

# Single Port Laparoscopic Appendicectomy versus Open Appendicectomy in Cases of Appendicitis.

Ashok Kshirsagar<sup>1</sup>, Mayank Vekariya<sup>2</sup>, Vaibhav Gupta<sup>2</sup>, Akshay Pednekar<sup>2</sup>, Ashar Shaikh<sup>2</sup>

<sup>1</sup>Professor, Department of General Surgery, KIMS, Karad

<sup>2</sup>Resident, Department of General Surgery, KIMS, Karad.

## ABSTRACT

**Background:** Appendicectomy is the treatment for appendicitis. A recent development in Appendicectomy has been the introduction of less invasive single incision laparoscopic surgery. There are still many unanswered questions regarding efficiency of this new technique in terms of benefits, cosmetic outcome, complications, etc. To study and compare the outcome, effectiveness and safety of single port laparoscopic Appendicectomy with that of open appendectomy.

**Methods:** This comparative study was carried out to analyze and evaluate the advantages and disadvantages of single port laparoscopic appendicectomy over open appendicectomy. The patient Age, sex, time of surgery, start up time, anesthesia given, Post-operative pain, Period of Nil by Mouth, Hospital stay and Post-operative complications were studied and compared. **Results:** The study of 137 patient revealed Single port laparoscopic appendicectomy better over open appendicectomy in terms of early resumption of oral feeds, shorter duration of stay, early resumption of daily activities and excellent cosmetic results. All these advantages are at a cost of slightly increased duration of surgery, steep learning curve and higher overall cost. **Conclusion:** Going by our study we definitely find an overall advantage of single port laparoscopic appendicectomy over Open appendicectomy.

**Keywords:** Appendicectomy, Laparoscopic, Single port.

## INTRODUCTION

It is a well-known adage that abdomen is a temple of surprises and a magic box as well. The appendix a cul-de-sac is crudely referred as “worm of the bowel” in ancient medical books and also called as “abdominal tonsil”. Acute appendicitis is the most common acute surgical condition of the abdomen.<sup>[1]</sup> Approx 7% of the population will have appendicitis in their life time<sup>[2]</sup>, with the peak incidence occurring between 10 and 30 years.<sup>[3]</sup>

Despite technological advances the diagnosis of appendicitis is still based primarily on the patient's history and the physical examination, prompt diagnosis and surgical referral may reduce the risk of perforation and prevent complications.<sup>[4]</sup>

The treatment is straightforward in most of the cases and depends upon the stage of the disease. In early appendicitis, appendicectomy is the treatment of choice. It can be done by open or laparoscopic approach.

Minimal invasive surgery had a considerable impact on the common surgical techniques and has almost replaced established operative procedures such as cholecystectomy. However, the laparoscopic approach for the treatment of acute appendicitis is still not very popular. The main advantage of the laparoscope in abdominal surgery is related to the avoidance of laparotomy wound.

In cholecystitis, laparoscopic approach has emerged as the clear gold standard, but in appendicectomy different schools of thought exist regarding the method to be followed, since the protocols are still in their nascent state of standardization.

A recent development in appendicectomy has been the introduction of less invasive single incision laparoscopic surgery, using a single multi-luminal port or multiple mono-luminal ports, through a single skin incision.

Here we try to provide an overview of the status of laparoscopic single port surgery for appendicitis and try to document the technique and balance the applications against potential advantages and disadvantages. This article describes a pure single-port appendicectomy.

To study and compare the outcome of single port laparoscopic appendicectomy (LA) with that of open Appendicectomy (OA).

To compare the effectiveness and safety of laparoscopic and conventional open appendicectomy in the treatment of appendicitis.

## MATERIALS AND METHODS

The comparative study was carried out in Krishna Hospital to analyze and evaluate the advantages and disadvantages of single port laparoscopic appendicectomy over open.

### Inclusion Criteria:

In this study all consecutive cases that have undergone appendicectomy irrespective of sex, and admitted in the department of surgery in Krishna Hospital, Karad in a span of period between October 2012 to October 2014 were included.

