



## Open Versus Laparoscopic Appendicectomy- A Comparative Study

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### ABSTRACT

**Background:** *Laparoscopic appendicectomy has rapidly become established as the popular alternative to open appendicectomy, it has a safety profile better than open procedure.*

**Objectives:** *Laparoscopic procedure for appendicectomy is compared with open surgical technique with respect to:*

- *Duration of procedure.*
- *Post operative pain.*
- *Duration of analgesic use.*
- *Complication encountered*
- *Post operative length of hospital stay.*
- *Conversion to open appendectomy*

**Methods:** *Prospective study from December 2008 to May 2010, involved 50 patients with diagnosis of acute or recurrent appendicitis was entered into a study randomizing the choice of operation to either the open or the laparoscopic technique. Statistical comparisons were performed using the chi-square test and students 't' test.*

**Results:** *25 patients were assigned to the laparoscopic appendicectomy group and 25 patients were assigned to the open appendicectomy group. There were statistically significant difference noted in respect to postoperative pain (LA,  $1.21 \pm 0.63$  Vs. OA,  $2.72 \pm 0.87$ ;  $P < 0.001$ ) duration of analgesic used (LA,  $2.2 \pm 1.08$  Vs. OA,  $6.44 \pm 1.84$ ;  $P < 0.001$ ) postoperative complications like vomiting [LA, 2 (8%) Vs. O.A, 7 (28%), fever [LA, 1 (4%) Vs. OA, 4 (16%), wound infection [LA, 1 (4%) Vs. OA, 5 (20%), ileus (LA,  $17.3 \pm 7.1$  Vs. OA,  $30.8 \pm 8.9$ ;  $P < 0.001$ ) postoperative length of hospital stay (LA,  $2.8 \pm 1.23$  Vs. OA,  $7.7 \pm 1.95$ ;  $P < 0.001$ ) and return to normal work (LA,  $13.5 \pm 2.86$  Vs. OA,  $20.8 \pm 3.21$ ;  $P < 0.01$ ) .Although above mentioned advantage were at the cost of slightly increased duration of surgery (LA,  $71.2 \pm 19.23$  Vs. OA,  $53.8 \pm 20.04$ ;  $P < 0.01$ ).*

**Conclusions:** *The patients who underwent laparoscopic appendicectomy had less postoperative pain and shorter duration of analgesic use, less postoperative complications like vomiting, fever ileus and wound infection with shorter postoperative duration of hospital stay and return to normal work when compared with patients who underwent open appendicectomy. Laparoscopic appendicectomy is better than open appendicectomy in selected patients with acute or recurrent appendicitis.*

**Keywords:** *Appendicectomy, Laparoscopic appendicectomy, Open appendicectomy, Acute appendicitis.*

### Introduction

It is a well-known adage that abdomen is a temple of surprises and a magic box as well. Since the abdomen accommodates innumerable viscera and

other anatomical compliments, diseases of the abdomen constitute a topic full of clinical curiosity. A meticulous examination of abdomen is one of the most rewarding diagnostic

procedures available to the doctor, especially the surgeon and plans an ideal treatment. As had been said by Bailey "A correct diagnosis is the hand maiden of successful operation". Despite the advancements in the fields of diagnosis the surprises never cease.<sup>1</sup>

Acute appendicitis is one of the commonest causes of acute abdomen encountered in surgical practice, requiring emergency surgery.<sup>2</sup> The life time rate of appendectomy is 12% for men and 25% in women, with approximately 7% of all people undergoing appendectomy for acute appendicitis during their lifetime. It has been observed that males had higher rates of appendicitis than females for all age groups with an overall ratio of 1.2 to 1.3:1.<sup>3</sup>

Even though modern diagnostic facilities, surgical skills, antibiotic therapy have brought down the mortality from 50% (before 1925) to less than 1/1,00,000 persons, still the morbidity is around 5-8% mainly due to delayed diagnosis & treatment, with the resultant complications.<sup>4</sup>

In acute appendicitis however, a treatment delay of even a few hours may result in stormy complication.

It has been said that nothing can be so simple nor yet so difficult as the diagnosis of acute appendicitis.

