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Converting a Laparoscopic Appendicectomy to Open: Factors and Outcome of Converted Caces

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ABSTRACT
Laparoscopic appendectomy (LA) is the preferred surgical approach for acute appendicitis due to its minimally invasive nature and faster recovery. However, certain intraoperative factors may necessitate conversion to open appendectomy (OA), potentially affecting clinical outcomes. To identify the risk factors associated with conversion for Laparoscopic appendicectomy to Open appendicectomy. The study was carried out in Bankura Sammilani Medical College and Hospital, Bankura, West Bengal with time frame of one and half year from acceptance of synopsis. One and half year (April 2020 - September 2021).70 patients were included in this study. Conversion from LA to OA occurred primarily due to severe inflammation (45%), difficult anatomical access (30%) and adhesions (25%). Converted cases exhibited significantly longer operative times and hospital stays, as well as a higher rate of postoperative complications compared to non-converted cases. Understanding the factors leading to conversion from LA to OA can improve preoperative assessment, surgical decision-making and patient outcomes. Identifying high-risk cases preoperatively may help reduce conversion rates and optimize patient management.

INTRODUCTION

Acute appendicitis is a common condition, with a rate of 9.4 per 10,000 people. The majority of cases are straightforward and have no perforation complications, while up to 25% of patients present with severe illness (peritoneal abscess or peritonitis). Since its discovery by Semm in 1983, laparoscopic appendectomy has grown in popularity as a definitive therapy, accounting for more than 75% of all appendectomies. Furthermore, its use in treating severe appendicitis is rising, with conversion rates ranging from 1 to 10%.

One of the most prevalent intra-abdominal diseases that necessitates surgical intervention is acute appendicitis (AA). According to the Global Burden of Disease Study (2016), 114.44% 481.60 surgeries were required per 100 000 incidences of AA, depending on the socio- economic level of countries[1]. The incidence of appendicitis in newly industrialized countries is rising rapidly[2]. Appendectomy is the standard treatment of choice for acute appendicitis[3,4]. Although open appendectomy (OA) through the right lower quadrant incision has been essentially unaltered for over a century due to its safety and efficacy, laparoscopic appendectomy (LA) is progressively gaining recognition. Recent studies demonstrate that laparoscopic appendectomy gives significant benefits over open appendectomy, including a decreased complication rate, a shorter duration of hospital stay (LOS), less postoperative discomfort and quicker recovery[5,6]. Laparoscopy also was associated with lower surgical site infection (SSI) rates[7,8].

The most common reason for converting from laparoscopic to open appendectomy is extensive inflammatory adhesions that obscure the anatomy or cause friability or perforation. Male sex, advanced age, ASA score >2, leukocytosis, laparoscopic inexperience, high-grade appendiceal inflammation or rupture on computed tomography scan and diffuse peritonitis are recognized pre-operative characteristics linked with conversion. However, due to the limited number of conversions in single-institution cohorts, no relevant powered analysis can be conducted to provide a comprehensive list of conversion factors. Furthermore, it is unknown what the differences in postoperative outcomes are between laparoscopic-only appendectomy (LA), conversion from laparoscopic to open appendectomy (OA) and primary open appendectomy (OA).

MATERIALS AND METHODS

Study Settings and Timeline: The study was carried out in Bankura Sammilani Medical College and Hospital, Bankura, West Bengal with time frame of one and half year from acceptance of synopsis.

Place of study: Department of General Surgery, Bankura Sammilani Medical College and Hospital, Bankura.

Period of study: Stipulated time frame of 3 academic terms i.e. 18 months after approval of synopsis by the University. One and half year (April 2020 - September 2021)

Study population: Patients admitted in Bankura Sammilani Medical College and Hospital, through outpatient department and emergency. Hospitalizations of 12 to 60 years age population diagnosed on admission with acute appendicitis within the study period.

