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Intraoperative Indications for Conversion of Laparoscopic Appendicectomy to Open Appendicectomy

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ABSTRACT
Appendicitis is the most common intra-abdominal condition requiring surgery, with a lifetime risk of 6%. The trend towards minimally invasive surgery has prompted general surgeons to adopt laparoscopic techniques for the treatment of nearly all surgical conditions treated by the conventional open technique. Present study was aimed to identify the factors that predicts the need for conversion from laparoscopic appendicectomy (LA) to open appendicectomy (OA). Present study was retrospective study, conducted in patients with acute or recurrent appendicitis and its complications undergoing laparoscopic appendicectomy. Each case was analyzed with respect to causes of intra-operative abdominal findings requiring conversion to open procedure. Out of 200 patients, majority were from 16-35 years age group (48%), were males (62%). Prevalence of Phlegmonous inflammation was found to be 38% followed by edematous inflammation in 32%. Retrocecal appendix was seen in 24% cases. Gangrenous inflammation of appendix was found in 20% cases. 16% appendix was found to be perforated. Prevalence of appendicular abscess was observed to be 22%. Cause of conversion from LA-OA was found to be severity of peritonitis in 4 patients i.e. 57.1%. peritoneal adhesions (28.6%) and inflammation as well as adhesions i.e. 14.3%. Factors related to the decision to convert laparoscopic procedure to open surgery were severity of peritonitis, peritoneal adhesions, phlegmonous inflammation, edematous inflammation and retrocecal appendix.

INTRODUCTION

Appendicitis is the most common intra-abdominal condition requiring surgery, with a lifetime risk of 6%[1]. Appendicectomy, one of the commonest procedures in general surgery and accounts for approximately 1% of all surgical operationss[2]. Laparoscopic appendicectomy combines the advantages of diagnosis and treatment in one procedure with least morbidity[3]. Patients are likely to have less postoperative pain and to be discharged from hospital and return to activities of daily living sooner than those who have undergone open appendicectomy[4].

The other advantages include decreased wound infection, better cosmesis, ability to explore the entire peritoneal cavity for diagnosis of other conditions and effective peritoneal toileting without the need for extending the incision[3]. Laparoscopic appendicectomy is being increasingly employed, particularly in young women of child-bearing age in whom the differential diagnosis of right lower quadrant pain is extensive and includes gynaecologic pathology[5].

The modern era of laparoscopic surgery has evoked a remarkable change in the approach to treatment of surgical diseases. The trend towards minimally invasive surgery has prompted general surgeons to adopt laparoscopic techniques for the treatment of nearly all surgical conditions treated by the conventional open technique. Present study was aimed to identify the factors that predicts the need for conversion from laparoscopic appendicectomy (LA) to open appendicectomy (OA).

MATERIALS AND METHODS

Present study was retrospective study, conducted in Department of general surgery in All patients diagnosed with acute and recurrent appendicitis at Raichur Institute of Medical Sciences during the course of study, India. Study duration was of 03 months of sample size 200. The study was initiated after obtaining approval from the institutional ethics committee.

Inclusion Criteria:

- All patients with acute or recurrent appendicitis and its complications undergoing laparoscopic appendicectomy, patients willing for surgery after written consent.

Exclusion Criteria:

- Pregnancy.
- Patients <12 years.
- Patients unfit for GA and pneumoperitoneum.
- Patients who refused procedure.

The patients selected for this study are those who are admitted with primary diagnosis of acute and recurrent appendicitis. A pretested Performa was used to collect relevant information from the patients who matched the above-mentioned criteria, such as patient data, clinical findings, lab investigations and follow up events. Investigations included complete hemogram, random blood sugar, blood urea, serum creatinine, E.C.G, HIV, HBsAg and routine urine analysis. After complete evaluation of the patients pre-operatively, they were posted for elective laparoscopic appendicectomy.

Surgical Procedure: After administration of GA pneumoperitoneum was created using a Veress needle. A right upper quadrant, Umbilical and Supra-pubic ports were secured. The caecum was grasped and retracted towards the liver. The appendix was held with a grasper. Monopolar cautery was used to divide the meso-appendix and the appendix was skeletonized by stripping it bit by bit up to the appendicio-caecal junction. Two pre-tied endoloops were applied at the base and appendix was divided and removed.

Each case will be analyzed with respect to causes of intra-operative abdominal findings requiring conversion to open procedure like appendix with aberrant anatomy such as: abnormal position of the appendix seen in very few cases, buried in mesocolon or adjacent right iliac fossa structures, complications like: appendicular mass, appendicular abscess and perforated appendix, other pelvic pathology such as ovarian cysts complicated or uncomplicated in females, diverticulitis, urinary tract pathology etc.

Intra-operatively the various reasons for conversion were analyzed. Postoperatively pain and duration of analgesic use was assessed after 48 hours from surgery. Duration of hospital stay and days for return to normal work were analyzed. The collected data were coded and entered into Microsoft Excel and analyzed using SPSS version 25.0 software.