With the introduction of the laparoscopic technique it provided an opportunity to explore new method of therapy in the management of the suspected cases of the acute appendicitis.<sup>5</sup>

Laparoscopic appendectomy combines the advantages of diagnosis and treatment in one procedure with the least morbidity<sup>6</sup>. Patients are likely to have less post operative pain and to be discharged from hospital and return to activities of daily living sooner than those who have undergone an open appendectomy.<sup>7</sup>

Other advantages include decreased wound infection, better cosmetic, ability to explore the entire peritoneal cavity for diagnosis of other conditions and effective peritoneal toileting without the need for extending the incision.<sup>4</sup>

Laparoscopic appendectomy is increasingly being employed particularly in young women of child bearing age in whom the differential diagnosis of right lower quadrant pain is extensive including gynecologic pathology.<sup>8</sup>

Critics of laparoscopic appendectomy often point to the increased cost of the surgical equipments as a major disadvantage of the laparoscopic procedure. Despite these concerns however the cost effectiveness for the laparoscopic appendectomy is easily realized once the decreased hospital stay and entire patient covalence period are accounted for.

The modern era of laparoscopic surgery has evoked remarkable changes in the approach to surgical diseases. The trend towards minimally invasive surgery has prompted general surgeons to scrutinize nearly all surgical procedures for possibility of conversion to the laparoscopic technique.<sup>9</sup>

### **Aims and Objectives**

The aim of the study is to compare open appendectomy and laparoscopic appendectomy with respect to:

1. Duration of the procedure.
2. Post operative pain.
3. Duration of analgesic used.
4. Complication encountered.
5. Post operative length of hospital stay.
6. Conversion to open appendectomy.

### **Materials and Methods**

#### **Source of Data**

The study subject consists of the patients admitted in the surgical wards of all units Krishna Institute of Medical Sciences, Karad with a clinical diagnosis of acute or recurrent appendicitis from Oct 2014 to June 2016 (including sampling procedures, if any).

#### **Method of collection of data:**

This prospective study from Oct 2014 to June 2016 involved 50 cases that were consecutively selected, where the investigator was a part of the

surgical team managing the patients, by using random sampling technique.

#### Inclusion Criteria

All adult patients diagnosed with acute/chronic appendicitis concluded by clinical evaluation and confirmed by USG of abdomen requiring operative intervention are included in this study, after obtaining the consent to be included in the study.

#### Exclusion Criteria

1. Patients with associated gynecological disease
2. Patient age less than 12 years
3. Appendicular abscess

Open appendicectomy was performed either under general anesthesia or spinal anesthesia, through a muscle splitting incision in the right iliac fossa. The base of the appendix was crushed and ligated and the stump of the appendix was not invigilated. Laparoscopic technique performed under general anesthesia using a standardized approach involving the open technique for the trocar insertion and by 3- port technique. The appendix was divided after double ligation of the base. Appendix extraction was performed using trocar sleeve to protect the wound from contamination during removal.

All cases were followed in the postoperative period till they were discharged and then later followed for a period of 4 weeks in the out patient department.

The following parameters were observed between the two procedures.

1. Duration of procedure
2. Postoperative pain using a visual analogue pain scale from 0 to 4.
3. Duration of analgesic used in number of days.
4. Postoperative complications like nausea/vomiting, ileus, fever and wound infection.
5. Post operative length of hospital stay in number of days was noted.
6. Conversion to open appendicectomy.

A proforma was used to collect the relevant information. Data was analyzed using the Students t-test, Chi-square analysis and P value of <0.05 was considered significant.

## Results

### Patients Demographics

The results of the analysis of data on 25 patients who underwent open appendicectomy and another group of 25 patients, who were operated laparoscopic ally are as follows:

**Table -1:** Age and Sex Distribution

Characteristic	Appendicectomy				Total
	Open		Laparoscopy		
	N	%	N	%	
Patients analyzed	25	100	25	100	50
<b>SEX</b>					
Male	13	52	8	32	
Female	12	48	17	68	
<b>Age (years)</b>					
10-20	7	28	10	40	
21-30	10	40	10	40	
31-40	4	16	3	12	
41-50	4	16	2	8	
Mean age $\pm$ SD	27.2 $\pm$ 5.62		25.52 $\pm$ 7.81		

In present study 13(52%) patients of open appendicectomy and 8 (32%) patients of laparoscopic appendicectomy were males.12 The mean age of the patients in open and laparoscopic appendicectomy was 27.2 and 25.5 years respectively.

(48%) patients of open and 17 (68%) of laparoscopic appendicectomy were females.