### Name & Address of Corresponding Author

Dr Mayank Vekariya  
Resident,  
Department of General Surgery,  
KIMS,  
Karad, India.  
E mail: dr.mayankvekariya@ymail.com

Patients who were scheduled for interval appendectomy were also included.

**Exclusion Criteria:**

Patients with appendicular mass, appendicular abscess or generalized peritonitis were excluded from this study.

Patients were evaluated first clinically and were then investigated in the form of routine investigations and specific investigations like plain x-ray abdomen and ultrasonography.

Once the diagnosis was established the patients were posted for either open or laparoscopic appendectomy based on the surgeon's discretion. For open appendectomy grid iron incision was used for all the patients. Patients with paramedian incision were not included in the study.

For Single Incision Laparoscopic appendectomy 10 mm subumbilical incision created threw it 5 mm endoscope and 5 mm working port inserted. For traction of appendix a spinal needle inserted from right iliac fossa and a thread is passed threw it to grasp the appendix so dissection of mesoappendix is easily done. Once the dissection is completed double tie the appendix base with thread and cut in between two ties. Specimen then retrieved in a specimen bag from subumbilical incision.

The patient age, sex, time of surgery, start up time, anesthesia given, postoperative pain, period of NBM, Hospital stay and postoperative complications were studied and compared with the inpatient period. Post-operatively the patient was

followed up after 1 month. In the one-month post-operative follow-up interview, patients were asked about the time to return to work and perception of cosmetic result on a scale of one to five.

**Statistical Analysis:**

Qualitative data were summarized in terms of percentage and quantitative data was summarized through mean values. The standard deviation was also computed to measure the variability.

Results in the two groups were compared using appropriate statistical techniques. The difference in the percentage was statistically assessed using chi-square test/Fischer's exact test. Statistical significance between mean values was analyzed employing t-test (independent). A p-value of <0.05 was considered as statistically significant result.

**RESULTS**

A total of 137 patients have undergone appendectomy in the department of surgery in Krishna hospital from October 2012 to October 2014.

Out of these, 76 patients have undergone open and 61 patients have undergone single port laparoscopic appendectomy.

44.5% of the total numbers of patients undergoing appendectomy were subjected to single port laparoscopic appendectomy whereas 55.5% patients underwent open appendectomy.

**Table 1:** Age distribution in open and laparoscopic appendectomy group

Age group	Open	Laparoscopic	Total	Percentage
10-20	24	17	41	29.9
21-30	34	26	60	43.7
31-40	6	10	16	11.6
41-50	5	4	9	6.5
51-60	3	5	8	5.8
61-70		1	1	0.7
71-80	1		1	0.7
81-90	1		1	0.7
Mean Age	24.3	26.4		

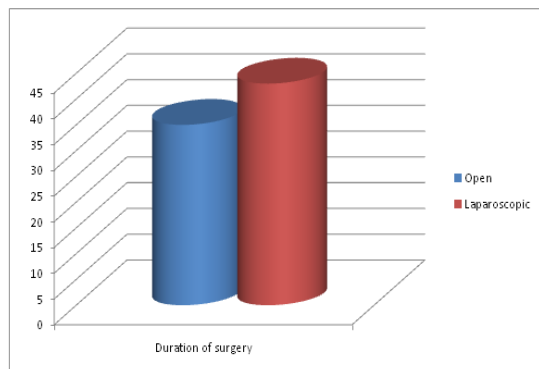
The age range for appendicitis in this study is from 10 to 85 years. The incidence is maximally in the age range of 21-30 years which form 43.7% of the cases in this study. The mean age for single port laparoscopic appendectomy was 26.4 years and

that for open appendectomy was 24.3 years. For both group the maximal age group was 21-30 years. Both groups were similar in age distribution.

