

Comparison of Laparoscopic Approach Over Conventional Appendicectomy in Emergency Uncomplicated Acute Appendicitis

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Abstract

Introduction: Acute appendicitis is one of the most commonly encountered surgical conditions with a lifetime incidence of 7-9%. Early diagnosis with prompt surgery is the preferred treatment option to prevent complications. Conventional appendicectomy has been the gold standard for the treatment of acute appendicitis. The major benefits to patients undergoing laparoscopic appendectomy are early hospital discharge, reduced postoperative pain, decreased wound infection, Early return to full activity and a better cosmetic scar.

Aim: To compare the efficacy of laparoscopic approach over conventional appendicectomy in emergency uncomplicated acute appendicitis.

Material and Methods: The present interventional clinical study was carried out at teaching government hospital during December 2014 to November 2016 and total 178 patients underwent appendicectomy. The study subjects were the patients who have undergone emergency appendicectomy for uncomplicated acute appendicitis, all with modified Alvarado score >7.

Results: Out of total 178 patients 130(73.03%) underwent Conventional Appendicectomy and 42(23.59%) had laparoscopic appendicectomy. The mean duration of surgery was longer in laparoscopic group than conventional group and the difference was statistically significant. Liquid diet and solid

diet were started earlier in laparoscopic group than conventional group. The postoperative pain was less in laparoscopic group as compared to conventional group. In the laparoscopic appendicectomy group, 3(7.14%) patients had wound discharge, 3 patients had burning micturition (7.14%). While in the conventional appendicectomy group, 13(9.55%) patients had wound discharge and wound dehiscence was seen in 5(3.67%) patients. The mean postoperative hospital stay was longer in laparoscopic group than conventional group. The difference was statistically significant. It was found that laparoscopic appendicectomy was costlier than conventional appendicectomy.

Limitation of Our Study: Long-term complications of both laparoscopic and conventional appendicectomy could not be studied.

Conclusion: The present study shows that laparoscopic appendicectomy provides benefits over conventional appendicectomy in terms of a shorter hospital stay, less postoperative pain, earlier resumption of oral feeds and reduced wound infection rate. Although the above-mentioned benefits were at the cost of significantly longer duration of surgery and higher cost associated with laparoscopic approach over conventional appendicectomy also feasibly in teaching government hospital is also a hindering factor.

Keywords: Appendicectomy, Conventional, Laparoscopic, Acute appendicitis.

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Introduction

Acute appendicitis is one of the most commonly encountered surgical conditions with a lifetime

incidence of 7-9%.¹ Early diagnosis with prompt surgery is the preferred treatment option to prevent complications, such as perforation that can lead to an increase in morbidity. The Modified Alvarado scoring system has been shown by recent studies to be easy, simple and cheap diagnostic tool for supporting the diagnosis of acute appendicitis especially for junior surgeons.²

Conventional appendicectomy has been the gold standard for the treatment of acute appendicitis since its introduction by Charles McBurney in 1889 due to its favorable efficacy and safety.³ Laparoscopic appendicectomy was first performed by Semm in 1983.⁴ The major benefits to patients undergoing laparoscopic appendectomy are early hospital discharge, reduced postoperative pain, decreased wound infection, early return to full activity and a better cosmetic scar.⁵ The limitations of laparoscopic appendectomy are technical difficulty, non-availability of equipment and expertise everywhere, longer duration of operation, higher expense and increased incidence of intra-abdominal abscesses⁶ and has not as yet gained widespread acceptance.

The present study is designed to compare the advantages of laparoscopic appendicectomy over conventional appendicectomy in uncomplicated acute appendicitis patients operated on emergency basis in a Teaching government hospital.

Aim

To compare the efficacy of laparoscopic approach over conventional appendicectomy in emergency uncomplicated acute appendicitis.

Objectives

- To study the type of complications related to the type of procedure and anesthesia induced.
- To study the feasibility of laparoscopy approach and the factors related to it.
- To compare cost of both the procedures.

Materials and Methods

The present interventional clinical study was carried out at teaching government hospital in Maharashtra during December 2014 to November 2016. The study subjects were the patients who have undergone emergency appendicectomy for uncomplicated acute appendicitis, all with modified Alvarado score >7.

