

Original Research Article

To identify independent risk factors for Surgical Site Infection in open vs laparoscopic appendectomy vs laparoscopic converted into open for acute appendicitis

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Abstract

Background & Methods: The aim of the study is to identify independent risk factors for Surgical Site Infection in open vs laparoscopic appendectomy vs laparoscopic converted into open for acute appendicitis. The present study was conducted as an observational study on patients who underwent appendectomy for acute appendicitis at Department of Surgery, People's College of Medical Sciences and Research Centre and associated People's Hospital Bhopal.

Results: Blood investigations between the patients of three groups. Mean ESR and WBC were significantly higher in Laparoscopy converted to open group whereas mean CRP was significantly higher in open appendectomy group. Overall, WBC, ESR and CRP were significantly lower in laparoscopic appendectomy group ($p < 0.05$).

Conclusion: Appendectomy is most common surgical procedure performed in day to day practice. Laparoscopic surgeries are preferred over open surgeries by patients in terms of better cosmesis. But only cosmesis is not the issue for treating surgeon, the rate of surgical site infections, a factor associated with increased morbidity and mortality is one of the major concern. The risk of surgical site infections was higher in laparoscopic converted to open surgery and open appendectomy as compared to laparoscopic surgeries. Surgical site infection is associated with superficial and deep infections as well as organ space infections.

Keywords: surgical, laparoscopic, appendectomy.

Study Design: Comparative Study.

1. Introduction

Open appendectomy is considered safe and effective method for management of acute appendicitis, it is associated with complications such as intestinal obstruction, ileus, and wound sepsis. However, laparoscopic appendectomy, being a minimally invasive surgery has

been considered as an alternative option for management of patients with acute appendicitis. Laparoscopic appendectomy is associated with less post-operative pain, lower incidence of surgical site infection, early return of normal activity, significant shorter hospital stay and thus reduced hospital cost.^[1] The prevalence rate for conversion of laparoscopic appendectomy to open appendectomy are estimated to be ranging from 1 to 10%.^[14,15] Common reasons requiring conversion of laparoscopic appendectomy to open appendectomy include presence of adhesions or perforation of appendix.^[2] The rate of conversion are noted to be higher in patients with advanced age; male gender; rupture appendicitis and diffuse peritonitis.^[3]

The appendix can have a variable length, ranging from 5 to 35 cm, an average of 9 cm.^[33] The function of the appendix has traditionally been a topic of debate. The neuroendocrine cells in the mucosa produce amines and hormones to assist with various biological control mechanisms, whereas the lymphoid tissue is involved with the maturation of B lymphocytes and the production of IgA antibodies^[4]. There is no clear evidence for its function in humans. The presence of gut-associated lymphoid tissue in the lamina propria has led to the belief that it serves a function in immunity, although the specific nature of this has never been identified. As a result, the organ has mostly maintained its reputation as a vestigial organ. However, as the recent understanding of gut immunity has improved, a theory that the appendix is a “safe house” for symbiotic gut microbes has emerged. Extreme bouts of diarrhea that may clear the gut of commensal bacteria can be replaced by that contained in the appendix. This suggests an evolutionary advantage for the maintenance of the vermiform appendix and weakens the theory that the organ is vestigial^[5]. Thus today it is accepted that this organ may have an immunoprotective function and acts as a lymphoid organ, especially in the younger person. Other theories contend that the appendix acts as a storage vessel for "good" colonic bacteria. Still, others argue that it is a mere developmental remnant and has no real function^[6].

2. Material and Methods

The present study was conducted as an observational study on patients who underwent appendectomy for acute appendicitis at Department of Surgery, People’s College of Medical Sciences and Research Centre and associated People’s Hospital Bhopal during the study period of 18 months i.e. from 1st November 2019 to 30th April 2021. After obtaining ethical clearance from institute’s ethical committee, all the patients fulfilling inclusion criteria were enrolled. Detailed demographic data such as age, gender, socioeconomic status was obtained from all the study participants and entered in questionnaire. Detailed clinical history regarding their symptoms, its onset, duration etc. was enquired from all the study participants. History of previous surgery if any and its indication was noted.

Study Design- an observational study

Study area- Department of Surgery, People’s College of Medical Sciences and Research Centre and associated People’s Hospital, Bhopal

Study duration- 18 months i.e. from 1st November 2019 to 30th April 2021

Study Population- Patient that were diagnosed with appendicitis and underwent appendectomy.

Inclusion criteria

- Patient that were diagnosed with appendicitis and underwent appendectomy.
- Patients who had given consent for taking part in study.

Exclusion criteria

- Immunocompromised patients.
- An incidental appendectomy in combination with another procedure

3. Result**Table 1: Distribution of patients of three groups according to gender**

Gender	Laparoscopic appendectomy (=29)		Open appendectomy (n=44)		Laparoscopy converted to open (n=15)	
	n	%	n	%	n	%
Male	23	79.3	35	79.5	11	73.3
Female	6	20.7	9	20.5	4	26.7
χ^2	0.28					
P value	0.871					

Majority of patients with appendicitis irrespective of the type of surgery were males (>70%). The gender composition among three groups was statistically insignificant ($p>0.05$).

