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Dr. Naveen Kushwah
Assistant Professor,
Department Of Surgery,
Gajraraja Medical College
Gwalior Mp

Dr. Reeta Kushwah
Demonstrator, Department Of
Anatomy, Gajraraja Medical
College Gwalior Mp

A comparative study between laparoscopic appendectomy and conventional open appendectomy

Naveen Kushwah, Reeta Kushwah

Abstract

Aims And Objectives -compare the outcome of laparoscopic and open appendectomy, in terms of Operating time. Intra operative and post operative complication. Hospital stay. Cost effectiveness.

Material And Methods -This prospective comparative study was performed in JA Groups of Hospital and Gajra Raja Medical College Gwalior (M.P.), from November 2012 to November 2013. The merits and drawbacks of LA and OA were explained to all of the patients who suffered an attack of acute appendicitis. Patients who gave their informed consent were randomized to either LA or OA groups. 50 patients were included in this study. Our study plan was approved by ethical committee of our institution.

Results- The study included 32 patients in open appendectomy group and 18 patients in laparoscopic appendectomy group. The two groups were similar to each other in terms of their age and sex characteristic.

The mean operation time was 60.8 and 45.7 min. respectively for the laparoscopic and open approach. There was significantly different between the two groups. Conversion rate of laparoscopic appendectomy to open procedure was 17%. 3 cases each were converted to open appendectomy. Laparoscopic appendectomy was associated with less post operative pain with comparable complication rates. Duration of stay in the hospital was significantly less with the Laparoscopic procedure. The time of return to normal activity and work was significantly more for open approach as compared to the laparoscopic approach, the mean being 10.9 days for open appendectomy and 9.6 days for laparoscopic appendectomy. Laparoscopic appendectomy is thus a safe, simple and efficient technique for treatment of appendicitis in experienced hands. Cases with gangrenous appendicitis and chronic inflammation with fibrosis were the most difficult to complete laparoscopically. Laparoscopic approach enables appendectomy to be performed in 83% of cases with lesser morbidity and an earlier return to the normal activity and work. More benefit is to be obtained from the laparoscopic approach in cases of milder appendicitis and where the diagnosis is uncertain.

Conclusion -we conclude that LA is a considerably better procedure as compared to OL, the advantages of LA being as follows-Less operating time, Less post operative pain, Less hospital stay, Earlier return to normal activity, Better cosmetic acceptability of scar, Diagnosis of other abdominal pathology

Keywords: Appendicitis, Open Appendectomy, Laparoscopic Appendectomy.

1. Introduction

Appendicitis is an inflammation of the vermiform appendix. It is mostly caused by obstruction of the lumen due to hyperplasia of the lymphoid follicles at younger age or by obstruction of the lumen by fecaliths in older patients^[1]. The vermiform appendix was first described by Leonardo da Vinci in 1492. Lawson Tait performed the first planned appendectomy for appendicitis in 1880^[2]. Hereafter, immediate surgery for appendicitis was recommended in 1886 by Reginald Fitz^[3]. Appendectomy was further popularised by Charles McBurney who introduced, in 1889, a new operating technique by performing appendectomy with the use of a less invasive muscle splitting incision and by describing in 1894 the McBurney point, localized "between an inch and a half and two inches from the anterior spinous process of the ileum on a straight line drawn from that process to the umbilicus"^[4, 5]. At present time, appendectomy is the most common abdominal operation because of their lately high lifetime risk of men (8.6%) and women (6.7%) for developing appendicitis^[6]. The diagnosis appendicitis remains difficult and is usually made by clinical history (pain localized around the umbilicus moving toward the right lower abdominal

Correspondence

Dr. Naveen Kushwah
Assistant Professor,
Department Of Surgery,
Gajraraja Medical College
Gwalior Mp

quadrant, anorexia and nausea), physical examination (mildly elevated temperature, diminished bowel sounds with direct tenderness and spasm in the right lower abdominal quadrant and rebound tenderness at Mc Burney's point) in combination with laboratory findings (elevated White Cell Count (WCC) and C-reactive protein (CRP) levels). Especially in fertile women the diagnosis can be difficult because several gynecological diseases can mimic appendicitis. Based on these clinical criteria are 15 to 30 percent normal appendices removed at open operation [7]. The removal of a normal appendix should be avoided because it has its own morbidity and costs. On the other hand, a delayed appendectomy due to a missed diagnosis may lead to a perforated appendicitis and so to severe complications as peritonitis and infertility in females. Nowadays, laparoscopic surgery has dramatically changed the field of surgery. With improvements in the equipment and increasing clinical experience it is now possible to perform almost any kind of procedure under laparoscopic visualization. Although several meta-analyses showed advantages of laparoscopic appendectomy (less post-operative pain and shorter hospital stay) compared to appendectomy by muscle splitting incision, laparoscopic appendectomy is not yet the gold standard for appendectomy.