Statistical Software: Sample size has been calculated with help of Epi Info (TM) 3.5.3. EPI INFO which is a trademark of the Centers for Disease Control and Prevention (CDC). For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS 27.0. and Graph Pad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. p-value ≤ 0.05 was considered for statistically significant.

Sample Size: 70

Study design: A prospective observational comparative study.

Inclusion criteria:

- Age 12 to 60 years
- Pain for <2 days.
- Anorexia , nausea , vomiting,fever,peri umbilical-pain with rebound tenderness.
- Non-specific RIF with appendix detected on USG
- Usg appendix diameter >6mm

Exclusion criteria:

- Age >60 years.
- Appendicular lump.
- Appendicular abscess.
- USG appendix diameter <6mm.
- Pain for >4 days.
- Other causes other than acute appendicitis(gynaecological cause, mesenteric CA etc.)
- Open appendix
- Sign of SAIO/ Ileus
- Complicated appendix

Study tools

Demographic data:

- Name,
- Age,
- Sex,
- Address,
- Occupation, Socioeconomic status

Statistical Analysis: For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Data had been summarized as meanand standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. Paired t-tests were a form of blocking and had greater power than unpaired tests. One-way analysis of variance (one-way ANOVA) was a technique used to compare means of three or more samples for numerical data (using the F distribution). A chi-squared test (χ^2 test) was any statistical hypothesis test wherein the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true. Without other qualification, 'chi-squared test' often is used as short for Pearson's chi-squared test. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate.

Statistical Analysis: For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. Paired t-tests were a form of blocking and had greater power than unpaired tests.

RESULTS

In With Conversion, 2 (25.0%) patients had DMComorbidity and 2 (25.0%) patients had HTN Comorbidity. Association of Comorbidity with Conversion was not statistically significant (p = 0.1261) (Table 1).

In Conversion Group, 4(50.0%) patients had Fever. Association of FevervsConversion was not statistically significant (p = 0.6644).

In With Conversion, 7 (87.5%) patients had Adhesions. Association of Adhesions with Conversion was statistically significant (p<0.0001). In With Conversion, 2 (25.0%) patients had Hostile anatomy.

Association of Hostile anatomy with Conversion was statistically significant (p<0.0001). Association of Faecal fistula with Conversion was not statistically significant (p = 0.5248) In Without Conversion, the mean Duration of symptoms in days (Mean±SD) of patients was 2.0161±0.4243.

In With Conversion, the mean Duration of symptoms in days (Mean±SD) of patients was 3.2500±0.4629. Distribution of mean Duration of symptoms in days with Conversion was statistically significant (p<0.0001) (Table 2).

Table 1: Conversion

Parameters	Conversion	No	Yes	Total	p-value
Comorbidity	COPD	7	0	7	0.1261
	Row %	100	0	100	
	Col %	11.3	0	10	
	DM	4	2	6	
	Row %	66.7	33.3	100	
	Col %	6.5	25	8.6	
	HTN	6	2	8	
	Row %	75	25	100	
	Col %	9.7	25	11.4	
	No	45	4	49	
	Row %	91.8	8.2	100	
	Col %	72.6	50	70	
	TOTAL	62	8	70	
	Row %	88.6	11.4	100	
	Col %	100	100	100	
Fever	No	36	4	40	0.6644
	Row %	90	10	100	
	Col %	58.1	50	57.1	
	Yes	26	4	30	
	Row %	86.7	13.3	100	
	Col %	41.9	50	42.9	
	TOTAL	62	8	70	
	Row %	88.6	11.4	100	
	Col %	100	100	100	
Adhesions	No	62	1	63	<0.0001
	Row %	98.4	1.6	100	
	Col %	100	12.5	90	
	Yes	0	7	7	
	Row %	0	100	100	
	Col %	0	87.5	10	
	TOTAL	62	8	70	
	Row %	88.6	11.4	100	
	Col %	100	100	100	
Hostile anatomy	No	62	6	68	<0.0001
	Row %	91.2	8.8	100	
	Col %	100	75	97.1	
	Yes	0	2	2	
	Row %	0	100	100	
	Col %	0	25	2.9	
	TOTAL	62	8	70	
	Row %	88.6	11.4	100	
	Col %	100	100	100	
Hostile anatomy	No	62	6	68	<0.0001
	Row %	91.2	8.8	100	
	Col %	100	75	97.1	
	Yes	0	2	2	
	Row %	0	100	100	
	Col %	0	25	2.9	
	TOTAL	62	8	70	
	Row %	88.6	11.4	100	
	Col %	100	100	100	
Faecal fistula	No	59	8	67	0.5248
	Row %	88.1	11.9	100	
	Col %	95.2	100	95.7	
	Yes	3	0	3	
	Row %	100	0	100	
	Col %	4.8	0	4.3	
	TOTAL	62	8	70	
	Row %	88.6	11.4	100	
	Col %	100	100	100	

