Original Research Article

Journal of College of Medical Sciences-Nepal, Vol-17, No 3, Jul-Sep 2021
ISSN: 2091-0657 (Print); 2091-0673 (Online) Open Access
DOI: 10.3126/jcmsn.v17i3.38771

Predictors of Difficult Laparoscopic Appendectomy in Acute Appendicitis

Mukesh Karki,[1] Narayan Belbase,[2]

[1]Department of Surgery, College of Medical Sciences, Bharatpur, Chitwan, Nepal.

ABSTRACT

Introduction

Acute appendicitis (AA) is the most common surgical emergency of the abdomen and appendectomy is one of the most frequently performed surgical procedures. Laparoscopic appendectomy (LA) is one of the commonest surgical procedure in most of the tertiary center and is being an effective alternative to open appendectomy (OA). Despite continuing evolution in laparoscopic appendectomy, this procedure continue to carry the risk of conversion to open appendectomy. The objective was to analyze the factor, identify the predictors for difficult laparoscopic appendectomy.

Methods

The study was conducted in College of Medical Sciences, Bharatpur. All patients who underwent laparoscopic appendectomy from 1st January 2020 to 30th December 2020 were included in the study after taking written informed consent. A detailed performa was developed to record information regarding patient history, physical examination, laboratory parameters, ultrasonography (USG) findings, CT findings and intra-operative details. Laparoscopic appendectomy done in more than 120 minutes, converted into open due to difficulty in surgery and not due to complications, severe adhesions were considered to be a case of difficult appendectomy.

Results

In our study total 94 patients underwent laparoscopic appendectomy among which 16 (17.02%) cases had difficult appendectomy. The incidence of difficult appendectomy was higher among older age group, male sex, long duration of symptoms, high white blood cell count, difficult anatomy, pre existing co-morbid condition, extreme findings on computed tomography and ultrasonography (USG). Operating time, anaesthetic time, and duration of hospital stay were longer after difficult appendectomy.

Conclusions

Identifying the potential factors for conversion preoperatively may assist the surgeons in making decisions concerning the management of patients with appendicitis and in the judicious use of laparoscopic appendectomy. From our study we found that independent predictors for difficult appendectomy are old age, male sex, prolonged duration of symptoms, high white blood cell count, higher body mass index (BMI), extreme inflammation in computed tomography scan and ultrasonography. Proceeding directly with open appendectomy under these circumstances may reduce operative time, reduce hospital stay and morbidity.

Keywords: acute appendicitis; laparoscopic appendectomy; open appendectomy; conversion.

Correspondence: Dr. Mukesh Karki, Department of Surgery, College of Medical Sciences, Bharatpur, Chitwan, Nepal, Email: mukeshkrki@gmail.com, Phone: +977-9843644887.

INTRODUCTION

The vermiform appendix is a vestigial organ, its importance in surgery is due to its propensity for inflammation, which result in the clinical entity known as AA. Acute appendicitis (AA) is the most common surgical emergency of the abdomen and appendectomy is one of the most frequently performed surgical procedures.[1] Laparoscopic appendectomy (LA) is one of the commonest surgical procedure in most of the tertiary center and is being an effective alternative to open appendectomy (OA). Despite continuing evolution in laparoscopic appendectomy, this procedure continue to carry the risk of conversion to open appendectomy.

OA has been a safe, effective operation for AA for more than a century but nowadays. LA has been performed increasingly over the past decade for management of AA, such that it is now at least as common as OA. LA was first performed by Semm in 1982 who conducted the procedure on a normal appendix.[2]

During the laparoscopic procedure, complications may arise or the extent of disease may make safe dissection impossible, and these conditions result in the conversion to OA. The rate of intra-abdominal abscess (IAA), which is one of the most concerning abdominal postoperative complications, occurs almost three times more often in LA than after OA.[3]

If conversion from laparoscopic to OA implies significantly more operative trauma and a worse outcome for these patients, there might be an upper limit for an acceptable conversion rate. Previous reports indicated that the decision to convert to an open procedure during LA usually is prompted by factors discovered intraoperatively, including a retrocaecal appendix, adhesions, presence of an abscess, or inflammation or necrosis of the base of the appendix. However, pre-operative factors may be associated with conversion, and previous studies have documented an association of conversion with age more than 65 years, diffuse tenderness on physical examination, surgeon inexperience, and severity of the findings at computed tomography (CT).[4]

The objective was to analyze the factor, identify the predictors for difficult laparoscopic appendectomy.

