

## Port exteriorization appendectomy: Is it the future?

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### ABSTRACT

The time honoured surgical procedure open appendectomy seems to be on the decline, it may be replaced in the modern era by laparoscopic appendectomy ("in appendectomy") performed with three trocars, or by the port exteriorization appendectomy ("out appendectomy") which can be done with two ports or even one. These techniques combine the benefits of decreased tissue trauma and operative time in addition to other advantages of minimal invasion. We conducted this study to know the effectiveness of Port Exteriorization Appendectomy, to analyze its complications and to assess the conversion rate. A one year prospective study consisted of fifty cases; a combination of emergency and elective group. They were operated under general anaesthesia and different variables were documented. Mean operative time, conversion rate, hospital stay, complications and patient satisfaction. There were 27 females with the (F: M) ratio of 1.17:1. The operative time of 23.3 mins, conversion in 4 (8.0%) patients and 2.4 days of hospital stay contributed to 86.0% operative success rate. Surgical site infection was seen in 5 (10.0%) patients and one (2.0%) developed pelvic abscess. On analysis of the satisfaction level, 44(93.6%) were completely satisfied and one (2.1%) patient seemed disappointed with the technique for cosmesis though, 42 (89.3%) remained completely satisfied and 5(10.7%) didn't like their scars. Port exteriorization appendectomy's efficacy can be verified by 86.0% success rate, operative time of 23.3 mins, indoor stay of 2.4 days, and minimal undesirable sequelae. However, more authentic results could be obtained if this technique is compared to open or laparoscopic appendectomy in a well designed randomized controlled clinical trial.

**Keywords:** Exteriorization, appendectomy, future.

### INTRODUCTION

Appendicitis has been a common problem for centuries. Open appendectomy, the commonest emergency operation performed worldwide has stood the test of time. However, technological improvements in the modern era look threatening to replace it in the future. Semm, a gynaecologist was the first to report Laparoscopic Appendectomy in 1983<sup>1</sup> and Gotz contributed to popularize this procedure in 1991.<sup>2</sup>

Conventionally laparoscopic appendectomy was done by using three ports<sup>3</sup>, it did not gain wide acceptance over open appendectomy. Studies claimed higher operative costs due to a prolonged procedure and requirement of extra equipments in laparoscopic appendectomy<sup>4</sup>; however the truth of the matter is: overall costs tend to be lower because the pain is less and patients return to work sooner. In the recent past, newer techniques have been developed which include laparoscopic assisted appendectomy or port exteriorization appendectomy, which can be done by using two ports or even one. These techniques combine the benefits of laparoscopic appendectomy with decreased tissue trauma and operative time in addition to other added advantages of minimal invasive surgery. We conducted this study to know the effectiveness of Port Exteriorization Appendectomy in acute

appendicitis, to analyze its complications and to assess the conversion rate.

This study was done to analyze the results of Port Exteriorization Appendectomy in terms of the mean operative time, conversion rate, hospital stay, complications (like wound infection, intra-abdominal abscess, and umbilical haematoma), and patient satisfaction.

### MATERIALS AND METHODS

This prospective study was conducted in the Department of Surgery at BP Koirala Institute of Health Sciences from Jan 15, 2005 to Jan 14, 2006. The study population consisted of acute appendicitis patients and those with recurrent or chronic appendicitis planned for interval appendectomy. Patients with appendicular lump, perforation peritonitis or appendicular abscess were excluded from the study.

Clinical assessment, informed consent was supplemented by ultrasonography. They received a prophylactic dose of ciprofloxacin and metronidazole and underwent port exteriorization appendectomy under general anaesthesia performed by a consultant having adequate exposure in laparoscopic procedures.