Table 2: Distribution of mean Duration of symptoms in days : Conversion

Parameters	Number	Mean	SD	Minimum	Maximum	Median	p- value
Duration of symptoms in days							
No	62	2.0161	0.4243	1.0000	3.0000	2.0000	<0.0001
Yes	8	3.2500	0.4629	3.0000	4.0000	3.0000	
OT time in minuit							
No	62	49.2742	8.7238	40.0000	70.0000	45.0000	0.0067
Yes	8	58.7500	11.2599	50.0000	80.0000	55.0000	

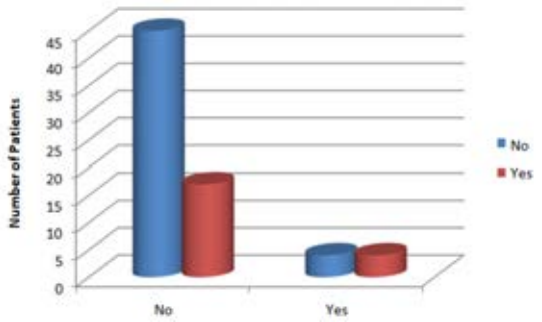

Fig. 1: Association between Ileus: Conversion

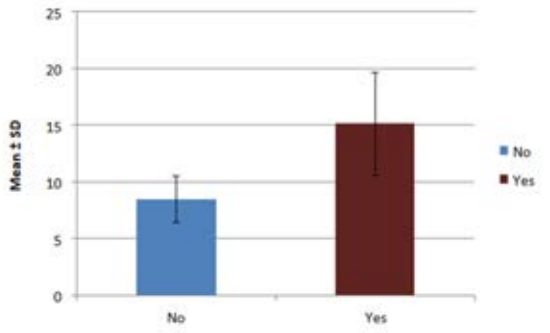

Fig. 2: Distribution of mean Duration of hospital stay in Days: Conversion

In Without Conversion, the mean OT time in minuit (Mean±SD) of patients was 49.2742±8.7238. In With Conversion, the mean OT time in minuit (Mean±SD) of patients was 58.7500±11.2599. Distribution of mean OT time in minuit twith Conversion was statistically significant (p = 0.0067) (Fig. 1 and 2).

DISCUSSION

This prospective observational comparative study was carried out in Bankura Sammilani Medical College and Hospital, Bankura, West Bengal from April 2020-September 2021.

This study was conducted after obtaining permission from Institutional Ethics Committee and approval of The West Bengal University of Health Sciences.

All the patients admitted in the hospital through the Out-patient or Emergency department having a condition requiring surgery for any indication that fulfills the inclusion criteria after a proper informed consent and counseling are to be included and evaluated in this study.

The patients are provided with a printed sheet with detailed information in Bengali, Hindi or English according to their vernacular.