METHODS

This was a cross sectional study conducted on 94 patients undergoing LA at College of Medical Sciences, Bharatpur. All patients undergoing LA from January 2020 to December 2020 were enrolled to participate in the study and written informed consent was taken. All patients underwent a standard clinical and laboratory evaluation. A detailed performa was developed to record information regarding patient history, physical examination, laboratory parameters, ultrasonography (USG) findings, CT findings and intra-operative details. The subject satisfying inclusion and exclusion criteria was enrolled in the study.

Inclusion Criteria: Patient with symptoms and clinical signs of appendicitis confirmed by USG/CT.

Exclusion Criteria: Patient medically unfit for pneumoperitoneum, Patients presenting with appendicular perforation with peritonitis and pregnant females.

Laparoscopic appendectomy done in more than 120 minutes, converted into open due to difficulty in surgery and not due to complications, severe adhesions were considered to be a case of difficult appendectomy.

Ethical Consideration

The ethical clearance was taken from the Ethical Review Board/Ethical Clearance Committee of CMS, Teaching Hospital.

Statistical Methods

Collected data was entered in Microsoft Excel 2007 and converted to SPSS version 20 for statistical analysis. Descriptive statistical such as mean, standard deviation, percentage, graphical and tabular representation were used. The correlation between various parameters were analyzed using Pearson correlation, Chi-square test and Independent sample t-test. Significance was assessed at 5% level of significance.

RESULTS

During the study period of 6 months the total patients enrolled was 94. Out of them 78 underwent successful LA while 16 cases had difficult appendectomy of which, 7 (7.4%) had open appendectomy, 5(5.3%) had OT time more than 120 minutes and 4 (4.3%) had severe adhesions. Patients who belonged to difficult appendectomy were observed to be older (51.62 ± 10.88) years while the mean age group in successfully performed case was (34.15 ± 5.57) years. This finding was statically significant. A higher proportion of male were converted to open procedure. Out of 58 males, 10 (10.6%) had difficult appendectomy, while out of 36 females, 6 (6.4%) had difficult appendectomy.

The rate of conversion was directly related to duration of symptoms with conversion progressively increasing with increase in duration of symptoms. Fifty-three (56.3%) who presented within 24 hours underwent simple LA while 4 (4.2%) had difficult appendectomy despite presenting within 24 hours of presentation. In the study 37 of patient had duration of symptoms for more than 24 hours out of which 12 (12.8%) had difficult appendectomy. Similarly, trend towards higher conversion seen with increase in WBC count. Seventy three (77.6%) of patients had WBC count between 11000-14000 cells/mm^3 and nine (9.6%) had difficult appendectomy, 4(4.2%) with count between 14000-16000 cells/mm^3 underwent successful laparoscopic appendectomy with 4(4.2%) had difficult appendectomy, four (5.3%) had count between 16000-18000 cells/mm^3 out of which 3(3.2%) difficult appendectomy. This findings were statistically significant.

Out of total participants 6 patients were known hypertensive. Out of them 5(5.3%) underwent successful LA while 1(1.1%) had difficult appendectomy. Likewise, 8(8.5%) known diabetic underwent successful LA while 2(2.1%) had difficult appendectomy.

Out of 94 patients 8 had history of previous abdominal surgery of which 7(7.4%) underwent successful laparoscopic procedure while 6(6.38%) had difficult appendectomy. On USG, 19 patients had normal study of which 4(4.2%) had difficult appendectomy. Seventy-four patients had inflamed appendix in USG of which 63 (67.02%) underwent successful LA and 11(11.7%) had difficult appendectomy. One (1.1%) with lump with abscess had difficult appendectomy. Similarly, on CT finding 7 patient had retrocaecal appendix out of his 5(5.3%) had simple laparoscopy and 2(2.1%) had difficult appendectomy. Three (3.2%) with caecal wall thickening as finding underwent simple LA while 1(1.1%) had difficult procedure. Out of 58 patients who did not had retrocaecal appendix 3(3.2%) had difficult appendectomy.

