

Laparoscopic or Open Appendectomy? An Aid to Guide a Novice Laparoscopic Surgeon (With Access to Basic Laparoscopic Instruments) for Apt Patient-Procedure Selection

Dr. Rudraiah H.G.M.¹, Dr. Benita Davis²

¹Professor, Department of General Surgery, JJM Medical College and Bapuji Hospital, Davangere: 577004.

²Postgraduate in Department of General Surgery, JJM Medical College and Bapuji Hospital, Davangere: 577004.
Corresponding Author: email id: [benita1092\[at\]gmail.com](mailto:benita1092[at]gmail.com)

Conducted in: Department of General Surgery, JJM Medical College and Bapuji Hospital Davangere, Karnataka, India

Abstract: ***Background:** Various intra-operative findings cannot be tackled suitably via laparoscopy by a novice laparoscopic surgeon, necessitating a conversion to open approach. These, if identified well in advance, can help the operating surgeon in proper selection of patient and procedure and its apt execution; thereby preventing avoidable conversion and its associated complications. **Objectives:** The primary outcome was to identify significant per-operative risk factors which necessitates conversion from laparoscopic to open appendectomy. Secondly, the post-operative course and outcomes comparing the two operative modalities were studied. **Methods:** This prospective, single-centre, observational study consisted of 50 adult patients diagnosed with acute or recurrent appendicitis in whom elective minimal access laparoscopic appendectomy was planned. Significant per-operative findings, conversion indications and rate, and post-op course was studied and statistical comparisons were done using Chi-squared test and Z test and p value was obtained. **Result:** Out of 50, 48 patients successfully underwent the planned laparoscopic appendectomy irrespective of the complicated nature of the appendicitis. 2 patients needed conversion to open approach; an appendicular mass with dense adhesions to the right ovary with no plane for dissection in the first, and a haemorrhagic right ovarian cyst with torsion and imminent risk of haemorrhage in the second. The patients who underwent laparoscopic surgery had a smooth uncomplicated post-op course with significantly less post-op pain, shorter duration of hospital stay and faster return to work. **Conclusions:** Patients with significant per-operative finding needing conversion to open appendectomy have an unfavourable complication profile compared to primary laparoscopic approach. Therefore, the predictors of the same if identified well in advance can help in the selection of patients who may benefit from primary open appendectomy.*

Keyword: Appendicitis; Complicated Appendicitis; Appendectomy; Laparoscopic Appendectomy; Converted Open Appendectomy.

1. Introduction

Appendicitis is the most common intra-abdominal inflammatory condition requiring surgery (lifetime risk of 6%)¹; making it one of the most common procedure done in general surgery.² Most cases are uncomplicated without any sequelae of mass formation or perforation, but up to 25% of patients present with complicated disease.^{3,4}

Since its development by Semm in 1983⁵, laparoscopic appendectomy (LA) is the main modality of treatment for both uncomplicated and complicated acute appendicitis, accounting for over 75% of all appendectomies⁶. It combines both diagnosis and treatment in a single procedure with least morbidity.⁴ When compared with the open approach, laparoscopy has several advantages: ability to explore the entire peritoneal cavity for diagnoses of other pathologies and its effective treatment, effective peritoneal toiletting without extending the incision,³ less post-op pain and need for analgesia, lesser incidence of wound infection, better cosmesis, shorter duration of hospital stay and faster return to work.⁵

The rate of conversion-to-open approach ranges from 1 to 10%⁶⁻¹⁰; the most common cause being severe inflammatory adhesions which either obscures the anatomy or results in friability and perforation¹¹. Pre-operative variables associated with conversion are: male sex¹¹, advanced age¹¹⁻¹³, diffuse peritonitis¹², American Society of Anaesthesiologists (ASA) score ≥ 2 ¹¹⁻¹³, leukocytosis^{11,12}, high-grades of appendiceal inflammation or rupture on CT scan⁹⁻¹³ and the intra-operative causes are: extensive adhesions with lack of dissecting plane, severe inflammation and friability leading to imminent perforation or haemorrhage and laparoscopic inexperience^{7,9}.

