

# To Study Intraoperative Factors Responsible for Conversion of Laparoscopic Appendicectomy to Open Appendicectomy

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## ABSTRACT

Laparoscopic appendicectomy for suspected appendicitis is considered safe and effective. It has gained popularity in recent years and has become one of the most widely performed procedures using the laparoscope globally. Laparoscopic appendicectomy become the gold standard for appendicectomy in the near future. However, owing to the emergency nature of the disease, abnormal anatomy, complications a small number of these cases would require conversion of the minimal access procedure to a more conventional open procedure. It is quite advantageous that most of the above mentioned problems can be easily diagnosed and treated definitively through the laparoscope. But the limitations in the flexibility of the laparoscopic instruments pose a problem requiring the surgeon to resort to an open procedure in a small number of these cases which cannot be easily performed. This study analyse the factors responsible for conversion of laparoscopic to open appendectomy on various different conditions.

**Key Words:** Laparoscopic appendicectomy, Aberrant anatomy, Perforation, Iatrogenic injuries.

## INTRODUCTION

In this era of technological advancement where minimal access surgery has been made available and is fast replacing every aspect of surgical practice, laparoscopic appendicectomy is well on its way to become the gold standard for appendicectomy in the near future. However, owing to the emergency nature of the disease, abnormal anatomy, complications like profuse appendicular artery bleeding, appendicular mass, abscess and perforation, accidental blowout of appendicular stump, associated tinea or cecal wall injury, possibility of other right iliac fossa or pelvic pathology for eg: ruptured ovarian cyst in females etc .these

cases would require conversion of the laparoscopic to more conventional open procedure. so the aims and objective of the study is to analyse the different factors that came across during laparoscopic appendicectomy that cannot be tackled with laparoscopic approach and ultimately open procedure is compulsory final outcome and to identify factors that may predict the need for conversion. Factors to be considered are. Profuse bleeding from a branch of the arteria appendicularis in mesoappendix that cannot be controlled laparoscopically, Aberrant anatomy like post ileal appendix, para cecal appendix and retrocecal appendix, Accidental tinea injuries with cecal and ascending colon tears, Appendix with

meckel's diverticulum, Accidental Blow out appendicular stump in gangrenous appendix, Appendicular mass that cannot be dissected laparoscopically, severe surgical emphysema etc. The significance of study is to early identification of these factors and avoid complication and morbidity related to lap appendicectomy for above mentioned special cases.

## MATERIALS AND METHODS

Total 200 cases selected randomly and observed in which laparoscopic appendicectomy done. Patients get admitted in Surgery department with diagnosis of acute and recurrent chronic appendicitis and undergone laparoscopy for appendicectomy at C.U. Shah Medical College, Surendranagar from date 1/3/2014 to 31/10/2015.

**Study design-** The present study was randomized, observational and longitudinal. Protocol of trial procedure was formed along with performa, Patient Information Sheet and Informed Consent which is needed as in all cases as preoperative written consent.

**Patient selection-**The patients selected for this study who was admitted with primary diagnosis of appendicitis proved clinically and radiologically. Based on detailed

previous history, thorough clinical examination, and recurrent or chronic appendicitis findings on USG abdomen, these patients were subjected to the required preoperative investigations if needed which was almost within the limits. After ensuring fitness for surgery, laparoscopic appendicectomy was performed. Cases placed in a prospective study group undergone laparoscopic appendicectomy and the cases in this group required conversion to an open procedure based on the problems encountered during laparoscopy was studied. Each case 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.

**Inclusion criteria:** All patients with clinically diagnosed appendicitis and its complications undergoing laparoscopic appendicectomy with grossly no pathology on other investigations.

**Exclusion criteria:** Pregnancy, Children <12 Years of age, Patients not fit for general anaesthesia and pneumoertioneum.

## ANALYSIS AND RESULT

TABLE 1: AGE WISE DISTRIBUTION OF CASES

Age group	Numbers of patients	Percentage	Converted cases	%
< 20	24	12%	08	33.33
21 – 30	51	25.5%	08	15.68
31 – 40	43	21.5%	11	25.58
41 – 50	42	21%	09	21.42
51 – 60	27	13.5%	11	40.74
61 – 70	11	5.5%	03	27.27
> 75	02	1%	00	00
TOTAL	200	100%	50	25

Maximum laparoscopy cases were in age group between 20 to 30 years (51) but maximum conversion into open procedure occurred in between 50 to 60 years (11 from 27)

TABLE 2: SEX WISE DISTRIBUTION OF CASES.

Catagory	Total	Percentage	Converted	%
MALE	79	39.5%	34	43.03
FEMALE	121	60.5%	16	13.22
TOTAL	200	100%	50	25

Maximum number of laparoscopy cases were females (121 out of 200) but maximum converted cases were of males(34 out of 79) which was 43% of total 50 converted cases.