Higher the BMI more chance of having difficult surgery. The mean BMI in difficult cases was 24.21 ± 3.97 and in simple LA was 21.62 ± 3.37, which was significant finding. The mean neutrophil value and CRP value was 80.31 ±5.46 and 52.25 ± 16.47 respectively in difficult cases while the mean neutrophil value in simple LA cases was 73.93 ± 2.78 and 45.82 ± 9.54 was mean value for CRP in simple cases. Mean neutrophil value was statistically significant.

Showing comparison of different variables between Simple and Difficult LA

Patient Demographics		Simple LA N=78	Difficult LA N=16	P value
Sex	Female	30 (31.9%)	6 (6.4%)	0.943
	Male	48 (51.1%)	10 (10.6%)	
Duration of symptoms	<24 hours	53 (56.3%)	4 (4.2%)	0.001
	>24 hours	25 (26.5%)	12 (12.8%)	
WBC count (cells/mm^3)	1100-14000	73 (77.6 %)	9 (9.6%)	0.001
	14000-16000	4 (4.2%)	4 (4.2%)	
	16000-18000	1 (1.1%)	3 (3.2%)	
Symptoms	Fever	46 (48.9%)	11 (11.7%)	0.946
	Diarrhea	29 (30.8%)	3 (3.2%)	
	Vomiting	3 (3.2%)	2 (2.1%)	
Diabetes Mellitus	Present	8 (8.5%)	2 (2.1%)	0.794
	Absent	70 (74.5%)	14 (14.9%)	
Hypertension	Present	5 (5.3%)	1 (1.1%)	0.730
	Absent	73 (77.6%)	15 (15.9%)	
Previous Abdominal Surgery	Present	7 (7.4%)	6 (6.38%)	0.002
	Absent	71 (75.5%)	10 (10.6%)	
USG finding	Normal	15 (15.9%)	4 (4.2%)	0.967
	Inflammed	63 (67.02%)	11 (11.7%)	
	Lump with abscess	0 (0%)	1 (1.1%)	
CT finding	Retrocaecal appendix present	5 (5.3%)	2 (2.1%)	0.487
	Retrocaecal not present	49 (52.1%)	9 (9.6%)	
	Appendicolith	5 (5.3%)	3 (3.2%)	
	Retrocaecal with Appendicolith	16 (17.02%)	1 (1.1%)	
	Caecal wall thickening	3 (3.2%)	1 (1.1%)	
Appendicitis	Acute	63 (67.02%)	12 (12.8%)	0.411
	Chronic	15 (15.9%)	4 (4.2%)	

Patient Demographics	Simple LA N=78	Difficult LA N=16	P value
Age in years	34.15 ± 5.57	51.62 ± 10.88	0.001
Hospital stay(days)	3.16 ± 0.81	4.13 ± 1.82	0.001
Anaesthesia time (minutes)	91.72 ± 6.94	109.44 ± 20.26	0.001
Operation time(minutes)	58.17 ± 8.60	88.38 ± 27.9	0.001
BMI kg/m^2	21.62 ± 3.37	24.21 ± 3.97	0.005
Neutrophil(%)	73.93 ± 2.78	80.31 ± 5.46	0.001
CRP	45.82 ± 9.54	52.25 ± 16.47	0.035

DISCUSSION

In our study the mean age of conversion was 51.62 ± 10.88, showing chances of difficult appendectomy higher with advancing age. In a study conducted by Liu et al.[5] it reported that advancing age>65 years is associated with a 4-fold higher conversion in LA (33.9% vs 8.9%) compared to conversion in patients <65year old, p=0.002. Potential reasons for the increased conversion in older patients include attributable co-morbidities, delayed surgical intervention perhaps because many present with non-classical symptoms and signs of the disease process, and a higher incidence of complicated (perforated or gangrenous) appendicitis.