Gupta *et al*.[10] found that of 763 patients who had undergone laparoscopic appendectomy, 44 patients were converted to open technique (conversion rate of 5.8%). For these 44 patients, the male to female ratio was 2 to 1 and the men were older (45 versus 37 years of age, p<0.001). Conversion rates decreased with time (8.7% in 2004 versus 3.5% in 2008). The conversion rate is highest in male patients above 45 years of age, with over 5 days' duration of symptoms, leukocytosis >20,000 and ruptured appendicitis on computed tomography scan.

In Our study showed that, 7 (10.0%) patients had COPD Co-morbidity, 6 (8.6%) patients had DM Co-morbidity and 8 (11.4%) patients had HTN Co-morbidity

On conversion 2(25.0 %) patients had DM as a co-morbidity and 2(25.0%) patients had HTN as a co-morbidity.

Association of co-morbidity with conversion was not statistically significant (p = 0.1261). It was found that, 5 (7.1%) patients had Duration of symptoms in days 1, 51 (72.9%) patients had Duration of symptoms in days 2, 12 (17.1%) patients had Duration of symptoms in days 3 and 2 (2.9%) patients had Duration of symptoms in days 4.In our study, 7 (10.0%) patients had Adhesions and all patients [70 (100.0%)] had Acute inflammation.

Present study showed that, 26 (37.1%) patients had Pelvic Appendix, 2 (2.9%) patients had Post ileal Appendix, 4 (5.7%) patients had Preileal Appendix, 32 (45.7%) patients had Retrocaecal Appendix and 6 (8.6%) patients had Subcaecal Appendix.

We examined that, 2 (2.9%) patients had Hostile anatomy, 16 (22.9%) patients had wound infection, 3 (4.3%) patients had Faecal fistula, 21 (30.0%) patients had Ileus and 8 (11.4%) patients had Conversion.

In our study the mean Duration of symptoms of patients was 2.1571±0.5807 days, the mean OT time of patients was 50.3571±9.4532minuit and the mean Duration of hospital stay of patients was 9.2143±3.2118 Days.

Gupta *et al*.[10] found that past surgical history was insignificant. However, a duration of symptoms of >5

days as well as a white blood cell count >20,000 were found to have a direct correlation. Incidence of postoperative complications did not increase in converted patients.

It was found that in With Conversion, 6 (75.0%) patients had Duration of symptoms in days 3 and 2 (25.0%) patients had Duration of symptoms in days 4 which was statistically significant (p<0.0001).We found that in With Conversion, 7 (87.5%) patients had Adhesions and this was statistically significant (p<0.0001). In With Conversion, all patients [8 (100.0%)] had Acute inflammation. Our study showed that in With Conversion, 1 (12.5%) patients had Pelvic Appendix, 1 (12.5%) patients had Pre ileal Appendix, 5 (62.5%) patients had Retrocaecal Appendix and 1 (12.5%) patients had Subcaecal Appendix. This was not statistically significant (p = 0.5278).

Wu *et al*.[11] found that acute appendicitis were divided into three groups: group 1, patients without a history of previous abdominal surgery (n = 1652, 92%); group 2, patients with a history of upper abdominal surgery (n = 20, 1.1%); group 3, patients with a history of lower abdominal surgery (n = 123, 6.8%). Overall postoperative complication rate was 10.7% (n = 193): rate of surgical wound infection was 8.2 % (n = 147), surgical wound seroma 1.3% (n = 24) and intra-abdominal abscess 0.8% (n = 14). Overall postoperative hospital stay averaged 3.2 (range, 0-39) days. There were no significant differences between the three groups regarding the conversion rate (0.8% vs. 0% vs. 0%, p = 0.567), operative time (57.3 vs. 55.8 vs. 56.9 min, p = 0.962), postoperative complication rates (10.7 vs. 10 vs. 12.2%, p = 0.863) and hospital stay (3.2 vs. 3.6 vs. 3.1 days, p = 0.673).