**The procedure:** After decompressing the stomach and

bladder, an infraumbilical 10mm incision was made and 10mm sheath was inserted under direct vision. Pneumoperitoneum was created by using CO<sub>2</sub> insufflation, the peritoneal cavity was examined by a laparoscope in a clockwise manner for confirmation of the diagnosis, to know the position of the appendix, and to exclude other pathologies. The site of the second right iliac fossa port (10mm) was variable and was decided according to the position of the appendix, choice of the operating surgeon and the patient's body habitus. The operating table was adjusted to the left lateral or head down position depending on the situation. The appendix was delivered out through the right iliac fossa port, pneumoperitoneum was deflated, and appendectomy performed outside the abdomen, the caecum was repositioned back into the peritoneal cavity. In case of difficult dissection a third 5mm port was made in the suprapubic region. Closure of the umbilical port was performed in two layers: rectus with vicryl 1-0 and the skin with nylon. Intraoperative complications like bleeding, injury to the bowel was identified and the procedure was converted to open.

**Operative time and Postoperative course:** Operative time was taken from the time of first skin incision to the complete skin closure. Patient was evaluated in the postoperative period for complications like shoulder pain, post operative ileus, vomiting, surgical site infection, intra abdominal abscess or evisceration of gut and were discharged when deemed fit by the operating surgeon. Postoperative antibiotics were administered only in cases of gangrenous, perforated appendix or purulent exudates.

**Hospital stays and Follow up:** Hospital stay was calculated from the time of presentation at the casualty to the time of discharge. Patients were followed up at one week for suture removal and histopathology report analysis. At one month again they were asked to fill a questionnaire in order to evaluate the level of satisfaction in terms of operative procedure, cosmetic results and return to routine work. The reasons of dissatisfaction were also determined.

## RESULTS

A total of 50 patients underwent port exteriorization appendectomy. Patients were between 6-65 years. The mean age of the patients was 26.5 years ( $\pm$  12.6). Majority 19 (38.0%) of the patients belonged to 11-20 years and 14 (28.0%) were between 21-30 years. There was a slight female preponderance. The ratio (F: M) was 1.1:1 (Fig. 1).

**Indications of surgery:** Majority i.e., 32 (64.0%) of the patients underwent appendectomy for acute appendicitis while interval appendectomy was the indication in 18 (36.0%) patients (Fig. 2).

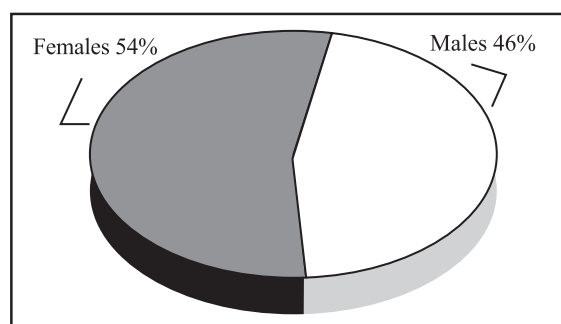


Fig. 1. - Gender distribution

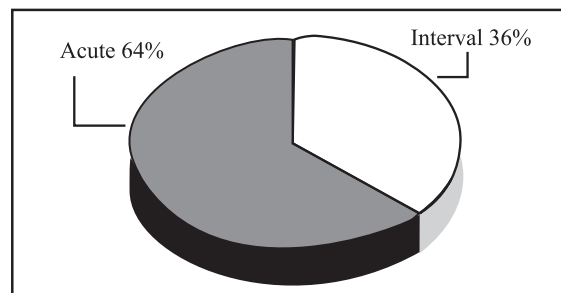


Fig. 2. Indications of laparoscopic appendectomy

**Mean operative time:** The operative procedure ranged from 10 to 50 minutes and the mean operative time was 23.2 mins. It was recorded from the time of first skin incision to the application of the last suture.

**Variations in the location of appendix:** Subcaecal position was found to be the commonest and was seen in 20(40%) of patients, retrocaecal in 17 (34.0%) patients, preileal and postileal in 4 (8.0%) patients each. Paracaecal position was only in 2 (4.0%) patients. The different appendiceal positions have been illustrated in Table-1.

**Additional port:** The procedure could be completed with two ports in 43 (86.0%) patients; in 3 (6.0%) cases of acute appendicitis an additional port was required for: (a) adhesions, (b) partial rupture of appendix and (c) bleeding from appendicular artery.