Source of Data

The patients presenting with features of appendicitis at casualty of department of Surgery, at a district level government hospital in Maharashtra were included in the study. Diagnosis of appendicitis was based on: Detailed clinical history, Clinical findings, Total W.B.C counts, Ultrasonography, Modified Alvarado score was calculated for each patient and only those patients with score greater than 7 were included in this study. Based on all above-mentioned factors, decision was taken whether surgical intervention was needed in a particular patient. Risks, benefits and possible outcomes of each operation were fully explained and written consent was obtained from respective subjects/guardians.

Exclusion Criteria: Patients less than 12 years of age, Patients with history of lump in right iliac fossa, complicated or perforated appendicitis, previous lower abdominal surgery, pregnant females.

Procedure-

Preoperative preparation consisted of

- a. Adequate resuscitation
- b. Nil by mouths,
- c. Preoperative dose of antibiotic (intravenous injection of cefotaxim)
- d. Information about type of anesthesia given was noted – Spinal/general
- e. Complications arising due to anesthesia, if any.

Procedure

- Conventional appendicectomy
 - McBurney's gridiron incision taken on skin
 - External oblique cut, Internal oblique and transverse abdominis split, Peritoneum opened, Caecum with anterior taenia identified. Caecal perforation ruled out, Appendix with mesoappendix identified, After ligation of mesoappendix with silk, base of appendix crushed, clamped, and cut. Base of appendix transfixed using silk 2-o Round body needle. Stump placed back in abdomen. Peritoneum, Internal oblique muscle, external oblique muscle and subcutaneous tissue sutured using a single Vicryl 2-o round body needle. Skin sutured using ethilon 2-o reverse cutting needle.
- Laparoscopic appendicectomy

Pneumoperitoneum created using Veress needle. Port Placement – 10 mm port at umbilicus, 5 mm port in suprapubic area, 5 mm port in right inguinal fossa, Appendix identified, Mesoappendix divided using electro-surgical unit. The base of appendix ligated using endoloop (catgut) and divided and the specimen delivered through the 10 mm port.

- B) Type of anesthesia and anesthesia related complications were noted.
- C) Intra-operative findings were noted:
 - 1) Type of Appendicitis: Catarrhal/Perforated/Gangrenous
 - 2) Operating time from time of skin incision to skin closure
 - 3) Intraoperative Complications: Hemorrhage, Spillage of purulent exudates, Bowel injury, Intraoperative hypothermia, Trocar related complications, CO₂ gas embolism
 - 4) Any other organ pathology was noted

Specimen of appendix from operated cases was subjected for histopathological.

Postoperative management of patients included: Intravenous fluids, Parenteral antibiotics (cefotaxim and metronidazole) for 3 days, Nil by mouth until bowel sounds returned, Analgesics–postoperative pain control for the initial twenty–four hours was achieved with intravenous injection of diclofenac (50 mg). Further analgesic were administered depending on patient’s perception of pain.

- Postoperative pain was assessed using visual analog scale (VAS).

Postoperative complications, if any, were noted.

- Oral feeds were started after appearance of bowel sounds and time taken in hours before initiation of oral feeds (both liquid and solid) was recorded. Patients were discharged from hospital once they were able to tolerate a regular diet, adequate pain relief was present and were fully mobilized.
- Postoperative length of hospital stay was recorded in terms of days since the date of surgery to date of discharge. During follow-up period, complications related to surgery were noted.

Cost Analysis

The total cost of both the procedures was analyzed. We took into account cost of various

drugs required for inducing anesthesia and maintaining it during the whole procedure, cost of CO₂ cylinder required to maintain pneumo-peritoneum during laparoscopic appendicectomy, cost of endoloop and various suture materials used. We excluded cost of human resources involved in the procedure, operation theater charges as well as instrument cost as it is a government hospital.

Statistical Analysis used in the Study

Descriptive statistics, Frequencies, Independent-Samples t test. All the statistical calculations were done through SPSS for windows (version 10.0). p value of <0.05 was considered significant.

Results

Total 178 patients underwent appendicectomy from December 2014 to November 2016.

Table 1: Distribution of patients according to the type of procedure done

Type of Procedure	No. of Patients (%)
Conventional appendicectomy	130(73.03%)
Laparoscopic appendicectomy	42(23.59%)
Laparoscopic to conventional appendicectomy	06(3.37%)
Total	178

Out of Total 178 patients, 130(73.03%) underwent conventional appendicectomy and 42(23.59%) had laparoscopic appendicectomy (Table 1).