Aims and Objectives-To compare the outcome of laparoscopic and open appendectomy, in terms of operating time. Intra operative and post operative complication. Hospital stay. Cost effectiveness.

Material and Methods-This prospective comparative study was performed in JA Groups of Hospital and Gajra Raja Medical College Gwalior (M.P.), from November 2012 to November 2013. The merits and drawbacks of LA and OA were explained to all of the patients who suffered an attack of acute appendicitis. Patients who gave their informed consent were randomized to either LA or OA groups. 50 patients were included in this study. Our study plan was approved by ethical committee of our institution.

Patient Selection

Inclusion criteria-All patients of age 15 yrs or more and both sexes who suffered an attack of acute appendicitis and in whom it was clinically decided to do an interval appendectomy Such patients were divided into two groups for laparoscopic and open procedure.

Exclusion criteria

Presence of generalized peritonitis. Patients having a palpable mass in RLQ or suggesting appendiceal abscess, Pregnancy. Previous abdominal surgery. Presence of any cardiac or pulmonary disorder that would affect the overall prognosis of the patient. Any known coagulation disorder. When imaging technique such as ultrasound, imaging studies and CT scan (in some cases) revealed some non-appendicular pathology, the patients were excluded. All patients were evaluated in detail, including history and clinical examination to assess for other differential diagnosis. In female patients. menstrual history and gynecological problems were given special emphasis.

Laboratory Investigations-All patients were subjected to an array of laboratory investigations which included: Complete blood count, Random blood sugar, Blood urea, Serum electrolytes, Routine urine examination, Chest x-ray, E.C.G

Definition of Acute Appendicitis

Alvarado appendicitis score was used to define the presence of acute appendicitis in each particular case.

| Criteria | Points |
|---|--------|
| 1. Symptoms | |
| Migration of pain to right lower quadrant | 1 |
| Anorexia or acetone in urine | 1 |
| Nausea/ vomiting | 1 |
| Fever | 1 |
| 2. Signs | |
| Right lower quadrant tenderness | 2 |
| Rebound pain | 1 |
| 3. Investigations | |
| Total leucocyte count >10,000 | 2 |
| Left shift (>75% neutrophils) | 1 |

Management Recommendation

| Score | Interpretation | Recommendation |
|---------|----------------------------|--|
| Under 5 | Appendicitis less likely | Look for other pathology |
| 5-6 | Possible appendicitis | Observe for 12 hrs. with antibiotics cover |
| 7-8 | Probably appendicitis | Treat as appendicitis |
| Over 8 | Very probable appendicitis | Treat as appendicitis |

Once the decision, to treat the patient as a case of acute appendicitis was taken, requirement of appendectomy as an elective or emergency procedure was taken based on criteria already defined above. The nature of the procedure and possible complications were explained to the patients and consent was taken for laparoscopic/open appendectomy, as also for general/spinal anesthesia.

Perioperative Methodology-All patients were given triple antibiotics as available in our hospital i.v. as one dose preop and 3 doses as postop prophylaxis. Patients with appendicular perforation, pus in peritoneal cavity or wound infection received additional doses of antibiotics based on individual case requirements. The type of anesthesia to be used was decided by anesthesiologists while the need for conversion of laparoscopic to open appendectomy was decided by the operating surgeon on the basis of local case findings. Most cases of open appendectomy were performed under spinal anesthesia while all cases of laparoscopic appendectomy were performed under general anesthesia. A foley's catheter was inserted in all cases of laparoscopic appendectomy prior to the port placement to decompress the urinary bladder. Operating time was considered as the time from the point of making an incision to the time of closure of wound. Standard analgesia was prescribed to all patients as Inj. Diclofenac 75 mg i.m. 8 hourly for three doses and thereafter on demand. No patient shall be given top-up epidural analgesia for pain relief. A visual analogue scale (a 10 cm horizontal line without gradations) to be filled by the patient 24 hours after the surgery was used to indicate the general level of pain and nausea (separate scores) during the previous 24 hours. Pain reading was taken after 6 hours of the last analgesic dose. Resumption of diet was taken as the ability to tolerate oral fluid intake. A wound complication meant redness or discharge from wound site. The wounds were checked after 48 hours for the presence of any infection and the necessary measures taken such as drainage of

subcutaneous abscess or stitch removal for stitch abscess. They were advised regarding dressing of the wound accordingly. Suture removal was done after one week in all patients who has no wound infection. Patients in each group were given the same set of instructions to return to normal activity and to work as soon as possible. Patient was discharged from the hospital when he/she tolerated oral meals, was ambulating well, and was afebrile. Duration of hospital stay was considered as the number of days after surgery (day 0 being the day of operation) spent in the ward. Return to normal activity was taken as the ability to pursue daily activity at the same level of intensity, duration and frequency as in the preoperative period. The patients were finally assessed regarding the relief of symptoms with which he/she presented. The data were recorded on the proforma.