Table-1: Positions of appendix

Positions	Number of patients	Percentage
Subcaecal	20	40.0%
Retrocaecal	17	34.0%
Preileal	04	08.0%
Postileal	04	08.0%
Pelvic	03	06.0%
Paracaecal	02	04.0%
Total	50	100.0%

**Rate of conversion:** The port exteriorization appendectomy had to be converted to open in 4 (8.0%) patients (Table-2). Reasons for conversion were: (a) mass over the caecum, (b) slippage of ligature over the mesoappendix, (c) immobile caecum in the obese and (d) thick fibrous adhesions.

**Table-2:** Reasons for conversion

Reasons	Patients (n=4)	Group
Mass over caecum	1	acute
Slippage of ligature	1	acute
Immobile caecum in obese	1	acute
Thick fibrous adhesions	1	interval

**Table-3:** Intraoperative complications

Complications	Patients (n=3)	Group
bleeding from appendicular artery and acute	2	Interval and acute
tear of appendix	1	acute

**Intraoperative Complications:** Intraoperative complications (Table-3) occurred in three: (a) bleeding from appendicular artery in two and (b) partial tear of appendix in another.

**Postoperative complications:** Six (12.0%) patients developed postoperative complications: (a) surgical site infection: It was seen in 5 (10.0%) cases at the site of right iliac fossa port. All patients were managed by wound dressings. Antibiotics were not used in any of them. Three of these patients belonged to the acute and two in the interval group and (b) pelvic abscess in one (2.0%) patient was managed by transrectal drainage on the 15<sup>th</sup> postoperative day.

**Hospital stay:** The hospital stay ranged from one to four days. The mean hospital stay in this study was 2.4 days. Majority i.e., (44.0%) patients were discharged on the 3<sup>rd</sup> day of admission, 19 (38.0%) patients on the 2<sup>nd</sup> day and six could be discharged on the first day (Fig. 3).

**Histopathology:** Histopathology examination reported acute appendicitis in 30 patients out of 32 in the acute group (Table-4). Other two reports were acute gangrenous appendicitis and chronic appendicitis. In the interval group (Table-5) histopathological examination reported normal appendix in 10 patients, chronic appendicitis in 5, healed recurrent appendicitis in 2 and acute appendicitis in one.

**Patient satisfaction: Operative technique and cosmesis:** A large group of 47 (94.0%) patients were followed up

till one month postoperatively while 3 (6%) patients were lost to follow up. The level of satisfaction of the patients with the operative technique and the cosmetic result was documented. Forty four (93.6%) patients were completely satisfied by the operative technique while 2 (4.2%) were incompletely satisfied (Fig. 4). Out of 47 patients followed up, 42 (89.3%) were completely satisfied by the cosmetic result but 5 (10.6%) patients who had developed surgical site infection were incompletely satisfied. None of the patients were disappointed.

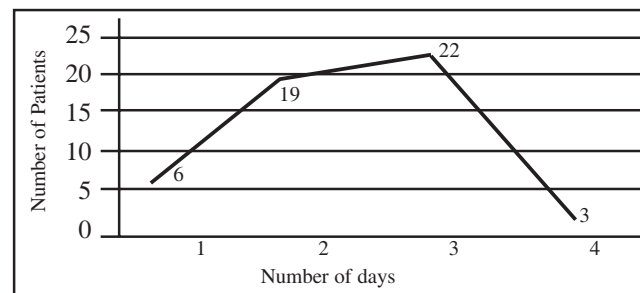
Return to normal work Time taken by the patients to return to their normal work after undergoing port exteriorization appendectomy ranged from 2 to 28 days and the mean of 5.3 days.

**DISCUSSION**

**Age/Gender:** The age ranged from 6 to 65 years. The mean age was 26.5 years. Majority of 19 (38%) patients were between 11-20 years followed by 14 (28.0%) in the age group of 21-30 years. The mean age in a study done by Valioulis *et al* was 8.4 years ranging from 3 to 14 years.<sup>5</sup> Similarly Gohary *et al* included patients between 3 to 13 years with a mean age of 8.9 years.<sup>6</sup> Out of 50 patients, there were 23 males and 27 females, and the ratio being F: M 1.1:1. The male-female ratio in studies done by Valioulis *et al* and Gohary *et al* in 2001 was 1:1.5 and 2.3:1 respectively.<sup>5,6</sup> Literature states affection more in males than females. This could be due to the inclusion of selected patients in our study. The data of these two studies conducted in 2001 have been compared with our findings. (Table-6).