Table 2: Operating Time between the Laparoscopic and Conventional Appendicectomy

	Method		t-value	p-value
	Laparoscopy (N = 42) Mean ± SD	Conventional (N = 136) Mean ± SD		
Median operating time (in minutes)	51.90 ± 16.76	44.89 ± 11.60	4.46	p<0.0001 S

The longest duration of surgery in laparoscopic group was 80 minutes and shortest was 40 minutes. The longest duration of surgery in conventional group was 60 minutes and shortest was 25 minutes. The longest duration of surgery in laparoscopic converted to conventional group was 95 minutes and shortest was 80 minutes. Overall, the mean duration of surgery was longer in laparoscopic group than conventional group and the difference was statistically significant (Table 2).

Table 3: Reasons for conversion of Laparoscopic Appendicectomy to Conventional Appendicectomy

Reasons for Conversion of Laparoscopic procedure to Conventional procedure	Number of patients	Percentage
i) Adhesions	03	2.20%
ii) Intraoperative instrument failure	02	1.74%
iii) Presence of Meckel's diverticulum	01	0.74%
Total	06	4.4%

Out of 42(23.59%) Laparoscopic appendicectomy patients, 6(4.41%) patients were converted to conventional approach due to extensive adhesions in 3(2.20%) patients, intra-operative instrument failure in 2(1.47%) patients and presence of Meckel's diverticulum in 1(0.74%) patient (Table 3).

Liquid diet and solid diet were started earlier in Laparoscopic group than Conventional group (Table 4).

Overall, the postoperative pain was less in laparoscopic group as compared to Conventional group and was statistically significant after 48 hours of procedure (Table 5).

In the laparoscopic appendicectomy group, 3(7.14%) patients had wound discharge, 3 patients had burning micturition (7.14%) and wound dehiscence was seen in one patient (2.38%). In the Conventional appendicectomy group, 13(9.55%) patients had wound discharge and wound dehiscence was seen in 5(3.67%) patients. The difference was not statistically significant (Table 6).

The mean postoperative hospital stay was longer in Laparoscopic group than Conventional group. The difference was statistically significant (Table 7).

We can conclude that laparoscopic appendicectomy was costlier than Conventional appendicectomy and the difference was statistically significant (Table 8).

Table 4: Postoperative Convalescence period

	Method		t-value	p-value
	Laparoscopy (N = 42) Mean ± SD	Conventional (N = 136) Mean ± SD		
Resumption of liquid diet following surgery (in hours)	8.30 ± 6.30	10.59 ± 4.33	2.69	p=0.008 S
Resumption of solid diet following surgery (in hours)	16.19 ± 7.70	18.53 ± 5.36	2.23	p=0.026 S

Table 5: Pain assessment by Visual Analog Score

VAS score	Method		t-value	p-value
	Laparoscopy (N = 42)	Conventional (N = 136)		
Pre-operative	7.33 ± 1.09	7.83 ± 0.99	1.14	p=0.125 NS
VAS after 24 hours of surgery	3.19 ± 0.99	4.41 ± 1.23	3.46	p=0.004 S
VAS after 48 hours of surgery	1.67 ± 0.65	3.20 ± 1.19	5.78	p<0.001 S

Table 6: Complications in Postoperative and follow up Period

Complications	Method		p-value
	Laparoscopy (N = 42)	Conventional (N = 136)	
Urinary retention	00	04	p=0.261 NS
Burning micturition	03	00	p=0.003 S
Neurogenic/adhesive ileus	00	03	p=0.489 NS
Wound infection (pus/serous discharge)	3 (Serous d/c- 2 Pus d/c - 1)	13 (Serous d/c- 9 Pus d/c- 4)	p=0.632 NS
Wound dehiscence	1	5	p=0.684 NS
Total (%)	7(16.66%)	25(18.38%)	p=0.174 NS

Table 7: Hospital stay of the Laparoscopic and Conventional Appendicectomy

	Method		t- value	p-value
	Laparoscopy (N = 42) Mean ± SD	Conventional (N = 136) Mean ± SD		
Median postoperative stay (in days)	3.33 ± 1.39	4.65 ± 1.18	6.04	p<0.0001 S