**Table 2:** Sex distribution in open and laparoscopic appendectomy group

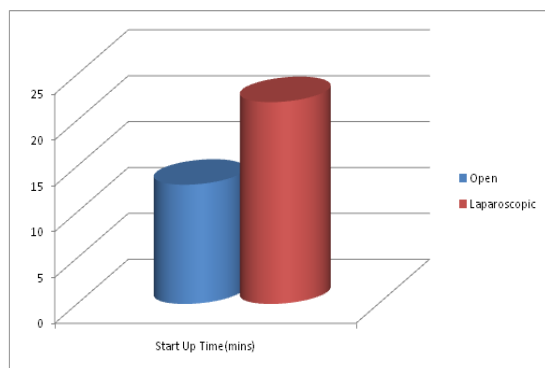
	Open	%	Laparo	%	Total
Male	47	58.75	33	41.25	80
Female	29	50.8	28	49.1	57
Total	76		61		137

Out of the 137 cases undergoing appendectomy, 57 cases were female and 80 cases were male. Thus, the percentage of females undergoing laparoscopic appendectomy was higher.



**Figure 1:** Duration of surgery in open and laparoscopy group

The duration of surgery was calculated from incision to suturing. The average duration of surgery for open appendectomy was 35 minutes and for single port laparoscopic appendectomy was 43 minutes. Thus, the duration of surgery was about 8 minutes longer for laparoscopic as compared to open appendectomy.



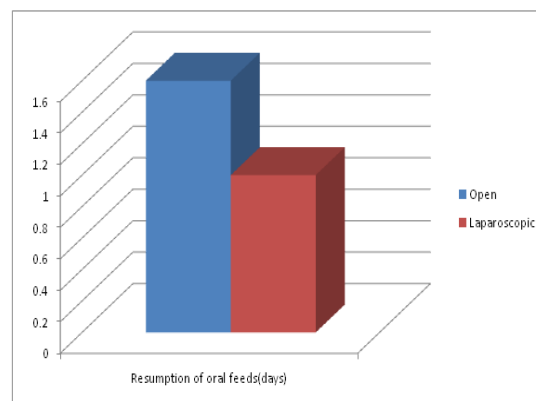
**Figure 2:** Start Up time in open and Laparoscopic group

The start Up Time was calculated from the time when the patient was shifted to operation theatre for surgery up to the time the incision was taken. It included the time required for setup and anesthesia. The average start-up time required for open appendectomy was 13 minutes and that for laparoscopic appendectomy was 22 minutes.

**Table 3:** Type of Anesthesia given in open and Laparoscopic group

	Open	%	Laparo	%	Total
General	20	26.3	61	100	81
Spinal	55	72.3	-	-	55
Epidural	01	1.4	-	-	01

Out of the 137 cases which underwent appendectomy, 81 cases were given general anesthesia, 55 cases were given spinal anesthesia, while one case received epidural anesthesia. All cases underwent single port laparoscopic appendectomy were given general anesthesia. Thus, spinal anesthesia was preferred for open appendectomy while general anesthesia was preferred for patients undergoing laparoscopic appendectomy in our setup.



**Figure 3:** Period of NBM in Open and Laparoscopic group

The period of NBM was calculated from the day of surgery up to the time the patient tolerated oral feeds.

The median duration for resumption of oral feeds was found to be 1.6 days in case of open appendectomy and 1 day in case of laparoscopic appendectomy.

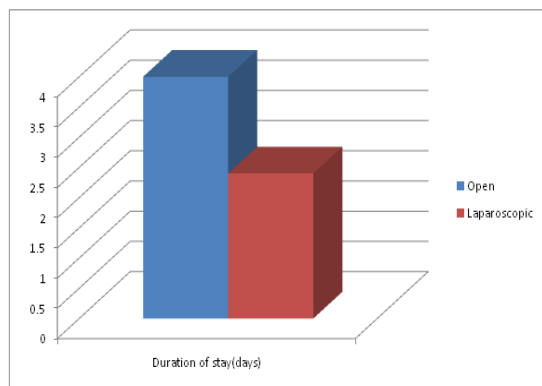
Thus, the resumption of oral feeds was early in laparoscopic appendectomy as compared to open. This difference was statistically significant (P<0.001).