**Mean Operative Time:** The mean operative time was 23.2 mins. Gohary *et al*<sup>6</sup> reported mean operative time of port exteriorization appendectomy, open appendectomy and conventional three port laparoscopic appendectomy as 34.4 mins, 40.1 mins and 74.6 mins respectively. Valioulis *et al* achieved the mean operative time of 19 mins in port exteriorization appendectomy.<sup>5</sup> Less time in our study possibly could be attributed to the selection criteria, easy anatomy, less adhesions etc.

**Success rate:** The operative success rate of 86.0% with 2 ports was obtained in our study. In 3 (6.0%) patients



**Fig. 3.** Hospital stay



Fig. 4. Patients satisfaction

additional port was inserted in the suprapubic region to complete the procedure successfully. Out of these three; 2 belonged to the acute group and one was planned for interval appendectomy. In 4 (8.0%) patients the procedure was converted to open which required extension of incision. Those were 3 from the acute group and one from the interval group. Slippage of ligature over appendicular artery, and immobile caecum in an obese patient were the reasons for conversion in the acute group. Dense periappendiceal adhesions warranted the conversion of procedure in the interval group without the third suprapubic port. None of these patients where suprapubic port was inserted required conversion. The success rate of 76.3% with 2 ports was reported by Valioulis *et al*,<sup>5</sup> third port was required in the remaining 23.7% of cases, and Gohary *et al*<sup>6</sup> completed all the procedures laparoscopically leading to a 100.0% success rate.

**Complications:** Exteriorization of appendix at a point close to its anatomical site makes the technique ideal for all types of appendiceal pathology. The argument against port exteriorization appendectomy technique is the potential risk of wound infection at the port delivery

Table-4: Histopathological findings in acute group

Acute Group (n=32)	
normal appendix	0
acute appendicitis	30
acute gangrenous appendicitis	1
chronic appendicitis	1

Table-5: Histopathological findings in interval group

Interval Group (n=18)	
normal appendix	10
acute appendicitis	1
healed recurrent appendicitis	2
chronic appendicitis	5

site.<sup>7</sup> Surgical site infection was seen in 5 (10%) patients in our study. It had 3 patients in the acute stage and 2 in the interval group. They were managed by wound dressing. None of these patients required systemic antibiotics. Wound infection rate of 0% was reported by Gohary *et al* and it was 2.6% with Valioulis *et al* series.<sup>5</sup> Pelvic abscess is a known complication of laparoscopic appendectomy.<sup>8</sup> In our group, 1 (2.0%) patient developed pelvic abscess. We had to readmit on the 14<sup>th</sup> postoperative day with high grade fever, chills and rigors. Transrectal drainage of abscess was done and he had an additional hospital stay of 4 days. Similar complication was also reported by Valioulis *et al* where transrectal drainage had to be done 2 weeks after the operation.<sup>5</sup>

**Hospital stay:** We had hospital stay ranging from 1-4 days with the mean hospital stay of 2.4 days. Gohary *et al* reported mean hospital stay of 3.4 days as compared to 4.5 days and 4.6 days in open appendectomy group and conventional 3 port laparoscopic appendectomy group respectively.<sup>6</sup> The mean hospital stay of 2.5 days was reported by Valioulis *et al* s.<sup>5</sup> The lowest mean hospital stay in our study was probably due to exclusion

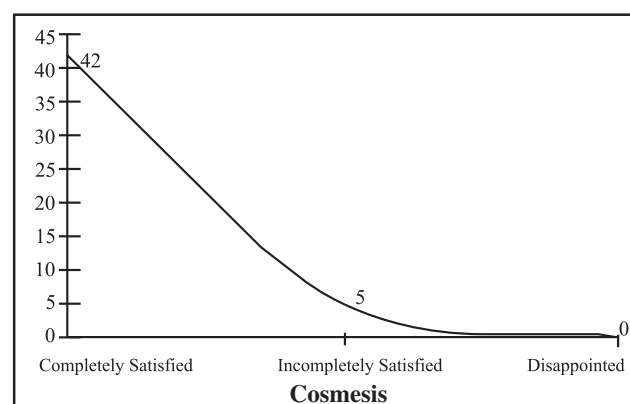


Fig. 5. Operative technique

of complicated appendicitis, low incidence of postoperative complications and adult patients, while the other studies were conducted predominantly in the paediatric age group.