The primary outcome of this study was to identify significant per-operative risk factors which necessitates conversion from laparoscopic (LA) to open appendectomy (OA). Secondly, the post-operative course and outcomes comparing the two operative modalities were studied, such as:

- Severity of post op pain and duration of analgesic use
- Incidence of post-op complications: vomiting, ileus, intra-abdominal abscess, wound infection etc.
- Duration of hospital stay post-op
- Return to work

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2. Methods

This prospective, observational study was conducted over a period of 12 months in tertiary care centre (access to basic laparoscopic equipment) in Davangere as per the ICH Good Clinical Practice (GCP) standards. 50 clinically and radiologically proven cases of acute or recurrent appendicitis, who fulfilled the below mentioned criteria, were inducted into the study and planned to undergo laparoscopic appendectomy (LA) by a novice laparoscopic surgeon.

Inclusion criteria:

- Age \geq 18 years of either gender
- Clinical diagnoses of appendicitis: Alvarado score \geq 5
- Radiological confirmation of acute/recurrent appendicitis on abdominal sonogram or CT abdomen
- Patients willing to undergo laparoscopic appendectomy

Exclusion criteria:

- Age $<$ 18 years
- Pregnancy
- Medically unfit patients who cannot tolerate general anaesthesia/pneumoperitoneum
- Refusal of procedure

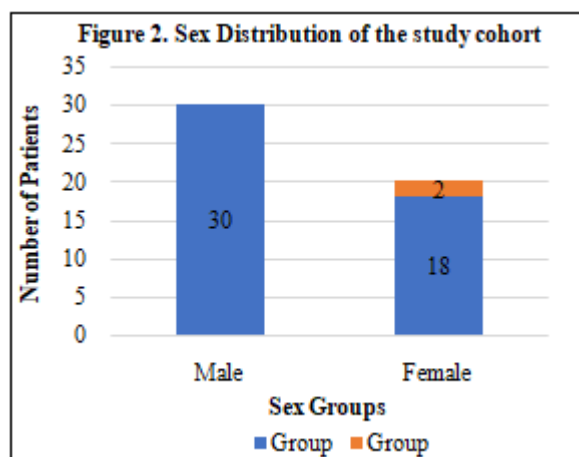
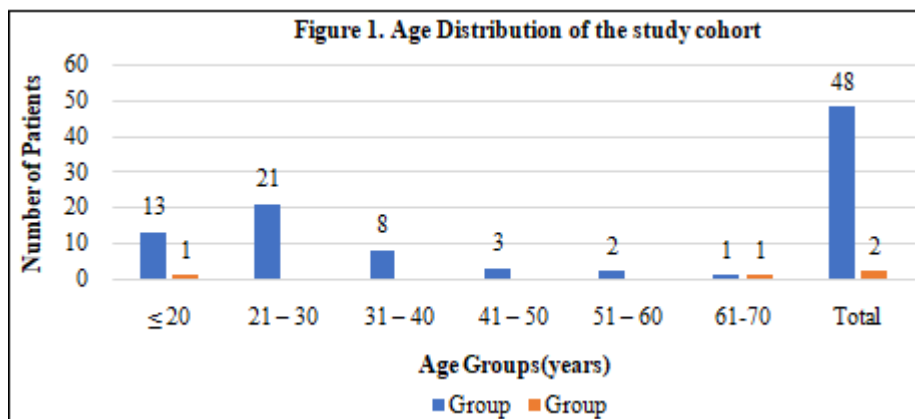
Operative Procedure