**Table 4:** Post-operative Analgesia used in Open and Laparoscopic group

Analgesic use	Open	Laparoscopic	P value
Parenteral (days)	2+0.7(1 to 4)	2	
Oral(days)	3+0.7(1 to 3)	3	<0.001

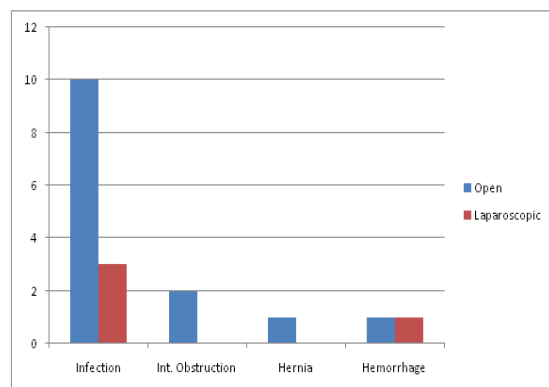
Diclofenac sodium showed significant difference in its usage in both the groups.

Mean usage of parenteral analgesic was 3 days in case of open appendectomy, while it was 2 days in case of laparoscopic appendectomy.



**Figure 4:** Hospital Stay in Open and Laparoscopic group

The average duration of stay was found to be 4 days in case of open appendectomy as compared to 2 days in case of laparoscopic appendectomy. This difference was found to be statistically significant. (P<0.001)



**Figure 5:** Post-operative complications in Open and Laparoscopic group

18% cases which underwent open appendectomy faced complications while only 6.5% of the laparoscopic appendectomy cases faced complications.

Thus, post-operative complications rate was lesser in single port laparoscopic appendectomy as compared to open appendectomy

**Table 5:** Cosmetic Result in Open and Laparoscopic group

Cosmetic Result	Open	Laparoscopic
Unacceptable	3	0
Ok	4	0
Acceptable	20	0
Good	43	6
Excellent	6	55

Patients were questioned about the cosmetic result of the surgery in their one-month follow-up interview. 90.2% of the patients who underwent laparoscopic appendectomy found their cosmetic result excellent as compared to 7.8% patients who underwent open appendectomy.

Thus, statistically significant better cosmetic result was found in laparoscopic appendectomy as compared to open appendectomy.

## DISCUSSION

Appendectomy is the most common abdominal emergency operation in the western world. More and more appendectomies are currently performed laparoscopically due to the fact that the technique offers advantages to patients in terms of more accurate diagnosis, diminished wound infections, and more rapid recovery.<sup>[5]</sup>

The traditional approach to laparoscopic appendectomy employs 3 ports. Over the past decade, successful attempts to perform the procedure with fewer ports have been reported. The medical literature has described 2-port techniques,<sup>[6]</sup> hybrid approaches,<sup>[7,8]</sup> and single-port assisted techniques.<sup>[9-11]</sup>

In the hybrid technique, the appendix is pulled through the umbilicus, and a traditional open appendectomy is then performed extracorporeally.<sup>[12,13]</sup>

The single-port assisted technique is intriguing in that a stitch is placed through the anterior abdominal wall to pull the appendix to the abdominal wall; this creates the tension necessary for performing the appendectomy intracorporeally.<sup>[9,14]</sup>

Minimally invasive surgical approaches have been widely recognized as offering significant advantages, including reduced postoperative pain, a shorter recovery time, and better cosmesis.

Always when a new technique is introduced to the surgical community, the focus should be concentrated on the feasibility, safety, and clinical advantage of the method. Further, safety is highly dependent on how easily the new technique can be learned by average surgeons. It is well acknowledged that the implementation phase of new techniques is associated with an increased risk of complications emphasizing the importance of through training and education.

In our study the mean age for laparoscopic appendectomy (LA) was 26.4 years, that for open appendectomy (OA) was 24.3 years, and the percentage of females undergoing laparoscopic appendectomy was higher. Utpal De et al<sup>[15]</sup> studied that patients who underwent LA were older (LA: 25.1 years, OA: 24.3 years) and more likely male (LA: 61% male, OA: 58.1% male).