It was found that in With Conversion, 2 (25.0%) patients had Hostile anatomy which was statistically significant (p<0.0001).

We also found that in With Conversion, 16 (22.9%) patients had Wound infection and this was not statistically significant (p = 0.0520).

In our study association of Faecal fistula with Conversion was not statistically significant (p = 0.5248). We observed that in With Conversion, 4 (50.0%) patients had Ileus and it was not statistically significant (p = 0.1896).

We found that in Without Conversion, the mean Age (Mean±SD) of patients was 33.0484±14.3017 and in With Conversion, the mean Age (Mean±SD) of patients was 27.8750±7.8274 which was not statistically significant (p = 0.3210).

It was found that in Without Conversion, the mean Duration of symptoms in days (Mean±SD) of patients was 2.0161±0.4243 and in With Conversion, the mean Duration of symptoms in days (Mean±SD) of patients was 3.2500±0.4629 which was statistically significant (p<0.0001).

Our study showed that in Without Conversion, the mean OT time in minute of patients was 49.2742±8.7238 and in With Conversion, the mean OT time in minute of patients was 58.7500±11.2599 which was statistically significant (p = 0.0067).

Tiwari *et al*.[12] found that laparoscopic appendectomy for uncomplicated appendicitis resulted in significantly better surgical outcomes. However, surprisingly, these outcomes resulted in comparable but not significantly reduced hospital costs (7825±6,009 for LA vs 7841±13,147 for OA; p>0.05). Laparoscopic appendectomy for complicated or perforated appendicitis showed lower mortality, reduced overall morbidity (17.43% for LA vs. 26.68% for OA; p<0.001), relatively less 30-day readmission rate, fewer intensive care unit admissions, significantly shorter length of hospital stay (4.34±4.84 days for LA vs 7.31±9.43 for OA; p<0.001) and reduced hospital costs (12,125±14,430 for LA vs. 17,594±28,065 for OA; p<0.001) compared with patients undergoing OA. On stratification for severity of illness in both complicated and uncomplicated appendicitis, laparoscopic appendectomy resulted in a greater or comparable clinical benefit than open appendectomy. Comparable clinical benefit was observed in minor severity patients and moderate and major/extreme severity patients showed vastly improved surgical outcomes with the laparoscopic approach.

In our study Without Conversion, the mean Duration of hospital stay in Days (Mean±SD) of patients was 8.4516±2.0460 and in With Conversion, the mean Duration of hospital stay in Days (Mean±SD) of patients was 15.1250±4.4861 which was statistically significant (p<0.0001).

Also found that 70 (100.0%) patients had Nausea. 26 (37.1%) patients had 6 mm inflamed appendix, 28 (40.0%) patients had 7 mm inflamed appendix, 13 (18.6%) patients had 8 mm inflamed appendix and 3 (4.3%) patients had 9 mm inflamed appendix. 15 (21.4%) patients had Blumberg Sign. 23 (32.9%) patients had Rovsing sign. 30 (42.9%) patients had Fever. 3 (4.3%) patients had Pelvic Absces.

Our study showed that in Conversion Group, 2 (25.0%) patients had 6 mm inflamed appendix, 4 (50.0%) patients had 7 mm inflamed appendix and 2 (25.0%) patients had 8 mm inflamed appendix. Association of USG Finding vs Conversion was not statistically significant (p = 0.8726).

In Conversion Group, 8(100.0%) patients had Blumberg Sign. Association of Blumberg Sign vs Conversion was statistically significant (p<0.0001). In Conversion Group, 6 (75.0%) patients had Rovsing sign. Association of Rovsing sign vs Conversion was statistically significant (p = 0.0070).

In Conversion Group, 4 (50.0%) patients had Fever. Association of Fever vs Conversion was not statistically

significant (p = 0.6644). In Conversion Group, 3(37.5%) patients had Pelvic Abscess. Association of Pelvic Abscess vs Conversion was not statistically significant (p<0.0001).

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