RESULTS AND DISCUSSIONS

Table 1: Distribution According to Age and Sex

	Male		Female		
Age group in years	Frequency	Percent	Frequency	Percent	Total
5-15	7	7	5	5	12
16- 35	48	48	47	47	95
36-55	32	32	32	32	64
≥55	13	13	16	16	29
Total	100	100.0	100	100.0	200

Table 1 details the distribution of participants according to age and sex. The participants are grouped into four age categories: 5-15 years (12 participants), 16-35 years (95 participants), 36-55 years (64 participants) and over 55 years (29 participants). Each age group contains an equal number of males and females, totaling 200 participants.

Table 2: Distribution According to Comorbid Conditions

Co morbid conditions	Frequency	Percent
Number of co morbidities		
One or more	32	16
None	68	34
Co morbid conditions		
Hypertension	17	8.5
Diabetes	23	11.5
IHD	7	3.5
COPD	12	6
Previous abdominal surgery	8	4

Table 2 outlines the distribution of participants according to comorbid conditions. Of the participants, 32 (16%) have one or more comorbid conditions, while 68 (34%) have none. Specific conditions include hypertension (8.5%), diabetes (11.5%), ischemic heart disease (IHD) (3.5%), chronic obstructive pulmonary disease (COPD) (6%) and a history of previous abdominal surgery (4%).

Table 3: Clinical and Laboratory Characteristics

Characteristics	frequency	percent
Migration of pain	26	26
Pain in right iliac fossa	96	96
Nausea and /or vomiting	56	56
Anorexia	6	6
Fever	28	28
WBC (> 10000/cm3)	76	76
Blumberg's sign	52	52

Table 3 describes clinical and laboratory characteristics of the participants. Notable findings include a high frequency of pain in the right iliac fossa (96%), nausea and/or vomiting (56%) and elevated white blood cell count (WBC) (>10,000/cm^3) in 76% of participants. Fever was noted in 28% of participants and a positive Blumberg's sign was observed in 52%.

Table 4: General Characteristics

	Mean	SD
Age	36.42	8.7
Leukocytosis	12375	4720
Alvarado score	5.1	1.8
CRP	6.9	7.3

Table 4 provides general characteristics such as mean age (36.42 years), leukocytosis level (12,375), average Alvarado score (5.1) and C-reactive protein (CRP) level (6.9).

Table 5: Distribution According to Conversion Rate from LA to OA

Conversion	Frequency	Percent
Laparoscopic (LA)	86	43
Open (OA)	14	7

Table 5 reports the conversion rate from laparoscopic appendectomy (LA) to open appendectomy (OA), with 86 participants undergoing LA (43%) and 14 (7%) converting to OA.

Table 6: Surgical and Anatomical Characteristics

Surgical and anatomical characteristics	Frequency	Percent
Phlegmonous inflammation	38	19
Edematous inflammation	32	16
Retrocecal appendix	24	12
Appendicular abscess	22	11
Gangrenous inflammation	21	10.5
Perforated appendix	17	8.5
Peritonitis	9	4.5

Table 6 focuses on surgical and anatomical characteristics observed during procedures, including types of inflammation (phlegmonous, edematous, gangrenous) and anatomical specifics like retrocecal appendix location and appendicular abscess.

Table 7: Distribution According to Cause of Conversion

Cause of conversion	Frequency (n=7)	Percent
Peritoneal adhesions	29	14.5
Severity of peritonitis	58	29
Inflammation + adhesions	14	7

Table 7 explores the causes of conversion from LA to OA, where the severity of peritonitis (29%) and peritoneal adhesions (14.5%) were significant factors.

Table 8: Post Operative Characteristics

	Laparoscopic (LA)		Open (OA)	
	Frequency	Percent	Frequency	Percent
Post op complications	6	3.0	4	2.0
Medical complications	3	1.5	2	1.0
Surgical complications	3	1.5	0	0.0
Re admissions	0	0.0	0	0.0
Re interventions	2	1.0	0	0.0

Table 8 looks at post-operative characteristics, comparing complications between LA and OA. It highlights fewer surgical complications and reinterventions in OA.

Table 9: Univariate Analysis of Risk Factors

Variables	Laparoscopic Appendicectomy (LA)	Open appendicectomy (OA)	p
Sex (Male, Female)	62%	38%	0.22
Mean age	36.42 ± 8.7	41.75± 9.2	0.04
Comorbidity	12%	20%	0.001
Hypertension	6%	10%	0.98
IHD	2%	4%	0.031
COPD	2%	8%	0.1
Diabetes	8%	14%	0.23
Previous abdominal surgery	0%	6%	0.001
BMI	23.65 ± 3.1	26.71 ± 8.3	0.02
Pain	16%	10%	0.11
Nausea	30%	26%	1
Anorexia	4%	2%	1.2
Fever	20%	8%	0.002
Leukocytosis (>10000/cm3)	56%	22%	0.01
Alvarado score	5.1 ± 1.8	5.9± 1.3	0.08
CRP	6.9 ± 7.3	11.2 ± 4.7	0.021

Table 9 conducts a univariate analysis of risk factors between LA and OA groups, noting significant differences in mean age, presence of comorbidities, specific conditions like IHD and previous abdominal surgery and outcomes like fever and leukocytosis.