Figure – 29: Sex distribution

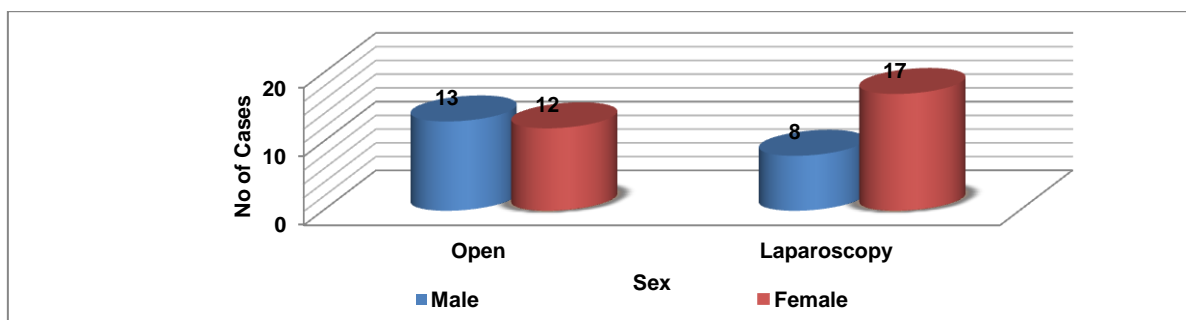


Figure – 30: Age distribution

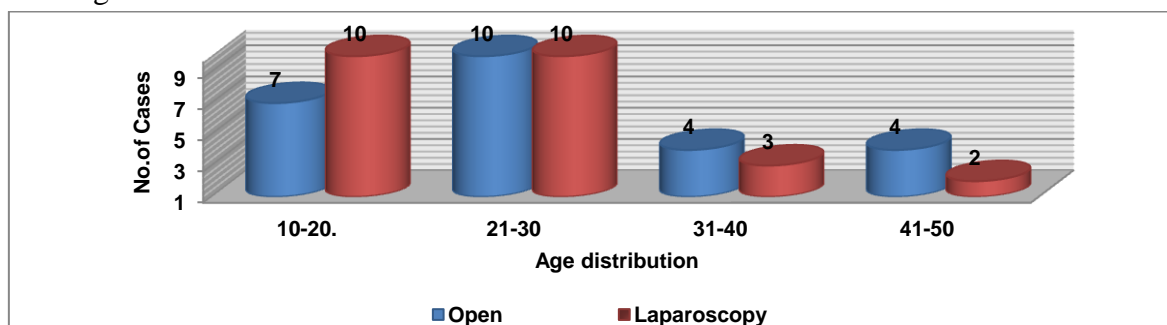


Table -2: Presenting Complaints

Symptoms	Appendicectomy			
	Open		Laparoscopy	
	N	%	N	%
Abdominal Pain	25	100	25	100
Nausea/ Vomiting	16	64	20	80
Fever	7	28	5	20

Figure -31: Presenting Complaints

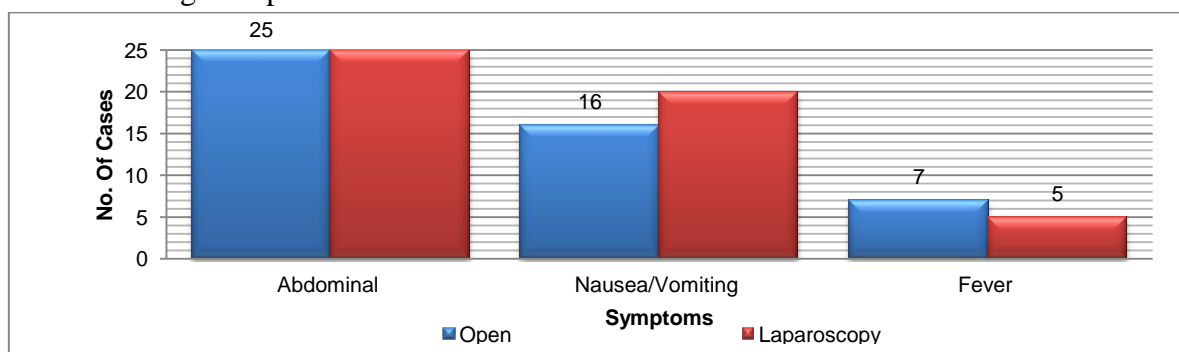


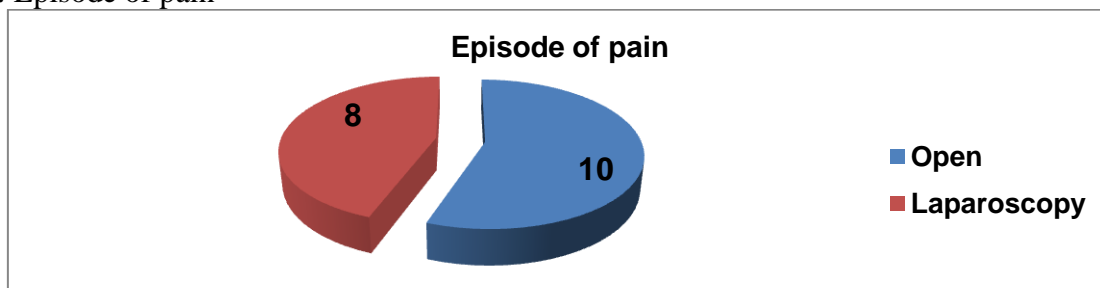
Table -3: Past History

History of	Appendicectomy			
	Open		Laparoscopy	
	N	%	N	%
Episode of Pain	10	40	8	32

In present study 10 (40%) and 8 (32%) of the patient of open and laparoscopic group

respectively had the history of episodes of abdominal pain in the past.