After administration of general anaesthesia, pneumoperitoneum was created using a Veress needle and 10mm camera port was secured at the umbilicus. Under vision, two 5mm working ports were secured at the right

upper quadrant or left iliac fossa (depending upon the convenience of the operating surgeon) and the other in the suprapubic region. Diagnostic laparoscopy was performed; pathologies if found were documented. The caecum was grasped at the lower taenia and retracted towards the liver to adequately visualise the appendix. The appendix was grasped, and by using a monopolar cautery, the mesoappendix was divided and skeletonised till its base at the appendico-caecal junction. Two pre-tied endoloops were passed through the appendix, secured and tightened at base and the appendix was divided; specimen sent for histopathological examination. If any difficulty was faced during conduction of the said procedure, decision for conversion to OA was undertaken according to the discretion of the operating surgeon. Various intra-operative findings necessitating such a conversion was analysed. Post-operative course was followed up for all patients till discharge and incidence of post-op complications, need and duration of analgesics, duration of hospital stay and return to work were documented. The data was statistically analysed (SPSS computer software v.20.0) using Chi-squared test and Z test and appropriate p values were obtained.

3. Results

Demographics: The mean age of the entire cohort was 28.62 ± 12.07 years with highest incidence (42%) between 21 to 30 years and 60% were male. Both patients who underwent conversion to OA were of female gender, 18 and 62 years of age respectively.

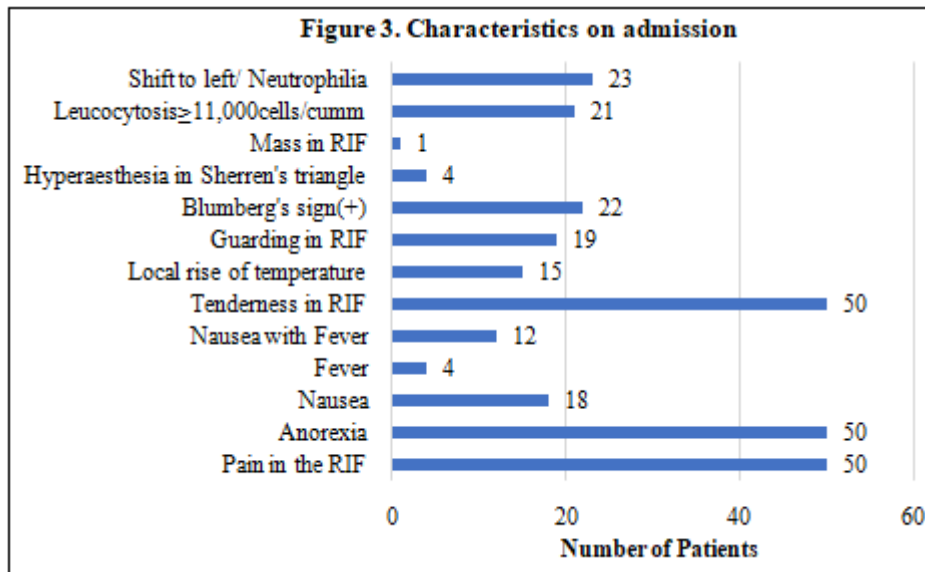


Admission characteristics: On admission, all 50 patients (100%) presented with typical pain in the right lower abdomen with or without radiation from the umbilicus and anorexia which was associated with: only vomiting in 18 patients (36%), only fever in 4 patients (8%) and vomiting with fever in 12 patients (24%).

On clinical examination, all 50 patients (100%) had tenderness over the McBurney's point with associated: local rise of temperature in 15 patients (30%) and guarding in right iliac region in 19 patients (38%). Blumberg's sign was positive in 22 patients (44%), hyperaesthesia over the Sherrren's triangle was present in 4 patients (8%) and a palpable mass in the right iliac region extending to the supra-pubic region was appreciated in 1 patient (2%).

After appropriate investigations, 21 patients (42%) had a significantly raised total leucocyte count $\geq 11,000$ cells/mm³ with a shift to left observed in 23 patients (46%).

All 50 patients (100%) had features of acute/recurrent appendicitis on ultrasonogram of the abdomen and pelvis with mass formation seen in 2 patients (4%) with superadded suppuration and free fluid in 1 patient (2%).