Overall conversion rate in bleeding cases were 30%, with maximum total converted cases seen with bleeding from accessory appendicular artery(8) and

conversion rate maximum seen with (05/05) however, no conversion seen in any bleeding from ileocolic artery(100%) cases of bleeding from body of appendix.

**TABLE 3: BLEEDING CASES..**

BLEEDING	SPECIFIC FACTOR	TOTAL NO. OF CASES	CONVERTED CASES	%
	BBA	20	00	00.00
	BAAA	10	08	80.00
	BIA	05	05	100
	BMAA	15	02	13.33
	TOTAL	50	15	30

[BBA= BLEEDING FROM BODY OF APPENDIX, BAAA=BLEEDING FROM ACCESSORY APPENDICULAR ARTERY, BIA=BLEEDING FROM ILEOCOLIC ARTERY, BMAA= BLEEDING FROM MAIN APPENDICULAR ARTERY]

**TABLE 4: ABERRANT ANATOMY CASES**

ABERRANT ANATOMY	SPECIFIC FACTOR	TOTAL NO. OF CASES	CONVERTED CASES	%
	RA	40	08	20.00
	PIA	08	03	37.50
	PCA	08	02	25.00
	TOTAL	56	13	23.21

[RA=RETROCECAL APPENDIX, PIA= POST ILEAL APPENDIX, PCA= PARA CECAL APPENDIX]

Overall conversion rate in aberrant anatomy cases were 23.21%, with maximum total converted cases seen with retrocecal appendix (8) and conversion rate maximum seen in cases with post ileal appendix (37.25) (03 out of 05).

**TABLE 5: PERFORATION CASES**

PERFORATION	SPECIFIC FACTOR	TOTAL NO. OF CASES	CONVERTED CASES	%
	SP/PP/TP	50	00	00.00
	SP/PP/BP	13	00	00.00
	SP/PP/BaP	02	00	00.00
	MP/PP/BP	02	02	100
	MP/PP/BaP	13	10	76.92
	TOTAL	80	12	15.00

[SP=SINGLE PERFORATION, MP= MULTIPLE PERFORATION, IP= IATROGENIC PERFORATION, PP= PATHOLOGICAL PERFORATION, TP= TIP PERFORATION, BP= BODY PERFORATION, BaP= BASE PERFORATION]

Overall conversion rate in perforation cases were 15%, with maximum total converted cases seen with multiple pathological perforation at base (10) and conversion rate maximum seen in cases with multiple pathological perforation at body (100%) however no conversion was seen in cases with single pathological perforation anywhere on appendix

**TABLE 6: IATROGENIC INJURY CASES**

IATROGENIC INJURY	SPECIFIC FACTOR	TOTAL NO. OF CASES	CONVERTED CASES	%
	TI	05	03	60.00
	BI	01	01	100
	CI	01	01	100
	MI	01	01	100
	TOTAL	08	06	75

[TI=TENIA INJURY, BI=BOWEL INJURY, CI=CECAL INJURY, MI=MESENTRIC INJURY]

Overall conversion rate in iatrogenic injury cases were 75% with maximum total converted cases seen with tenia injury (3) and conversion rate maximum (almost 100%) seen in all cases with bowel, cecal and mesenteric injury.

**TABLE 7: ASSOCIATED PATHOLOGY CASES**

ASSOCIATE PATHOLOGY	SPECIFIC FACTOR	TOTAL NO. OF CASES	CONVERTED CASES	%
	IS	01	01	100
	ApAb	02	01	50.00
	MD	01	01	100
	CG	02	01	50.00
	TOTAL	06	04	66.66

[IS= ILEAL STRICTURE, ApAb= APPENDICULAR ABSCESS, MD= MECKEL'S DIVERTICULUM, CG= CECAL GROWTH]

Overall conversion rate in associated pathology cases were 66.66% with total converted cases (1) seen with all category of associated pathology (ileal stricture, appendicular abscess, meckel's diverticulum, cecal growth) were same and conversion rate maximum (almost 100%) seen in case with ileal stricture and meckel's diverticulum.

## DISCUSSION

Various factors responsible for conversion and difficulties in laparoscopy carried out worldwide so less comparative detail and discussion available grossly. But whatever details available so far is very much valuable and productive. In my study, maximum laparoscopy cases are in age group between 20 to 30 years but maximum conversion into open procedure occurs in between 50 to 60 years. In my study, maximum number of conversion cases are males (34 out of 79) but maximum laparoscopy cases are of females (121 out of 200). These findings of the age distribution are similar to a study carried out by DA Hale <sup>[1]</sup> in which the mean age was 25.5 years, with 64% males and 36% females, acute appendicitis found in 66.4% cases, and perforated appendicitis found in 20.9% cases. In our study, 50 laparoscopic cases there were bleeding factor is present but out of that only 15 cases converted into open procedure. Mostly in cases were significant bleeding present from ileocolic artery and accessory appendicular artery. While there were total 6 cases reported with associated significant pathologies like appendicular abscess, ileal stricture, meckel's diverticulum and cecal growth. Out of all majorities (4 cases) are converted into open procedure. In the Department of Emergency Surgery of Villa Scassi Hospital in Genoa, study done by Cariati A, Brignole E, <sup>[2]</sup> 86 patients underwent open appendectomy (32 men; mean age 29.8 years; range 15-54 years/54 women; mean age 22.4 years; range 13-80 years) suggestive of "laparoscopic appendectomy should be done in case of suspected appendicitis in women.