**Figure-32:** Episode of pain



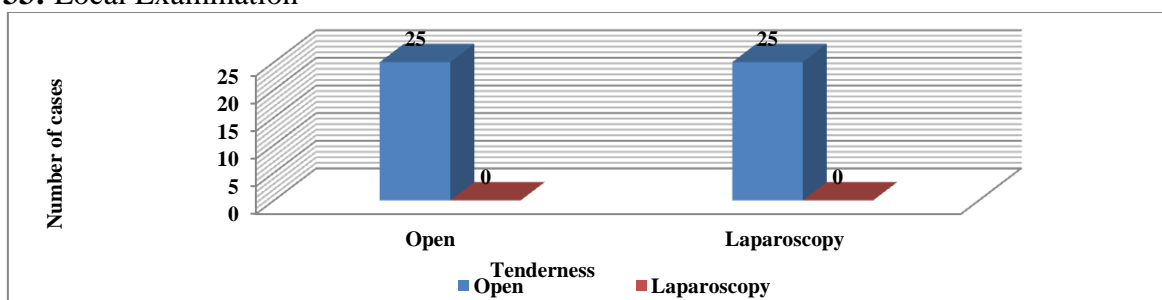
**Table- 4:** Local Examination

Findings	Appendicectomy			
	Open		Laparoscopy	
	N	%	N	%
<b>Tenderness</b>				
Present	25	100	25	100
Absent	0	0	0	0
<b>Guarding/Rigidity</b>				
Present	6	24	4	16
Absent	19	76	21	84

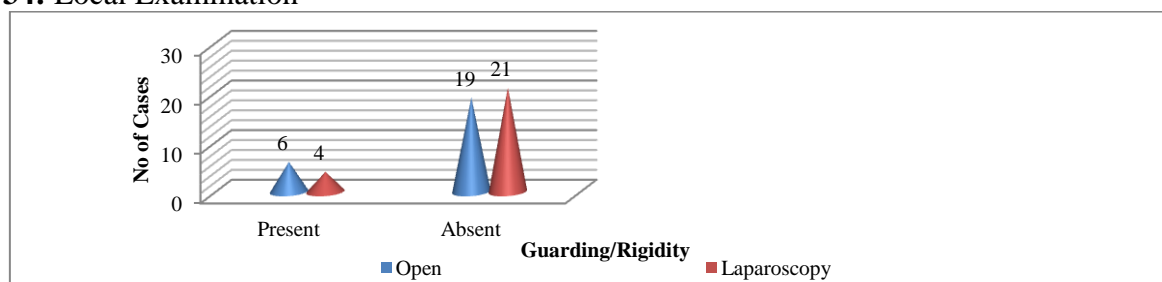
In present study, all patients in both groups had right iliac fossa tenderness and 6(24%) patients in

open and 4 (16%) patients in laparoscopic group had guarding/rigidity.

**Figure -33:** Local Examination



**Figure -34:** Local Examination



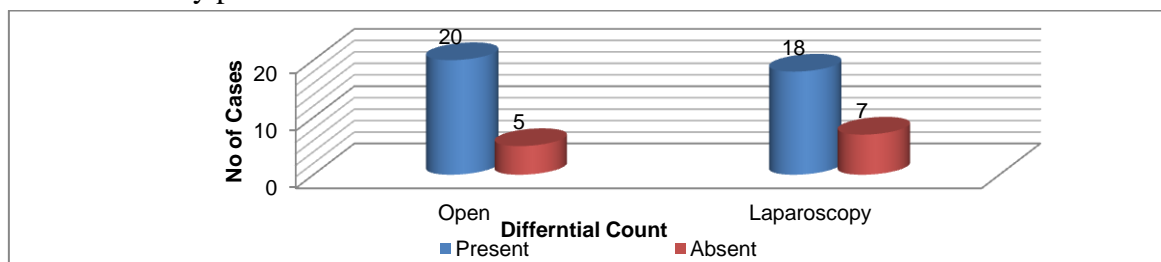
**Table -5:** Laboratory parameters

Parameters	Appendicectomy			
	Open		Laparoscopy	
	N	%	N	%
Total count				
Mean SD	10.200±1988.37		10.000±2067.65	
<b>Differential count with shift to left</b>				
	N	%	N	%
Present	20	80	18	72
Absent	5	20	7	28

In present study, the laboratory parameters of patients in open and laparoscopic group were comparable. 20(80%) and 18 (72%) of open and

laparoscopic group respectively were showing differential count with shift to the left.