Table 8: Approximate Cost of Laparoscopy and Conventional Appendicectomy

	Method		p-value
	Laparoscopy (N = 42)	Conventional (N = 136)	
Cost of anesthesia	4390	2050	p<0.0001 S
Cost of Suture materials and Endoloop	1140	580	p<0.0001 S
Cost of CO ₂	56	NA	--
Hospital cost	970	1010	p=0.134 NS
Total	6556	3640	p<0.00001 S

Discussion

The present study was done to assess various factors related to use of laparoscopy approach for emergency appendicectomy and to study its efficacy over conventional appendicectomy in a district government hospital. This study took into account various factors which cause hindrance to use of laparoscopy approach in a government hospital during emergency hours for appendicectomy so that an attempt can be made to solve such issues and provide high quality healthcare to patients in government hospital.

Demographic Factors

In the present study, the mean age for laparoscopic appendicectomy group was 30.47 years and for conventional appendicectomy was 29.30 years. The male to female ratio was 1.33 in laparoscopy group and 1.77 in conventional group.

Anesthesia Complications

In the present study, general anesthesia was administered to all patients who underwent laparoscopic appendicectomy and spinal anesthesia to all the patients who underwent conventional appendicectomy (73.04%). Laparoscopic appendicectomy has been routinely performed under general anesthesia with endotracheal intubation despite the several disadvantages of

general anesthesia compared to regional anesthesia, including hemodynamic instability, postoperative nausea and vomiting, increase in the requirement for postoperative analgesia, complications related to intubation or extubation, and a sore throat postoperatively⁸. Various complications that we observed in general anesthesia group were nausea (33.33%), sore throat (22.91%), postoperative headache (20.83%), thrombophlebitis (18.75%), vomiting (12.5%), myalgia (10.41%), oral trauma (8.33%), backache (6.25%), hypotension and bradycardia (4.16%).

Such complications were also observed in the study done by Tennant *et al.*⁹ comparing complication rate between general and spinal anesthesia. Sore throat was the most common complication in laparoscopic group in his study (44%). Another study done by Tiwari *et al.*¹⁰ had nausea and vomiting as most common complication in general anesthesia group (5.26%). Various complications that we observed in Spinal anesthesia group were backache (32.35%), postoperative headache (16.17%), hypotension and bradycardia (11.02%), myalgia (10.29%), nausea (8.82%), vomiting (7.35%) and Thrombophlebitis (9.55%). Such complications were also observed in the study done by Tennant *et al.*¹¹. In a similar study done by Tiwari *et al.*¹⁰, backache was observed only in 1.81% patients and none of the patient in his study had vomiting in spinal anesthesia group, which is in contrast to our study. The overall incidence of post-

dural puncture headache after intentional dural puncture varies from 0.1 to 36%.

Duration of surgery

The mean duration of surgery in the laparoscopic group was 51.90 minutes as compared to 44.89 minutes in the Conventional group, the difference being statistically significant ($p < 0.0001$). The longest duration of surgery in Laparoscopic group was 80 minutes and shortest was 40 minutes. The longest duration of surgery in Conventional group was 60 minutes and shortest was 25 minutes.

Similar observation of laparoscopic appendicectomy taking longer duration has been reported by other studies in Table 9.

This difference in duration is due to the inclusion of additional steps for setup, insufflation, trocar entry under direct vision, diagnostic laparoscopy and expertise¹².

Feasibility of Laparoscopy approach

Laparoscopic procedure was not feasible in 130 cases (73.03%) due to: (i) Unavailability of expertise in 93 patients (71.54%): Laparoscopic approach was not possible in all patients of uncomplicated acute appendicitis mainly because of unavailability of expertise in emergency hours. Various contributory factors for non-feasibility of laparoscopic appendicectomy in emergency hours are: In a busy government hospital like ours, there are number of surgeries posted in emergency operation theater mainly in evening and night hours. Laparoscopy set up takes a lot of time during emergency hours due to less number of nurses and helping staff available. Doing laparoscopic appendicectomy may cause inconvenience to other patients who are on the waiting list of emergency operation theater. During emergency hours, not all nursing staff posted in emergency operation theatre are well oriented with the use of laparoscopy instruments and its cleaning. ii) Due to technical problems in 37 patients (28.46%): Laparoscopic appendicectomy was not feasible in 29 patients due to various technical problems mentioned

below: CO₂ insufflators leakage in 12 patients (8.82%), Non-functioning of Electrosurgical unit in 11 patients (8.08%), Non-functioning of light source in 8 patients (5.88%), Instrument failure in 6 patients (4.41%), in a government hospital where the present study was conducted, it took 8 months for repair of various non-functioning instruments.