Open appendectomy-All cases were done using a standard Mc Burney (oblique) or Rocky Davis (transverse) right lower quadrant muscle-splitting incision. The incision was centered over the point of maximal tenderness or a palpable mass. The appendix was identified and mesoappendix divided, taking care to ligate the appendiceal artery securely. All standard septic precautions were taken during, before and after the surgery. Wound was closed in all cases. The terminal ileum, other assessable viscera i.e. ovaries and fallopian tube in females were looked out for any alternative or co-existing pathology.

Laparoscopic appendectomy -A Foley's catheter was placed in all cases prior to port placement to decompress the urinary bladder. Two ports, each of 10 mm through umbilical and suprapubic position and third port of 5 mm through the left lower quadrant was used. The camera is inserted through the suprapubic port. A window was created in appendicular mesentery and appendicular artery controlled with metal clips. The appendix was removed through the umbilical port. All accessible pelvic and abdominal viscera were visualized to look for alternative or co-existing pathology.

Biopsy -All operative pathological specimens were sent for biopsy examination. The severity of appendicitis and periappendicitis was noted in all cases.

Follow up

First visit (at 1 week): For assessment of wound and removal of stitches. Patient were asked about any other complaints and these were dealt with accordingly. Inquiries were also made about return to normal activities and similar set of instructions given to all patients for return to work.

Second visit (at 2 weeks): If needed, for any wound complication or else.

Third visit (at 3 month): All relevant data were procured from the patients.

Observation

The present study included 50 cases of 15 -55 years age which were studied prospectively under the following groups:

- Laparoscopic appendectomy - 18 cases
- Open appendectomy - 32 cases

Table 1: Age distribution

| S. No. | Age yrs | LA (n=18) | OA (n=32) |
|--------|---------|-----------|-----------|
| 1. | 15-20 | 05 | 09 |
| 2. | 21-30 | 07 | 14 |
| 3. | 31-40 | 05 | 06 |
| 4. | 41-50 | 01 | 00 |
| 5. | 51-55 | 00 | 03 |
| | Total | 18 | 32 |

X²=3.96,t test =0.03, P value = 0.411

Most of the patients were <30 years of age at presentation. The mean age was 27.4 and 27.5 years in the laparoscopic and open group respectively, with the range of 17 to 45 in the laparoscopic group and 15 to 55 years in the open group. P value = 0.411, There is no significance difference in Age group

Table 2: Sex distribution

| S. No. | Sex | LA (n=18) | OA(n=32) |
|--------|--------|-----------|----------|
| 1. | Male | 11 | 21 |
| 2. | Female | 07 | 11 |
| | Total | 18 | 32 |

X²=0.10, P value =0.749

11 Male and 07 Female out of 18 in LA and 21 Male and 11 Female out of 32 in OA.

Table 3: Operating time

| S. No. | Operation time (min) | LA(n=15) | | OA(n=32) | |
|---------------------|----------------------|----------|------|----------|-------|
| | | n | % | n | % |
| 1. | 21-40 | 00 | 00% | 14 | 43.8% |
| 2. | 41-60 | 9 | 60% | 13 | 40.6% |
| 3. | 61-80 | 03 | 20% | 03 | 09.4% |
| 4. | 81-100 | 03 | 20% | 02 | 6.2% |
| 5. | 101-120 | 0 | 0% | 0 | 00% |
| 6. | >120 | 0 | 0% | 0 | 00% |
| | Total | 15 | 100% | 32 | 100% |
| Mean Operating Time | | 60.8 | | 45.7 | |

X²=10.10, t test =15.10, P value <0.017

The average operating time was more in the laparoscopic appendectomy as compared to the time taken in performing open appendectomy. It is to be noted that the cases of laparoscopic appendectomy which were subsequently converted to open surgery [3 cases in our study] were also usually the ones which took longer time, though not vice-versa. These cases would not be considered for further calculations and comparison analysis. P value <0.017 there is significance difference in operating time.