**Figure – 35:** Laboratory parameters



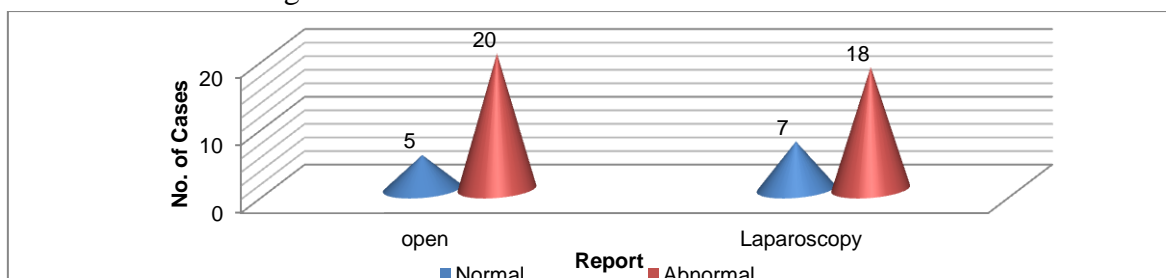
**Table -6:** Ultrasound Findings

Report	Appendicectomy			
	Open		Laparoscopy	
	N	%	N	%
Normal	5	20	7	28
Abnormal	20	80	18	72

In present study, abnormal pathology was noted in 20 (80%) and 18 (72%) of open and laparoscopic groups respectively. Ultrasound was normal in 5

(20%) and 7 (28%) of open and laparoscopic groups respectively.

**Figure-36:** Ultrasound Findings



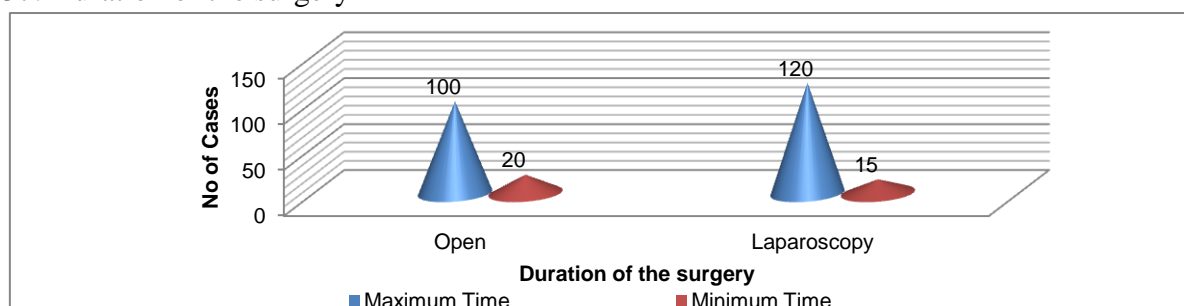
**Table-7:** Duration of the surgery

Duration of the surgery (Min)	Appendicectomy		*Significance	
	Open	Laparoscopy	't'	'p'
Mean duration /SD	53.8±20.4	71.2±19.23	3.16	0.01
Maximum time	100	120		
Minimum time	20	15		

In present study, the mean duration of surgery was (53.8±20.4) min in the open group and

(71.2±19.23) min in the laparoscopy group. This difference was statistically significant (P<0.01).

**Figure-37:** Duration of the surgery



**Tabl-8 :** Post operative pain score and medication

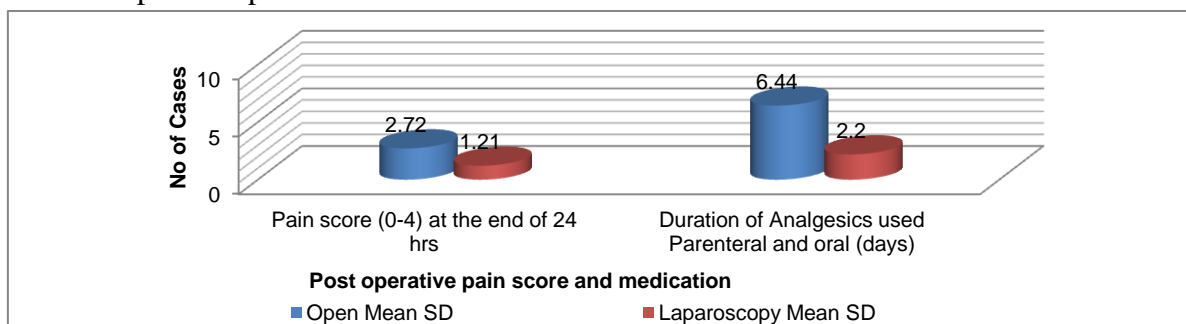
Details	Appendicectomy		*Significance	
	Open Mean SD	Laparoscopy Mean SD	't'	'p'
Pain score (0-4) at the end of 24 hrs	2.72±0.87	1.21±0.63	7.19	0.001
Duration of Analgesics used Parenteral and oral (days)	6.44±1.84	2.2±1.08	9.86	0.001