In the other cases, when there is a strong clinical suspect of appendicitis and, in particular, in case of supportive appendicitis, the Authors recommend performing an open appendectomy using the Stropeni approach. In case of perforated appendicitis with abdominal abscess and associated significant accidental bleeding present mainly from accessory appendicular artery they recommend performing an open appendectomy using the right para-rectal approach or the median umbilical-pubis approach. In our study, there were 56 total cases reported with aberrant anatomical position of appendix during laparoscopic appendicectomy. Out of that 13 cases converted into open procedure mainly in position with post ileal and para cecal appendix. There were 80 of cases found out to be perforated appendix during laparoscopy but mostly non-converted cases (65 cases) were of single perforation involving base or body of appendix. While majorities of multiple perforations (13 cases) involving base of appendix must be converted into open. In Subgroup analysis from a randomised multicentre study at four county hospital in Sweden done by Hellberg A, Rudberg C <sup>[3]</sup> A total of 500 patients were randomised to laparoscopic (n = 244) or open (n = 256) appendicectomy. Thirty operations (12%) were converted to open appendicectomy. This study suggests "The main reasons for conversion were difficult anatomy and the presence of an abscess. After conversion patients recovered more slowly than those operated on laparoscopically or by primary open operation". In one significant study done by Liu SI, Siewert B, <sup>[4]</sup> results are conclusive of "Conversion to OA occurred in 58 patients (9.7%). The most common reason for conversion was dense adhesions due to inflammation, followed by localized perforation and diffuse peritonitis. Based on 261 patients evaluated by CT scan preoperatively, significant factors in the final multivariate analysis associated with conversion to OA were age > or = 65 [Odds ratio (OR) = 3.78, 95% CI:1.11-12.84],

diffuse tenderness on physical examination (OR = 11.32, 95% CI: 1.32-96.62), and a surgeon with less experience in LA (< or = 10 operations, OR = 3.38, 95% CI:1.02-11.17). The presence of significant fat stranding associated with fluid accumulation, inflammatory mass or localized abscess in CT scan also significantly increased the possibility of conversion (OR = 5.60, 95% CI:2.48-12.65). In one study done by Antonacci N, Ricci C, [5] the factors significantly related to the conversion were the presence of comorbidities ( $p < 0.001$ ) and, among these, the presence of arterial hypertension ( $p = 0.006$ ) or other cardiovascular diseases ( $p = 0.031$ ) and the history of previous abdominal surgery ( $p = 0.023$ ). Patients with higher mean age ( $33.9 \pm 15.4$  vs.  $46.0 \pm 19.3$ ,  $p = 0.001$ ) and higher body mass index (BMI) ( $23.5 \pm 4.3$  vs  $25.8 \pm 4.9$  kg/m<sup>2</sup>,  $p = 0.006$ ) had a higher risk of conversion. Multivariate analysis finally showed that factors significantly related to the conversion were the presence of comorbidities ( $p = 0.029$ ), the presence of an appendiceal perforation ( $p = 0.003$ ), a retrocecal appendix ( $p = 0.004$ ), the presence of appendicular abscess ( $p = 0.023$ ) and the presence of diffuse peritonitis ( $p = 0.008$ ). In our study, there were total 8 cases reported with iatrogenic injury out of that majorities (6 cases) converted into open procedure are of tenia, bowel, cecal and mesenteric tear during laparoscopic procedure. In one Romanian study, done by Tărcoveanu E [6] suggestive of out of 10 cases 7 cases undergone laparoscopic procedure and 3 were converted in open procedure conversion to open operation were because of torsion of ovarian cyst and also from few cases reported due to iatrogenic injuries (specially tenia) likely that have occurred during laparoscopic appendicectomy.

## CONCLUSION

Considering various factors responsible for conversion laparoscopic to open appendicectomy we conclude that

iatrogenic injury mainly of tenia coli and associated pathology mainly of appendicular abscess are the highest factors in which conversion done from laparoscopic to open appendicectomy occurred in more than 75% cases. The other factors were included in chronological order are bleeding, aberrant anatomy and perforations. Bleeding mainly from ileocolic artery, aberrant anatomy mainly at position of post ileal appendix and multiple perforations at base of appendix with gangrenous changes also showed conversion from laparoscopic to open appendicectomy but was less than 30%. In Most of recurrent cases conversion into open can be prevented by advanced surgical skillful hand and also by advanced laparoscopic facility and also by using special investigations like CECT and other specialized study as preoperative investigation when necessary.

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