Intraoperative complications

There was one intra-operative complications observed during laparoscopic procedure. One patient had serious CO₂ gas embolism requiring intensive care management. Patient had a long hospital stay compared to others in laparoscopy group but she recovered well. A study done by Geetha *et al.*¹³, it was found that 2 patients out of 86 patients who underwent laparoscopic appendicectomy had injury to the bowel. In a study done by Kathkouda *et al.*¹⁶, four major complications in the laparoscopic group required a reoperation: 3 postoperative bleedings from an injury to the inferior epigastric artery from the left lower quadrant trocar and the other from the appendiceal artery.

Pain assessment by Visual analog scale

Pain assessment made by Visual Analog score was Laparoscopy 3.19 vs Conventional 4.41 after 24 hours of surgery ($p < 0.004$) and Laparoscopy 1.67 vs Conventional 3.20 ($p < 0.001$) after 48 hours of surgery. Both these results are statistically significant. These results are comparable with most of the studies performed earlier^{9,13,15} where postoperative visual analog score was higher in conventional group when compared with laparoscopic group after 48 hours of surgery. We can conclude that Laparoscopic appendicectomy is less painful compared to Conventional appendicectomy.

Postoperative Complications

Postoperative complications in the form of wound infection (serous/pus discharge) was seen in 3 patients (7.14%) in the laparoscopic group as

Table 9: Duration of surgery - references.

	Basant Kumar <i>et al.</i> ¹²	Geetha K.R. <i>et al.</i> ¹³	Azaro <i>et al.</i> ¹⁴	Shirazi <i>et al.</i> ¹⁵	Katkouda <i>et al.</i> ¹⁶	Present study
Conventional (operative time in minutes)	30(20-70)	58.29	59(15-180)	39.6	60(45-75)	44.89
Laparoscopic (operative time in minutes)	55(25-95)	74.13	84.4(20-220)	51.8	80(60-105)	51.90

compared to 13(9.55%) in the conventional group, which is not statistically significant ($p = 0.632$). Our results are in contrast with other studies where higher wound infection rate in the Conventional group has been observed^{14,17}. Wound Dehiscence was present in 1 patient (2.38%) in laparoscopic group as compared to 5 patients (3.67%) in conventional group. Other postoperative complication noted was urinary retention in 4 patients (2.94%) of conventional group. As we catheterize all patients posted undergoing laparoscopic appendicectomy, incidence of burning micturition was higher in laparoscopy group (7.14%).

Postoperative Convalescence period

During the postoperative period, liquid feeds were resumed after surgery on an average of 8.30 hours in the laparoscopic group compared to 10.59 hours in the conventional group ($p < 0.008$). Similar results have been observed by previous studies^{13,15}.

Postoperative Hospital stay

In the present study the average duration of postoperative hospital stay was 2.88 days in the laparoscopic group as compared to 4.65 days in the Conventional group, the difference being statistically significant ($p < 0.0001$). Other studies (Table 10) have also reported longer postoperative hospital stay following Conventional appendicectomy in comparison to laparoscopic appendicectomy.^{12,13}

Table 10: Postoperative Hospital stay - references

	Postoperative hospital stay (in days)	
	Laparoscopy	Conventional
Geetha <i>et al.</i> ¹³	3.13	4.36
Basant Kumar <i>et al.</i> ¹²	1.4	3.5

Cost-effectiveness

The Laparoscopy approach was found to be costlier than conventional appendicectomy approach. Similar result was found in a study conducted by Cothren *et al.*¹⁸ who concluded that unless patient factors warrant a laparoscopic approach (questionable diagnosis, obesity), open appendicectomy remains the most costeffective procedure in a teaching environment.

However, another study done by Shah *et al.*¹⁹ argues that though cost of conventional appendicectomy is less than laparoscopic

appendicectomy but high direct cost associated with laparoscopy approach is compensated by reduction in Length of Postoperative hospital stay and decreased indirect cost in laparoscopy approach (Earlier return to daily activity, Less wound infection rate).