In present study, mean pain score was (2.7 ± 0.87) in open group as compared to (1.21 ± 0.63) in laparoscopic group with P< 0.001 which was significant. The mean duration of analgesics used parenteral and oral in days were on an average (6.44 ± 1.84) and (2.2 ±1.08) for open and

laparoscopic group respectively. Again this difference was significant (P< 0.001).

Above analysis reveal that both pain and duration of analgesics used were highly significantly reduced in laparoscopic compared to open appendicectomy.

**Figure-38:** Post operative pain score and medication



**Table-9 :** Postoperative Complications

Complication	Appendicectomy				*Significance	
	Open		Laparoscopy		't'	'p'
	N	%	N	%		
Vomiting	7	28	2	8	12.12	0.01
Fever	4	16	1	4		
Wound Infection	5	20	1	4		
Ileus in hrs	30.8±8.9		17.3±7.1			

In present study post operative complications were analyzed in detail: vomiting, fever, wound infection and ileus.

The incidence of vomiting 7 (28%) was higher following open appendicectomy than laparoscopic group 2(8%).

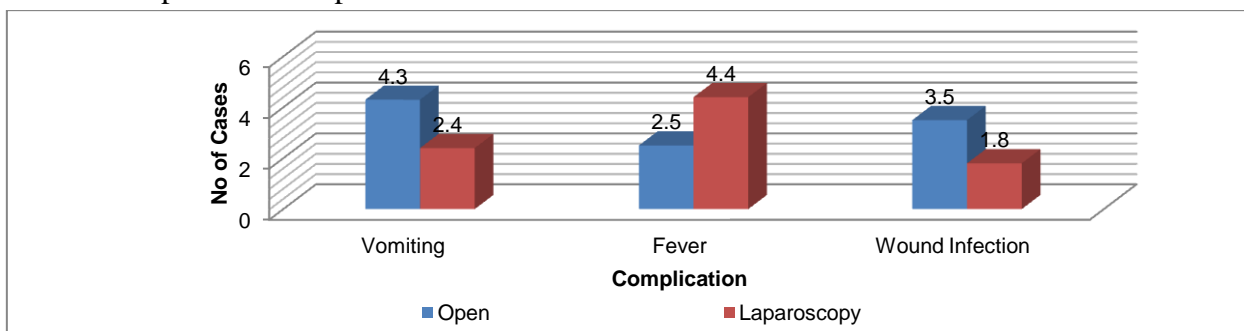
Average post operative ileus was (30.8 ± 8.9)hours for open and (17.3 ± 7.1) hours for laparoscopic group was noted .

Wound infection was more common after open 5(20%) than laparoscopic group 1(4%).

Fever4(16%)developed more in the open group than the laparoscopic group1 (4%).

All these parameters where significant with P <0.01

**Figure 39 :** Postoperative Complications





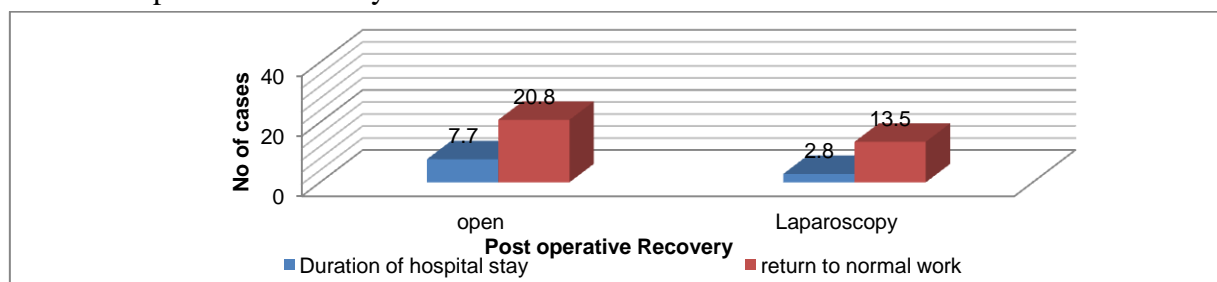
**Table -10 :** Post operative Recovery

Details	Appendicectomy		*Significance	
	Open Mean /SD	Laparoscopy Mean /SD	't'	'p'
Duration of hospital stay after surgery (days)	7.7±1.95	2.8±1.23	4.9	0.001
Time taken for return to normal work (days)	20.8±3.21	13.5±2.86	7.3	0.001

Mean Duration of post operative hospital stay for open group(7.7±1.95) and (2.8±1.23) days for laparoscopic group. Which shows that laparoscopic appendicectomy significantly reduced the hospital stay (P< 0.001).