In our study, the duration of surgery was about 8 mins longer for laparoscopic as compared to open

appendectomy. In almost all the literature the operating time of laparoscopic appendectomy was found to be more than that of open appendectomy. The difference time of LA also depends on the experience of the surgeon and the competence of their team.<sup>[16]</sup>

A prospective randomized trial comparing LA with OA was conducted in 158 patients by Hansen et al.<sup>[17]</sup> They reported that despite of longer operating time, (63 versus 40 minutes) the advantages of laparoscopy (such as fewer wound infection and earlier return to normal activity) make it a worthwhile alternative for patients with a clinical diagnosis of acute appendicitis.<sup>[18]</sup>

In our study, the average duration of stay was found to be 4 days in case of OA as compared to 2 days in the case of LA. Utpal De et al<sup>[15]</sup> found that the length of hospital stay ranged from 2 days to 9 days. The length of stay was significantly shorter after LA (3 days after LA, 5 days after OA,  $P < 0.0001$ ).

In our study, 18% cases which underwent OA faced complications like wound infections, late intestinal obstruction and injury to other organs. In case of LA the incidence of post operative complications was only 6.5% of the total 61 cases. A meta-analysis of randomized controlled trials has been reported with outcomes of 2877 patients included in 28 trials. Overall complication rates were comparable, but wound infections were definitely reduced after laparoscopy (2.3% to 6.1%).<sup>[17]</sup>

90.2% of the patients who underwent LA found their cosmetic result excellent as compared to 7.8% patients who underwent OA. The scar was found unacceptable in 3.9% patients who underwent OA. These were majorly the patients who suffered from post-operative wound infection.

In their post operative one month follow up interview, patients who had undergone LA were found to have a faster resumption of their normal duties. It has been shown that those patients who underwent successful LA have a better postoperative recovery. The reduced trauma to the abdominal wall is a very significant factor in post-surgical discomfort. The better mobility of the abdominal musculature and the earlier ambulation, reduce the risk of the early post-operative complications of pneumonia and embolism.

A prospective randomized, multi center study was performed to compare the outcome of LA and OA in patients with suspected acute appendicitis by Hellberg A et al.<sup>[19]</sup> Patients having LA recovered more quickly than their open counterpart, but interestingly there was no significant reduction in sick leave after LA may be due to unawareness of general practitioners about the recovery time difference between both the procedures, or patient expectation in terms of time off work.

Studies comparing single-port and conventional laparoscopic techniques have not shown consistent findings. In a study of 688 patients, Liang et al concluded that single-incision laparoscopic appendectomy resulted in rapid recovery, no increase in pain or complications, and a better cosmetic outcome.<sup>[20]</sup> Qiu et al concluded that single-port laparoscopic appendectomy had no benefits over conventional laparoscopic appendectomy.<sup>[21]</sup> Antoniou et al concluded that the two methods showed similar postoperative morbidity and wound infection.<sup>[22]</sup>

## CONCLUSION

Single port laparoscopic appendectomy scores over open appendectomy in terms of early resumption of oral feeds, shorter duration of stay, early resumption of daily activities and excellent cosmetic results. The post operative complication rate is also lesser in laparoscopic appendectomy. All these advantages are at a cost of slightly increased duration of surgery, steep learning curve and higher overall cost.

Going by our study, we definitely find an overall advantage of single port laparoscopic appendectomy. It is a useful method for reducing hospital stay, complications and return to normal activity. With better training in minimal access surgery now available, the time has arrived for it to take its place in the surgeon's repertoire.

## REFERENCES

1. Liu CD, Mcfadden DW. Acute abdomen and appendix, In: Greenfield JJ, et al., eds. Surgery: Scientific Principles and practice. 2nded. Philadelphia: Lippincott-Raven; 1997. 126-1261.
2. Addis DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the United States. *Am J epidemiol*. 1990;132: 910-925.
3. Schwartz SI, Appendix, In: Schwartz SI, ed, Principles of Surgery, 6th ed. New York: McGraw Hill; 1994. 1307-1318.
4. Wilcox RT, Traverso LW. Have the evaluation and treatment of acute appendicitis changed with new technology? *SurgclinNorth Am*. 1997;77:1317-1355.
5. S. Sauerland, R. Lefering and E.A Neugebauer. Laparoscopic versus open surgery for suspected appendicitis. *Cochrane Database of Systematic Reviews* (online), no. 4, article CD001546, 2004.
6. Schier F. Laparoscopic appendectomy with 1.7-mm instruments. *PediatrSurg Int*. 1998;14(1-2):142-3.
7. Fazili FM, Al-Bouq Y, El-Hassan OM, Gaffar HF. Laparoscope-assisted appendectomy in adults: the two-trocar technique. *Ann Saudi Med*. 2006;26(2):100-4.
8. Meyer A, Preuss M, Roesler S, Lainka M, Omlor G. Transumbilical laparoscopic-assisted "one-trocar" appendectomy -- TULAA -- as an alternative operation method in the treatment of appendicitis. *ZentralblChir*. 2004;129(5):391-5.
9. Ates O, Hakgüder G, Olguner M, Akgür FM. Single-port laparoscopic appendectomy conducted intracorporeally with

