figure found was 97%. Ultrasonography is a fairly accurate and safe modality in acute appendicitis. It can be useful in reducing the negative appendectomy rate. The sensitivity and specificity of USG for acute appendicitis were 87.7% and 88.2% respectively.[14] In our series also ultrasound abdomen was very sensitive in diagnosing the cases of acute appendicitis 93%. Re-usable laparoscopic instruments substantially reduce the cost of laparoscopic surgery, without compromising the safety of patients and medical personnel.[15] At our centre, too various cost-reducing strategies were adopted so that laparoscopy can be offered to the rural financially not so well patients at the minimum cost. We also used sterilized reusable instruments and many other local innovations as described. The complication rate which we observed is wound infection and it was just 2.7%, which is similar to the percentage of wound infection seen with laparoscopic appendicectomy in an earlier series which was 2.8% and was significantly lower than the wound infection rates in open appendicectomy which were 6.9% in that series.[16]

CONCLUSION

It is highly evident that with few safety precautions and proper training even the rural centres with single surgeons, with minimum resources can offer laparoscopic appendicectomy to their patients, which is a very safe and effective procedure. This study reaffirms the statement and proves that it is a feasible and safe technique and carried out with minimum equipment and in a cost-effective manner in a rural centre. Therefore, laparoscopic appendicectomy should be considered as a gold standard in the management of appendicitis, even in the rural centres.

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