Patients who had laparoscopic appendicectomy return to full activities was (13.5±2.86)versus(20.8±3.21) days for patients who underwent open appendicectomy. Again this difference was significant (P<0.00).

**Figure-40:** Post operative Recovery



**Discussion**

The pendulum of the surgical opinion continuous to swing with gradual decreasing sweep as the appropriate application of the laparoscopy for the suspected case of the acute and recurrent appendicitis is popularizing.

Critics of laparoscopic appendicectomy often point to the increase cost of the surgical equipments as a major disadvantages of the laparoscopic procedure despite these concerns, it has become safe popular procedure. However the cost effectiveness for laparoscopic appendicectomy is easily realized once the decreased hospital stay and entire patient convalescence period are accounted for laparoscopy as a major surgical advantage has enable the general surgeon to stretch his hands in the Superspeciality area. The controversy that currently exits over the potential benefit of laparoscopic appendicectomy motivated us to analyze our experience with this procedure.

The relative advantage and disadvantages of the laparoscopic and open appendicectomy are measured primarily in terms of duration of surgery, post operative pain score and duration of

analgesic used in days, Post operative complication like ileus ,fever, vomiting, wound infection post operative recovery in the terms of post operative duration of hospital stay, returns to normal were assessed.

In this study the mean age group is 27.2yrs and 25.5yrs in the open and laparoscopic group respectively.

**Table-11:** Duration of surgery

	Mean time (minutes)	
Studies	Open	Laparoscopy
Heikkim T.J et al	82	91
Ortega AE et al	58	68
Youg JL et al	60	80
Geeta.K.R et al	58.2	74.13
Present study	53.8	71.2

In our study there was significant increases in the mean time taken for the procedure during laparoscopic appendicectomy compared to the open method (LA 71.2 ± 19.2 Vs. OA 53.8 ± 20.04) respectively. This was statistically significant (P< 0.01) Similar Studies were observed in some of the studies<sup>21,27,38,42.</sup>



This was because of learning curve level of surgical experience and patient selection accounted for increased operative time.

**Table-12:** Post operative pain score at the end of 24 hours

Studies	Pain score (0-4) (Mean)	
	Open	Laparoscopy
Ortega AE et al	3.25	2.01
Swneeny KJ et al	3.01	2.25
Present study	2.72	1.21

In our study there was significant difference in the mean post operative pain score between open and laparoscopic appendicectomy at the end of 24hrs (OA, 2.72 ± 0.87 Vs LA, 1.21 ± 0.63) respectively; p< 0.001). Similar observation has been reported by others<sup>27,30,.</sup>

This difference is because of a longer incision and stretch of the muscles

**Table-13:** Post operative analgesic used parenteral and oral (days)

Studies	Number of days (Mean)	
	Open	Laparoscopy
Frazee RC et al	6.95	2.29
Shaikh AR et al	7.25	3.95
Geeta.K.R et al	7.05	3.31
Present study	6.44	2.20

In our study mean duration post operative analgesic parenteral and oral doses required in days was more in the open group than the laparoscopic group (OA, 6.44±1.84 Vs. LA, 2.2 ±1.08) respectively: p<0.001. Similar observation has been reported by others.<sup>27,40,42.</sup>

**Table-14:** Duration of hospital in days

Studies	Number of days (Mean)	
	Open	Laparoscopy
Attwood SE et al	3.8	2.5
Yong JL et al	4	3
Wei HB Hung et al	7.2	4.1
Geeta.K.R et al	4.36	3.31
Present study	7.7	2.8

In our study mean duration of hospital stay was significantly lower for the Laparoscopic group (2.8±1.73) days as compared to the open group (7.7±1.95) with (P< 0.001)

Similar studies has been reported by others<sup>19,38,39,42.</sup>

Post operative complication like, vomiting was lower in laparoscopic groups 2(8%) as compared with 7(28%) in open group and fever was lower in laparoscopic group 4(16%) as compared with 1 (4%) in open group.