**Patient satisfaction and return to normal activity:** The operative procedure was explained to the patient or relatives before taking an informed consent for appendectomy. The overall satisfaction of patients to the operative technique and cosmesis was recorded at the end of one month postoperatively. Out of 47 patients followed up; 44 (93.6%) patients were completely satisfied with the operative technique and 42 (89.3%) were completely satisfied with the cosmetic result. Two (4.3%) patients were incompletely satisfied with the operative technique. Additional port was required in both these patients. A patient who developed pelvic abscess was unsatisfied and 5 (10.7%) were incompletely satisfied by the cosmetic result. Postoperative surgical

**Table-6:** A comparison with other series

Variables	Our series	Valioulis <i>et al</i>	Gohary <i>et al</i>
Mean operative time	23.3 mins (10-50)	19 mins (10-100)	34.41 mins
Success rate	86.0%	76.3%	100.0%
Complications			
Wound infection	5 cases	1 case	Nil
Intra-abdominal abscess	1 case	1 case	Nil
Hospital Stay	2.4 days (1-4)	2.8 days (2-8)	3.4 days (-)

site infection was seen in these cases; however none of the patients were disappointed by the cosmetic result (Table-7). The mean time required to return to normal activity was 5.3 days. Minimum of 2 days was taken by a patient who had scheduled examinations 2 days following surgery. Patient who had developed pelvic abscess resumed his normal duties approximately a month later.

**Histopathology:** Histopathology was chronic appendicitis in 1 (3.1%) case of acute group. In a total of 32 patients, 30 (93.7%) had features of acute appendicitis on histopathological examination, one case showed acute gangrenous appendicitis. Negative appendectomy rate of up to 15-20% is acceptable by various centers across the world as a protocol.<sup>9</sup> The patient with acute gangrenous appendicitis did not develop postoperative surgical site infection and was completely satisfied with the operative technique and the cosmetic result. Features of chronic appendicitis were seen in 5 (27.7%) patients out of 18 who had interval appendectomy. Healed recurrent appendicitis was reported in 2 (11.1%) patients. This suggested a persistent smoldering infection in a large number of acute appendicitis cases managed conservatively.

**The pitfalls:** Other technical challenges encountered during the procedure were: difficulty in delivering the appendix out of the abdominal wall in a fixed caecum,

**Table-7:** Patient satisfaction at one month follow up

Patient satisfaction (n=47)		
<b>Operative Technique</b>	Completely satisfied	44 (93.6%)
	Incompletely satisfied	2 (4.3%)
	Disappointed	1 (2.1%)
<b>Cosmesis</b>	Completely satisfied	42 (89.3%)
	Incompletely satisfied	5 (10.7%)
	Disappointed	0

retrocaecal appendix and obese patients. Placement of additional port in the suprapubic region in these situations eases the procedure and provides an opportunity to complete the procedure successfully as well. Albeit in none of our cases we detected other coexisting pathologies, yet laparoscopy assisted appendectomy has an added advantage of diagnostic exploration of the pelvic cavity particularly in the fertile group. This technique has some edge over the conventional three port laparoscopic appendectomy with the benefits of decreased mean operative time and the pneumoperitoneum time. This results in decreased total hospital stay and early return to normal activity. We realize that this is a relatively small series to allow a categorical statement, however the current data looks promising and we believe that port exteriorization appendectomy should some day become the preferred method of appendectomy in the near future.

The efficacy of port exteriorization appendectomy in our study can be verified by its 86.0% success rate, the operative time of 23.3 mins, 2.4 days of hospital stay and the absence of any significant complications or mortality. However, more authentic results could be obtained if this technique is compared to open or laparoscopic appendectomy in a well designed randomized controlled clinical trial.

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