- the aid of a transabdominal sling suture. *J Pediatr Surg.* 2007;42(6):1071-4.
10. Baik SM, Hong KS, Kim YI. A comparison of transumbilical single-port laparoscopic appendectomy and conventional three-port laparoscopic appendectomy: from the diagnosis to the hospital cost. *J Korean Surg Soc.* 2013;85(2):68-74.
  11. Park J, Kwak H, Kim SG, Lee S. Single-port laparoscopic appendectomy: comparison with conventional laparoscopic appendectomy. *J Laparoendosc Adv Surg Tech A.* 2012;22(2):142-5.
  12. Valla J, Ordorica-Flores RM, Steyaert H, Merrot T, Bartels A, Breaud J. Umbilical one-puncture laparoscopic-assisted appendectomy in children. *Surg Endosc.* 1999;13(1):83-5.
  13. D'Alessio A, Piro E, Tadini B, Beretta F. One-trocar transumbilical laparoscopic-assisted appendectomy in children: our experience. *Eur J Pediatr Surg.* 2002;12(1):24-7.
  14. Carus T. Current advances in single-port laparoscopic surgery. *Langenbecks Arch Surg.* 2013.
  15. De U. Laparoscopic versus open appendectomy: An Indian perspective. *J Min Access Surg.* 2005;1:15-20.
  16. Chung RS, Rowland DY, Li P, Diaz J. A meta analysis of randomized controlled trials of laparoscopic versus conventional appendectomy. *Am J Surg.* 1999;177(3):250-6.
  17. Hansen JB, Smithers BM, Schache D, Wall DR, Miller BJ, Menzies BL. Laparoscopic versus open Appendectomy. *World J Surg* 1996; 20:17-21.
  18. Michael R. Cox, John L. McCall, James Tooli, Robrt T.A. Padbury, Thomas G. Wilson, David A. Wattchow, Mary Langcake. Prospective Randomised Comparison of open versus Laparoscopic appendectomy in Men. *World J. Surg.* 1996;20:263-266.
  19. Hellberg, A., Rudberg, C., Kullman, E et. al. Prospective randomized multicentre study of laparoscopic versus open appendectomy. *Br J Surg,* 1999;86:48-53.
  20. Liang HH, Hung CS, Wang W, Tam KW, Chang CC, Liu HH, et al. Single-incision versus conventional laparoscopic appendectomy in 688 patients: a retrospective comparative analysis. *Can J Surg.* 2014;57(3):E89-97.
  21. Qiu J, Yuan H, Chen S, He Z, Wu H. Single-port laparoscopic appendectomy versus conventional laparoscopic appendectomy: evidence from randomized controlled trials and nonrandomized comparative studies. *Surg Laparosc Endosc Percutan Tech.* 2014;24(1):12-21.
  22. Antoniou SA, Koch OO, Antoniou GA, Lasithiotakis K, Chalkiadakis GE, Pointner R, et al. Meta-analysis of randomized trials on single-incision laparoscopic versus conventional laparoscopic appendectomy. *Am J Surg.* 2014;207(4):613-22.

**How to cite this article:** Kshirsagar A, Vekariya M, Gupta V, Pednekar A, Shaikh A. Single Port Laparoscopic Appendectomy versus Open Appendectomy in Cases of Appendicitis. *Ann. Int. Med. Den. Res.* 2016;2(1):322-27.

**Source of Support:** Nil, **Conflict of Interest:** None declared.