Our study showed clear male predominance, with difficult appendectomy 10.6% in male compared to 6.4% in female. The findings from our study showed similarity with study from Kumar and Kumar [6] where prevalence of conversion was high in male patients and showed male sex as risk factor for conversion. The reason for this is unclear, however it may be perceived bias towards males, as higher laparoscopic conversion rates in males has been reported for other laparoscopic surgeries.[7]

Similarly in our study out of 57 patients who presented with duration of symptoms less than 24 hours only 4(4.2%) had difficult LA compared to 12(12.8%) patients who had difficult appendectomy out of 37 patients with symptoms duration more than 24 hours. Hellberg et al.[8] also mentioned in his study that conversion rate was high in patients presenting with symptoms for more than 24 hours. This may be because increase duration can lead to formation of dense adhesion with chances of perforation so laparoscopic dissection can be technically more difficulty leading to conversion.

According to Manuneethimran et al.[9] WBC count was essential indicator for conversion, higher the count more chance of conversion. Likewise in our study patients with higher WBC count had difficult LA. This may be because patients with high WBC count had symptoms for long duration with likely formation of gangrenous appendix or appendicular lump.

One of the published report from Kumar and Kumar[6] showed amongst the hypertensive patients undergoing LA 17% were converted to OA, and also showed diabetes as strong predictor for conversion. In our study among 10(10.6%) who had diabetes 2(2.1%) had difficult LA and 6(6.4%) of hypertensive patients 1(1.1%) had difficult LA. Since most conversions are determined by the degree of intra-operative inflammation, our analysis identifies patient co-morbidities that may predispose the patient to having more severe appendicitis requiring conversion and difficult LA.

In our study we found higher the BMI more chance of conversion, in the converted cases mean BMI was 24.21 ± 3.97 compared to 21.62 ± 3.37 in laparoscopically performed cases. Similarly Hellberg et al.[8] mentioned BMI in converted group (25.3 kg/m^2) was significantly higher ($p<0.05$) than the ones completed laparoscopically (23.7 kg/mm^2). This may be due to availability of advanced long size trocars and increase practice of open insertion of umbilical trocar.[5]

In our study among 13(13.78%) who had history of previous abdominal surgery 6(6.38%) had difficult LA. Higher probability of conversion with history of previous abdominal surgery. Similar findings were reported in the study conducted by Manuneethimaran et al.[9] In our experience history of previous abdominal surgery led to high probability of omental and

bowel adhesion owing to increase number of conversion.

Among 75(79.8%) of participants with acute appendicitis 12(12.8%) were converted and among 19(20.2%) with chronic appendicitis 4(4.2%) were converted to open appendectomy. On the other hand the study done by Kumar and Kumar[6] showed conversion rate high amongst the participants with chronic appendicitis (16.6% vs 9.5%).

Various studies mentioned that anatomical position of appendix as an indicator for conversion. Hellberg et al.[8] specified in his study that main reason for conversion was anatomical difficulties like retrocaecal position of appendix. Likewise in our study we found two (4.2%) out of 25(26.6%) of patients having retrocaecal appendix had difficult surgery. Our study also showed retrocaecal appendix as one of the reason for conversion, because difficult anatomy led to technically difficult laparoscopic dissection so to avoid longer operative period and iatrogenic bowel injury surgeries were converted to open procedures.

The CT finding of AA has been well established and CT scan is an important tool for diagnosis of appendicitis with high specificity. Siewert et al.[10] conducted a study with the aim to establish CT scan findings of appendicitis as a predictor for conversion to open surgery. Similarly Manuneethimaran et al.[9] while comparing CT scan findings showed 102 subjects out of 700 had appendicolith of which 6 were converted out of total 50 converted cases which was statistically significant, similarly 32 out of 700 subject had caecal wall thickening in CT scan and amongst them 4 were converted. We had similar findings which showed 1(1.1%) out of 4(4.3%) with caecal wall thickening in CT scan had difficult and 1(1.1%) out of 7(7.4%) with retrocaecal appendix in CT scan were converted to OA. Conversion was 14.2% in case of retrocaecal and 25% in case of caecal wall thickening.