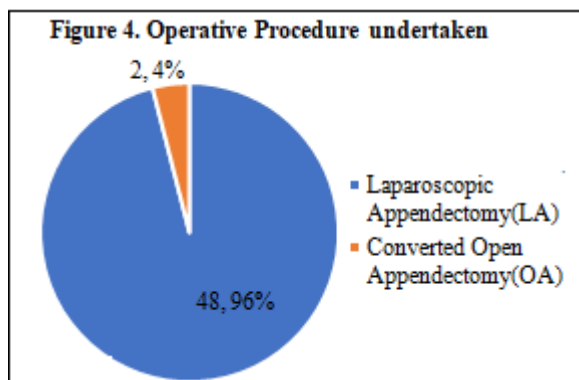
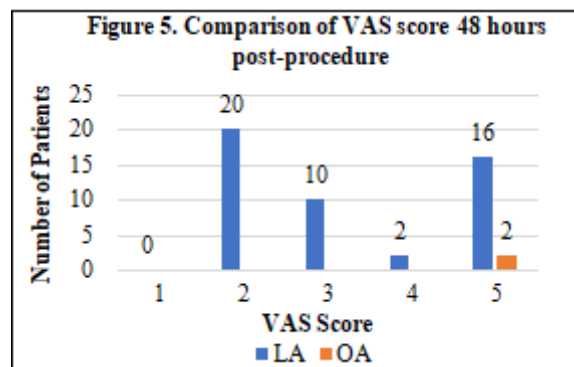


Operative procedure conducted and Predictors of conversion from LA to OA: Of the 50 patients inducted into the study, 48 patients (96%) underwent the planned Laparoscopic Appendectomy (LA), but 2 patients (4%) underwent converted Open Appendectomy (OA). The first patient had an appendicular mass with massive adhesions to the right ovary, where a suitable plane for dissection and adhesiolysis was not attainable. The second patient had a 10x12cm haemorrhagic cyst over the right ovary with superadded torsion with high risk of imminent haemorrhage. Since these two pathologies couldn't be tackled safely via LA, conversion to OA was deemed necessary.

revealed that majority of patients i.e.32(68%) suffered from moderate pain grading between 2-4 score; the most common score=2 in LA, whereas a score=5 in both patients who required conversion to OA; this was statistically highly significant(p value=0.0026).One patient (2%) who underwent (converted)OA developed wound site infection on the 4th post-op day; with no other complications reported in the studied patient cohort.

Table 1. Summary of the various intra-operative findings present in the study cohort.

Intra-operative findings	Number of cases
Inflamed uncomplicated appendix	45
Gangrenous perforated appendix	2
Appendicular mass with abscess formation	1
Appendicular mass adherent to the right ovary and fallopian tube	1
Inflamed appendix with 10x12cm haemorrhagic right ovarian cyst with torsion	1

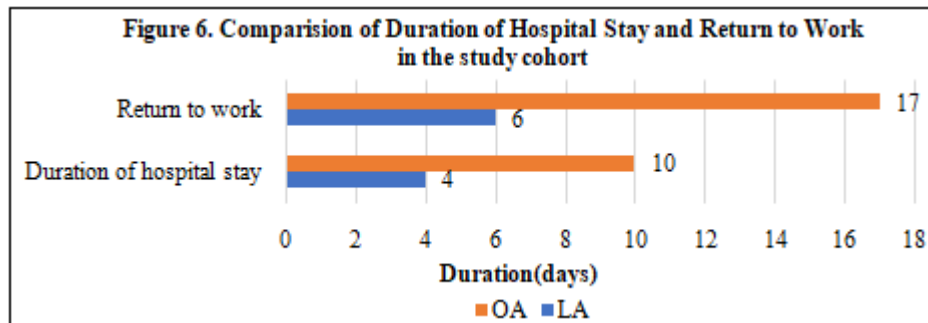


Patients who underwent LA had a faster recovery, with statistically significant (p value=0.03) shorter duration of hospital stay and faster return to work.(p value=0.02).