**Table-15:** Post operative wound infection

Studies	Number of cases (Mean)	
	Open	Laparoscopy
Ortega AE et al	11	4
Geeta.K.R et al	11	0
Present study	5	1

In our study mean post operative wound infection rate was lesser in laparoscopic group with 1(4%), as compared with 5(20%) in open method. The similar observation has been observed.<sup>27,42.</sup> All these parameters were significant with P <0.01.

**Table-16:** Post operative ileus in hours

Studies	Number of hours (Mean)	
	Open	Laparoscopy
Swneeny KJ et al	33.3	20.6
Yasmin Vellani et al	21.0	10.6
Present study	30.8	17.3

In our study mean post operative ileus was lower in laparoscopic group with (17.3±7.1hrs) and for open group (30.8±8.9hrs). The similar studies have been observed<sup>30, 41.</sup>

**Table-17:** Return to normal work (days)

Studies	Number of days (Mean)	
	Open	Laparoscopy
Ortega AE et al	14.0	9.0
Pedersen AG et al	26.5	14.0
Wei HB Hung et al	13.7	9.1
Geeta.K.R et al	19.44	13.86
Present study	20.8	13.5

In our studies return to normal work was earlier for the laparoscopic group ( $13.5 \pm 2.86$  days) as compared to the open appendectomy ( $20.8 + 3.21$  days). This difference being Significant ( $P < 0.001$ ). Other studies has also shown similar result.<sup>27,29,39,42.</sup>

In addition to a therapeutic modality laparoscopic has distinctive advantage of being a diagnostic tool.

There was no case of conversion from laparoscopic appendectomy to open appendectomy in our study.

### Conclusion

On analyzing the data, we found a definite difference in outcome between open and laparoscopic appendectomy in a properly selected patient. The laparoscopic appendectomy was better than the open appendectomy with respect to:

- Post operative pain.
- Duration of analgesic use.
- Postoperative complications like vomiting, ileus, fever, and wound infection,
- Post operative length of hospital stay.
- Return to normal work.

Overall, laparoscopic appendectomy is better than open appendectomy in selected patients with acute or recurrent appendicitis, at a cost of slight increase in duration of surgery.

### Summary

Appendicitis is the most common intra abdominal condition requiring emergency surgery; appendectomy is the commonest procedure in general surgery. Although a number of trials have analyzed the outcome of laparoscopic versus open appendectomy the value of laparoscopy in appendicitis is not established.

Krishna Institute of Medical Sciences, Karad. with a clinical diagnosis of acute or recurrent appendicitis from Oct 2014 to June 2016 (including sampling procedures, if any).

This study was done from Oct 2014 to June 2016 on 50 patients with clinical diagnosis of acute or

recurrent appendicitis admitted in surgical wards of Krishna Institute of Medical Sciences, Karad. The patients were selected by random sampling technique. All the patients were followed every day in post operative period till they were discharged and then later followed for a period of 4 weeks in and out patients department. The following parameters were observed during follow up in comparison between two procedure with, duration of surgery, post operative pain and duration of analgesics used, post operative complication, hospital stay and return to normal activities.

After analyzing the data using chi-square test and students t test we noticed that, there are significant difference between the two procedure with laparoscopic appendectomy being better in respect to postoperative pain. (LA,  $1.21 \pm 0.63$  Vs. OA,  $2.72 \pm 0.87$ :  $P < 0.001$ ) duration of analgesic used (LA,  $1.21 \pm 0.63$  Vs. OA,  $2.72 \pm 0.87$ :  $P < 0.001$ ) duration of analgesic used (LA,  $2.2 \pm 1.08$  Vs. OA,  $6.44 \pm 1.84$ :  $P < 0.001$ ) postoperative complications like vomiting [LA, 2 (8%) Vs. O.A, 7 (28%), fever [LA, 1 (4%) Vs. OA, 4 (16%), wound infection [LA, 1 (4%) Vs. OA, 5 (20%), ileus (LA,  $17.3 \pm 7.1$  Vs. OA,  $30.8 \pm 8.9$ :  $P < 0.001$ ) postoperative length of hospital stay (LA,  $2.8 \pm 1.23$  Vs. OA,  $7.7 \pm 1.95$ :  $P < 0.001$ ) and return to normal work (LA,  $13.5 \pm 2.86$  Vs. OA,  $20.8 \pm 3.21$ :  $P < 0.01$ ). Although above mentioned advantage were at the cost of slightly increased duration of surgery (LA,  $71.2 \pm 19.23$  Vs. OA,  $53.8 \pm 20.04$ :  $P < 0.01$ ).

We conclude that the laparoscopic appendectomy is better than open method for acute or recurrent appendicitis, with less postoperative pain and reduced duration of analgesic used, with lesser incidences of postoperative complication, shorter duration of hospital stay and early return to normal work with the cost of slight increase in duration of surgery.

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