Limitation of Our Study

Long term complications of both Laparoscopic and Conventional Appendicectomy could not be studied.

Conclusion

The present study shows that laparoscopic appendicectomy provides benefits over conventional appendicectomy in terms of a shorter hospital stay, less postoperative pain, earlier resumption of oral feeds and reduced wound infection rate. Although the above-mentioned benefits were at the cost of significantly longer duration of surgery and higher cost associated with laparoscopic approach over conventional appendicectomy also feasibly in teaching government hospital is also a hindering factor.

References

1. Addis DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the United States. *Am J Epidemiol.* 1990;132:910-25.
2. McBurney C. An incision is made in the abdominal wall in cases of appendicitis, with a description of a new method of operating. *Ann Surg* 1894;20:38-43.
3. Semm K. Endoscopic appendectomy. *Endoscopy.* 1983;15(2):59-64.
4. Aziz MI, van der Burg BL, Hamming JF. Laparoscopic versus open appendectomy in children: a meta-analysis. *Ann Surg.* 2006;243:17-27.
5. Chiarugi M, Bucciatti P, Celona G, Decanini Mastino Mc, Goletti O, Cavina E. Laparoscopic compared with open appendicectomy for acute appendicitis: A Prospective study. *Eur J Surg* 1996;162:385-90.
6. Martin JV, Memon AM. The justification for laparoscopic appendicectomy. *Rev Esp Enferm Dig.* 1999;91:447-55.
7. Emmanuel S Kanumba, Joseph B Mabula, Peter Rambau, Phillip L Chaly. Modified Alvarado scoring system as a diagnostic tool for acute appendicitis at Bugando Medical Centre, Mwanza, Tanzania. *BMC Surgery.* 2011:4.
8. Go-WoonJun, Min-Su Kim, Hun-Ju Yang, Tae-Yun Sung, Dong-Ho Park, Choon-Kyu Cho

- et al.* Laparoscopic appendectomy under spinal anesthesia with dexmedetomidine infusion. Korean J Anesthesiol 2014 Oct;67(4):246-251.
9. Basavaprabhu Achappa, *et al.* Comparative Study of Laparoscopic Appendectomy and Open Appendectomy. International Journal of Anatomy Radiology and Surgery. 2012 June;1(1):12-16.
 10. Tiwari S, Chauhan A, Chaterjee P, *et al.* Laparoscopic cholecystectomy under spinal anaesthesia: A Prospective, Randomized study. J Minim Access Surg. 2013 Apr-Jun;9(2):65-71.
 11. Ingrid T, Richard A, Annette CS, *et al.* Minor postoperative complications related to anesthesia in elective gynecological and orthopedic surgical patients at a teaching Hospital in Kingston, Jamaica. Rev. Bras. Anesthesiol. 2012 Mar-Apr; 62(2).
 12. Basant K, Abdul Sd, Tariq WK, *et al.* Superiority of laparoscopic appendectomy over open appendectomy: The Hyderabad Experience. Rawal Medical Journal 2008;2008:165-68.
 13. Geetha KR, Annappa K, Bhavatej. Laparoscopic appendectomy versus open appendectomy: A comparative study of clinical outcome and cost analysis – Institutional experience. Indian J Surg May-June 2009;71:142-46.
 14. Euler M. Azaro. Laparoscopic versus Open Appendectomy: A Comparative Study. JSLS. 1999;3:279-283.
 15. Bushra S, Naureen A, Muhammad SS. Laproscopic versus open appendectomy: A Comparative study. JPMA. 2010;60:901-4..
 16. Namir K. Laparoscopic versus open appendectomy. Ann Surg. 2005 Sep;242(3):439-450.
 17. Yarram R, Gaddam V, Thokala S. Open and Laparoscopic Appendectomy: A Comparative Study. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS). 2015 May;14(5):36-40.
 18. Cothren C, Moore E, Johnson J, *et al.* Can we afford to do laparoscopic appendectomy in an academic hospital? Am J Surg. 2005;190:973-77.
 19. Shah B, Vaidhya N, Anchalia MM. A Comparative Study between laparoscopic appendectomy and small incision open (Minilap) appendectomy in cases of acute appendicitis. International Journal of Science and Research (IJSR). 2013 Nov;2(11):144-50..