In present study, majority patients were from 16-35 years age group (48%), followed by 36-55 years age group (32 %). Mean age in our study was found to be 36.42±8.7 years. In study by Nicola Antonacci[6] the mean age of patients was 37.1±17.8 years. In study by Tomoyuki[7] overall average age was 38.7±18.7 years with a range from 15-86 years. Mean age of our study population is also consistent with other studies.

In present study, majority of our subjects were males i.e. 31 (62%) and 19 (38%) were females. Goel[8] also observed that most of his patients were males i.e. 66% and 44% were females. B Ndofor[9] found that majority of their subjects were males i.e. 51.7% and remaining were females i.e. 41.9%. Nicola Antonacci[6] stated that 46.9% were male population and 53.1% were female population. Tomoyuki[7] observed that 61.8% were males and 38.2% were females in their study who underwent OA.

In present study, 16 (32 %) patients were having one or the other comorbid condition.

Nicola Antonacci[6] in his study stated that 16% patients had comorbid conditions. It states that majority of study subjects were having diabetes as an important comorbid condition. So prevalence of diabetes as a comorbid condition was observed to be 22%. This is followed by hypertension as 16%, COPD as 10% and IHD as 6%. Nicola Antonacci[6] in his study observed that comorbid conditions prevails in study as follows: Arterial hypertension (8.4%), Cardiovascular diseases (6.5%), Chronic obstructive pulmonary disease e COPD (3.3%) and Diabetes mellitus (1.9%).

In present study, conversion rate was found to be 14% in our study. In Nicola Antonacci[6] study conversion rate was found to be 6.7%. S. Sauerland[10] observed that the conversion to conventional open surgery conversion rate was 7.9%. Conversion rate in our study though on higher side i.e. 14%, but still it approximately matches with other study findings[11-13].

Nicola Antonacci[6] quoted regarding anatomic and surgical data, in 79 cases (21.4%), the appendix was found to be in retrocecal position, in 116 cases (31.4%) was catarrhal, in 169 cases (45.8%) phlegmonous, in 108 cases (29.3%) 83 gangrenous and in 57 cases (15.4%) was perforated. In 2 cases (0.5%) a neoplasm was found at histological examination. Similar findings were noted in present study.

In present study, cause of conversion from LA to OA was found to be severity of peritonitis in 4 patients i.e. 57.1%. 2 patients had peritoneal adhesions (28.6%) and one patient had inflammation as well as adhesions i.e. 14.3%. Nicola Antonacci[6] in his study observed the causes of conversion from LA to OA. Commonest cause was Severity of peritonitis (48.3%), peritoneal adhesions (24.1%) and inflammation of adhesions (24.1%). Factors statistically predictive of conversion were presence of comorbidities, a finding of an appendiceal perforation, retrocecal appendix, the presence of appendicular abscess and the presence of a diffuse peritonitis. These factors were strongly related to the risk of conversion also in many papers in literature[14-16]

Tomoyuki[7] studied the causes of LA to OA in his study and found that Severe adhesions in 69.0%, Base inflammation or necrosis 24.1%, intra operative bleeding 3.4% and intra operative complication (perforation of stapler stump) 3.4% cases.

Univariate analysis of risk factors for conversion from LA-OA showed that mean age, comorbidity, IHD, Previous abdominal surgery, BMI, Fever, Lukocytosis (>10000/cmm) and CRP were found to be statistically significant risk factors. ($p<0.05$). Nicola Antonacci[6] stated that presence of comorbidities, a finding of an appendiceal perforation, retrocecal appendix, the presence of appendicular abscess and the presence of a diffuse peritonitis were associated with conversion. For these reasons we can say that our results confirmed that there are multiple factors related to the decision to convert laparoscopic procedure to open surgery related both to characteristics of the patient and severity of the disease.

OA is widely considered the gold standard in complicated appendicitis (gangrenous and perforated appendices) due to decreased intra-abdominal infectious complications in the postoperative period. It is also used as an intraoperative backup plan for LA in cases where there is severe appendiceal inflammation (the main reason for conversion to open) or if there are significant adhesions from a previous surgery-all making safe laparoscopic dissection of the appendix nearly impossible.

CONCLUSION

Mean age, comorbidity, IHD, Previous abdominal surgery, BMI, Fever, Leukocytosis (>10000/cmm) and CRP were found to be statistically significant risk factors. Severity of peritonitis, peritoneal adhesions, phlegmonous inflammation, edematous inflammation and retrocecal appendix were characteristics of appendicular findings. Thus, there are multiple factors related to the decision to convert laparoscopic procedure to open surgery, related both to characteristics of the patient and severity of the disease. Conversion itself lengthens the operative time, leads to a longer hospital stay and cause s a high incidence of postoperative complications.

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