Table 2: Comparison of Duration of Hospital Stay and Return to Work in the study cohort

	Laparoscopic Appendectomy(LA)		Converted Open Appendectomy(OA)	
	Mean	Standard Deviation	Mean	Standard Deviation
Duration of hospital stay(days)	3.4	0.6	9.5	0.7
Return to work (days)	5.7	1.0	16.5	0.7
p value	0.03 Significant		0.02 Significant	

Post-operative course and return to work: Post-operative pain assessed using VAS scale 48hours postoperation



4. Discussion

Complicated appendicitis is associated with a higher risk of peri-operative complications and has been considered as a relative contraindication for LA. This concept has been challenged in our study.

In our study consisting of 50 patients ranging from 18 to 70 years of age with majority (42%) of them in 21-30 years age group; 30 (60%) were male and 20 (40%) were female. Studies like Patrick et al¹⁴ and Liu et al¹⁰ have shown male gender and age ≥ 65 years as risk factors for conversion to OA; whereas, in our study, the 2 patients who underwent OA were of the female gender, of age 18 and 62 years respectively.

All 50 (100%) presented with pain in the right lower abdomen with anorexia and tenderness over the RIF, associated with fever, nausea, local rise of temperature and signs of local peritonitis of varying severity and duration. On laboratory evaluation, 21 (42%) patients had an elevated leucocyte count, with shift to left i.e., neutrophilia seen in 23 (44%) patients. Patrick et al¹⁴ mentioned longer duration of symptoms, rigidity on examination and neutrophilia on admission as predictors for conversion.

We were able to successfully conduct LA in 48 (96%) patients, 5 (10%) of whom had complicated intra-op findings, with conversion OA necessary in 2 patients due to distorted anatomy with lack of plane for dissection and imminent haemorrhage. Our results were similar to Basant Kumar et al¹⁵ in which 7 (14%) patients revealed complicated intra-op findings necessitating conversion in 3 patients, owing to dense adhesions with inadequate plane for dissection and distorted anatomy as the most common cause.

When compared with OA, LA has several advantages: ability to explore the entire peritoneal cavity for diagnoses of other pathologies and its effective treatment, effective peritoneal toiletting without extending incision,³ less post-op pain and need for analgesia¹⁸, lesser incidence of wound infection and better cosmesis with shorter duration of hospital stay and faster return to work.⁴

The rate of conversion-to-open approach ranges from 1 to 10%⁶⁻¹⁰; the most common cause being severe inflammatory adhesions which either obscures the anatomy or results in friability and perforation^{11,16}. Pre-operative variables associated with conversion are: male sex¹¹, advanced age¹¹⁻¹³, diffuse peritonitis¹², ASA score ≥ 2 ¹¹⁻¹³, leukocytosis^{11,12}, high-grades of appendiceal inflammation or rupture on CT

scan⁹⁻¹³. Intra-operative causes are: extensive adhesions with lack of dissecting plane, severe inflammation and friability leading to imminent perforation¹⁰ or haemorrhage, difficult visualisation,¹⁶ laparoscopic inexperience in advanced procedure and lack of high end laparoscopic gadgets^{7,9}.

Several studies^{10,12,18} have also reported significantly higher complication rates in converted OA patients (8%- 34%) compared to 5%-9% in LA, typically including intra-abdominal abscess, surgical site infection, ileus, and pneumonia.

Our study also demonstrated that patients who underwent conversion to open approach were at a significant risk for poorer outcomes, longer duration of hospital stay, and higher healthcare costs, which was comparable with other studies.¹⁶⁻¹⁸

5. Conclusion

Complicated appendicitis does not warrant an absolute need for conversion to OA and can be excised safely by LA. Early identification of risk factors for conversion can help a novice laparoscopic surgeon who has access only to basic laparoscopic equipment, in proper selection of patient-for-procedure and its apt execution; thereby preventing avoidable conversion, unfavourable post-op course, poorer outcomes, longer duration of hospital stay and higher healthcare costs.