Table 2: Comparison of urine culture between the groups

Urine culture	Laparoscopic appendectomy (=29)		Open appendectomy (n=44)		Laparoscopy converted to open (n=15)	
	n	%	n	%	n	%
E.coli	1	3.4	9	20.5	6	40
Proteus	0	0	2	4.5	0	0
No growth	28	96.6	33	75	9	60
χ^2	11.4					
P value	0.02					

In the majority of the patients, urine culture was sterile irrespective of groups based upon type of surgery (>60%). E.coli was observed in 20.5% and 40% cases in open appendectomy group and laparoscopy to open group respectively whereas proteus was observed in only 2 (4.5%) cases in open appendectomy. Urine culture revealed growth in significantly higher proportion of cases belonging to laparoscopy converted to open group followed by open appendectomy group ($p<0.05$).

Table 3: Mean body temperature among the groups

	Laparoscopic appendectomy (=29)		Open appendectomy (n=44)		Laparoscopy converted to open (n=15)	
	Mean	SD	Mean	SD	Mean	SD
Body Temperature	98.45	0.827	99.73	1.619	100.00	1.927
ANOVA	8.36					
P value	0.001					

The mean body temperature among the patients who underwent laparoscopic appendectomy, open appendectomy and laparoscopy converted to open surgery was 98.45 ± 0.83 , 99.73 ± 1.62

and 100 ± 1.93 °F. Body temperature reflected fever and was suggestive of underlying infection. Overall, the body temperature was significantly higher in Laparoscopy converted to open group followed by open appendectomy group and was least in laparoscopic appendectomy group ($p < 0.05$).

Table 4: Difference in hematological parameters between the groups

Investigations	Laparoscopic appendectomy (n=29)		Open appendectomy (n=44)		Laparoscopy converted to open (n=15)		ANOVA	P value
	Mean	SD	Mean	SD	Mean	SD		
Hemoglobin	12.21	1.048	12.11	1.224	12.40	1.352	0.326	0.723
WBC	9.76	2.029	11.36	3.779	12.33	4.435	3.264	0.043
Platelet	3.1	0.76	2.95	0.98	3.07	1.1	0.08	0.920
ESR	13.93	3.206	18.48	8.690	20.87	8.476	5.43	0.006
CRP	8.17	3.001	15.41	12.94	13.27	11.68	4.2	0.02

Above table reveals difference in blood investigations between the patients of three groups. Mean ESR and WBC were significantly higher in Laparoscopy converted to open group whereas mean CRP was significantly higher in open appendectomy group. Overall, WBC, ESR and CRP were significantly lower in laparoscopic appendectomy group ($p < 0.05$).

4. Discussion

Acute appendicitis is one of the most common condition for which patients seek care in surgical Department and thus, appendectomy is one of the most common surgical procedure performed worldwide. Open appendectomy is conventional surgery which is safe but carries the risk of complication especially the risk of surgical site infection is high.^[7] With the improvement and advancement of surgical technique, minimally invasive surgeries are preferred as this procedure has certain advantage over open procedure. The present study entitled “Prospective study of surgical site infection in Laparoscopic Appendectomy vs Laparoscopic converted into Open vs Open Appendectomy” was conducted at a tertiary care centre with the aim to study of surgical site infection in laparoscopic appendectomy vs. open appendectomy vs. laparoscopic converted into open appendectomy. Though laparoscopic and open appendectomy was conducted in equal proportion of cases i.e. 44 cases each, laparoscopy was converted to open in 15 (17%) cases. Based upon the type of surgical procedure, patients were categorized into 3 categories. About 44 (50%) patients underwent open appendectomy whereas laparoscopic appendectomy was done in 33% cases and in remaining 17% laparoscopic converted to open surgery was performed.

The present study was conducted with broad objective of comparing surgical site infection and factors affecting the surgical site infections in patients undergoing appendectomy i.e. laparoscopic, open or converted. Overall, the incidence of surgical site infections was significantly higher in patients with open appendectomy (25%) and laparoscopic converted to open (40%) as compared to laparoscopic appendectomy group (3.4%). The incidence of superficial infection was higher in laparoscopy converted to open group followed by open appendectomy group and laparoscopic appendectomy group. Deep infections and organ space infections could be observed in none of the patients undergoing laparoscopic appendectomy. Our study findings were concordant with the findings of **Soltan HM et al (2019)**^[8], in which the authors suggested that laparoscopic technique is associated with significantly less

intraoperative as well as postoperative complications as compared to open appendectomy group.^[8] Similarly, also documented that open appendectomy (11.0 per 100 surgical procedures) are associated with higher incidence of SSI as compared to laparoscopic appendectomy (4.6 per 100 appendectomies) ($p=0.0002$).^[9] Our study findings were similar to findings of **Deshpande A et al (2020)**, about 23.82% of cases following open appendectomy and none following laparoscopic appendectomy reported SSI.^[10]

5. Conclusion

Appendectomy is most common surgical procedure performed in day to day practice. Laparoscopic surgeries are preferred over open surgeries by patients in terms of better cosmesis. But only cosmesis is not the issue for treating surgeon, the rate of surgical site infections, a factor associated with increased morbidity and mortality is one of the major concern. The risk of surgical site infections was higher in laparoscopic converted to open surgery and open appendectomy as compared to laparoscopic surgeries. Surgical site infection is associated with superficial and deep infections as well as organ space infections.

6. References

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