Conversion to open surgery affected patient post operative recovery with increase in morbidity so it is an important factor that should be considered if laparoscopic appendectomy is planned. Our study showed operating time was 58.17 ± 8.60 minutes in simple laparoscopic appendectomy and 88.38 ± 27.9 minutes in difficult cases, hospital stay was 3.16 ± 0.81 days compared to 4.13 ± 1.82 days in difficult cases and anesthesia duration was 91.72 ± 6.94 minutes in simple laparoscopic procedure cases and 109.44 ± 20.26 in difficult. Similar findings were found in study done by Hellberg et al.[8]

CONCLUSIONS

We conclude that the difficult laparoscopic appendectomy can be predicted preoperatively. From our study we found that independent predictors for difficult appendectomy are old age, male sex, prolonged duration of symptoms, high white blood cell count, higher body mass index (BMI), extreme inflammation in computed tomography scan and ultrasonography and morbidity. There are very few reports to determine the predictors of difficult appendectomy and more research is required to establish it.

ACKNOWLEDGEMENTS

The authors would like to thank all patients in the study and entire Department of Surgery, COMSTH for helping to conduct this study.

FUNDING: No funding sources

CONFLICT OF INTEREST: None declared

REFERENCES

1. Imber C, Glazer G. Management of peritonitis with special reference to appendicitis. Surgery-Oxford. 1999;17(11):253-7.
2. Peiser JG, Greenberg D. Laparoscopic versus open appendectomy: results of a retrospective comparison in an Israeli hospital. Isr Med Assoc J. 2002 Feb;4(2):91-4. PMID: 11875999.
3. Abe T, Nagaie T, Miyazaki M, Ochi M, Fukuya T, Kajiyama K. Risk factors of converting to laparotomy in laparoscopic appendectomy for acute appendicitis. Clin Exp Gastroenterol. 2013 Jul 4;6:109-14. doi: 10.2147/CEG.S41571. PMID: 23869174; PMCID: PMC3706257.
4. Wagner PL, Eachempati SR, Aronova A, Hydo LJ, Pieracci FM, Bartholdi M, et al. Contemporary predictors of conversion from laparoscopic to open appendectomy. Surg Infect (Larchmt). 2011 Aug;12(4):261-6. doi: 10.1089/sur.2010.079. Epub 2011 Jul 26. PMID: 21790480
5. Liu SI, Siewert B, Raptopoulos V, Hodin RA. Factors associated with conversion to laparotomy in patients undergoing laparoscopic appendectomy. J Am Coll Surg. 2002 Mar;194(3):298-305. doi: 10.1016/s1072-7515(01)01164-4. PMID: 11893133
6. Kumar NS, Kumar R. Factors affecting conversion of laparoscopic appendectomy to open surgery in a tertiary hospital in South India: a prospective study. IJSS Journal of Surgery. 2016;2(2):1-4. doi: https://doi.org/10.17354/SUR/2016/08
7. Livingston EH, Rege RV. A nationwide study of conversion from laparoscopic to open cholecystectomy. Am J Surg. 2004 Sep;188(3):205-11. doi: 10.1016/j.amjsurg.2004.06.013. PMID: 15450821.
8. Hellberg A, Rudberg C, Enochsson L, Gudbjartsson T, Wenner J, Kullman E, et al. Conversion from laparoscopic to open appendicectomy: a possible drawback of the laparoscopic technique? Eur J Surg. 2001 Mar;167(3):209-13. doi: 10.1080/110241501750099438. PMID: 11316407.
9. Manuneethimaran T, Mohanapriya T, Arun KK, Nitesh N, Balaji SK. The risk factors for conversion of laparoscopic appendectomy to open appendectomy. IOSR-JDMS. 2015;14(10):33-6.
10. Siewert B, Raptopoulos V, Liu SI, Hodin RA, Davis RB, Rosen MP. CT predictors of failed laparoscopic appendectomy. Radiology. 2003 Nov;229(2):415-20. doi: 10.1148/radiol.2292020825. PMID: 14595145.

Citation: Karki M, Belbase N. Predictors of Difficult Laparoscopic Appendectomy in Acute Appendicitis. JCMS Nepal. 2021; 17(3); 234-40.