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Conflict of interest: None declared

Ethical approval: Taken.

References

- [1] Guller U, Hervey S, Purves H, Muhlbaier L, et al. "Laparoscopic database". *Ann Surg* 2004; 239:43-52.
- [2] Telfor G, Wallace J, "Appendix" chapter 13 in *Oxford textbook of Surgery*, Morris PJ., Wood WC, Eds. Vol.2, 2nd Edn, Oxford Medical Publications, 2000; 180-189.
- [3] Palanvelu C "Laparoscopic Appendectomy" chapter 53 in *Textbook of Surgical Laparoscopy*, Shrinivas fine art LTD, 2002:411-424.
- [4] D.G. Addiss, N. Shaffer, B.S. Fowler, R. V Tauxe, et al. The epidemiology of appendicitis and appendectomy in the United States. *AmJ Epidemiol* 1990; 132:910-925.

- [5] K. Semm. Endoscopic appendectomy, *Endoscopy* 1983; 15:59-64.
- [6] H. Masoomi, N. Nguyen, M. Dolich, et al. Laparoscopic appendectomy trends and outcomes in the United States: data from the nationwide inpatient sample (NIS), 2004-2011, *AmSurg*2014; 80:1074-1077.
- [7] S.V. Sakpal, S.S. Bindra, R.S. Chamberlain, et al. Laparoscopic appendectomy conversionrates two decades later: an analysis of surgeon and patient-specific factors resulting in open conversion. *JSurgRes*2012;176:42-49.
- [8] J.M. Wu, H.F. Lin, K.H. Chen, et al. Impact of previous abdominal surgery on laparoscopic appendectomy for acute appendicitis. *SurgEndosc.* 2007;21:570-573.
- [9] P.L. Wagner, S.R. Eachempati, A. Aronova, et al. Contemporary predictors of conversionfrom laparoscopic to open appendectomy. *SurgInfect(Larchmt)* 2011;12:261-266.
- [10] Liu SI, Siewery B, Raptopoulous V, et al. Factors associated with conversion to laparotomy in patients undergoing laparoscopic appendectomy. *J Am Coll Surg* 2002 Mar; 194(3): 298-305.
- [11] N. Gupta, D. Machado-Aranda, K. Bennett, et al. Identification of preoperative risk factors associated with the conversion of laparoscopic to open appendectomies. *Int J Surg*2013;98:334-339.
- [12] T. Abe, T. Nagaie, M. Miyazaki, et al. Risk factors of converting to laparotomy in laparoscopic appendectomy for acute appendicitis. *Clin. Exp. Gastroenterol*2013;6:109-114.
- [13] B. Siewert, V. Raptopoulos, S.-I. Liu, et al. CT predictors of failed laparoscopic Appendectomy, *Radiology* 2003;229:415-420.
- [14] Patrick L. Wagner, Soumitra R. Eachampati, Anna Aronova, et al. Contemporary predictors of conversion from laparoscopic to open appendectomy. *Surgical Infections* 2011 Aug;12(4): 261-266.
- [15] Basant Kumar, Abdul Samad, Tariq Wahab, et al. Superiority of laparoscopic appendectomy over open appendectomy: The Hyderabad experience. *Rawal Med J* 2008 Aug; 33:165-168.
- [16] Anders Hellberg, Steafan Sorensen, Claes Rudberg, et al. Conversion from laparoscopic to open appendectomy: a possible drawback of laparoscopic technique? *Eur J Surg* 2001 Mar;167(3):209-213.
- [17] Bushra Shirazi, Naureen Ali, Muhammad Shahid, et al. Laparoscopic verses open appendectomy: a comparative study. *JPMA* 2010 Nov; 60(11): 901-904.
- [18] Brendan M. Finnerty, Xian Wu, Gregory P. Giambone, et al. Conversion-to-open in laparoscopic appendectomy: A cohort analysis of risk factors and outcomes. *Int J Surg* 2017; 40:169-175.