Table 4: Conversion Rate

| LA | No. of cases | Percent |
|-----------|--------------|---------|
| Completed | 15 | 83% |
| Converted | 3 | 17% |
| Total | 18 | 100 |

Three patients (17%) out of the Eighteen considered for laparoscopic appendectomy had to be converted to open surgery. Cause of conversion was:

1. Retrocecal densely adherent appendix making dissection difficult in two cases.

2. Grossly gangrenous appendix with edematous mesentery, getting torn with manipulation leading to bleeding.
3. Unsure anatomy due to adhesions.

The cases which were converted would not be considered for subsequently analysis. It appears that the more difficult cases in terms of severity of appendicitis or subsequent adhesions are the ones most unlikely to be completed with the laparoscopic approach. P value <0.004, there is significance difference in conversion rate.

Post operative pain -All patients were given three doses of Inj. Diclofenac 75mg i.m. in the post operative period. A visual analogue scale filled by the patient indicating the level of pain on a graded scale of 0 to 10 was used. The reading was taken after 24 hours of surgery and 6 hours of the last analgesic dose.

Table 5: Post operative pain

| S. No. | VAS* (Pain) | LA(n=15) | | OA(n=32) | |
|--------|-------------|----------|-------|----------|------|
| | | N | % | n | % |
| 1. | 0-2 | 7 | 46.66 | 4 | 12.5 |
| 2. | 3-4 | 4 | 26.67 | 08 | 25 |
| 3. | 5-6 | 3 | 20 | 16 | 50 |
| 4. | 7-8 | 1 | 6.67 | 03 | 9.3 |
| 5. | 9-10 | 0 | 0 | 01 | 3.2 |
| | Total | 15 | 100 | 32 | 100 |

$\chi^2 = 7.94, t \text{ test} = 2.63, P \text{ value} < 0.093$

*** VAS -Visual analogue score.**

Mean pain score for appendectomy was 3.2 and 4.8 for the laparoscopic and open approach respectively. Thus, post operative pain is on an average more intense after open appendectomy.

Table 6: Post operative complications

| S. No. | Complications | LA (n=15) | | OA (n=32) | |
|--------|-----------------|-----------|------|-----------|------|
| | | n | % | N | % |
| 1. | Wound infection | 2 | 13.4 | 3 | 9.4 |
| 2. | Fever | 0 | 00 | 2 | 6.3 |
| 3. | Loose stools | 0 | 00 | 0 | 0 |
| 4. | Mortality | 0 | 00 | 0 | 0 |
| 5. | No complication | 13 | 86.6 | 27 | 84.3 |
| | Total | 15 | 100 | 32 | 100 |

$\chi^2 = 1.09, P \text{ value} < 0.57$

Overall, there was no significant difference in the incidence of complications between the open and laparoscopic groups. 2 out of 15 (13.4%) patients had complications in the laparoscopic group while 5 out of 32 (15.7%) had complications in the open appendectomy group. Wound infection was seen in 2 (13.4%) cases of laparoscopic appendectomy and 3 (9.4%) cases of open appendectomy.

Table 7: Post operative Hospital Stay

| S. No. | Stay (hours) | LA(n=15) | | OA(n=32) | |
|--------|--------------|----------|-------|----------|-------|
| | | n | % | n | % |
| 1. | 21-40 | 8 | 53.3% | 8 | 25% |
| 2. | 41-60 | 6 | 40% | 12 | 37.5% |
| 3. | 61-80 | 1 | 6.7% | 10 | 31.3% |
| 4. | 81-100 | 0 | 0% | 1 | 3.1% |
| 5. | >100 | 0 | 0% | 1 | 3.1% |
| | Total | 15 | 100% | 32 | 100% |

$\chi^2 = 6.00, t \text{ test} = 2.31, P \text{ value} < 0.025$

Mean post-op stay in the hospital in the laparoscopic and open groups was 41.5 and 55.5 hours respectively.

Table 8: Return to Normal Activity.

| S. No. | Return to activity (days) | LA(n=15) | | OA(n=32) | |
|--------|---------------------------|----------|------|----------|------|
| | | n | % | N | % |
| 1. | 7-8 | 7 | 46.7 | 1 | 3.2 |
| 2. | 9-10 | 4 | 26.7 | 14 | 43.7 |
| 3. | 11-12 | 3 | 20 | 11 | 34.4 |
| 4. | 13-14 | 1 | 6.6 | 6 | 18.7 |
| 5. | 15-16 | 0 | 0 | 0 | 0 |
| | Total | 15 | 100 | 32 | 100 |
| | Mean | 9.6 | | 10.9 | |

$\chi^2 = 13.86, P \text{ value} < 0.003$

Mean number of days for return to normal activity was significantly higher in open appendectomy group as compared to the laparoscopic appendectomy groups. P value < 0.003, there is significance difference in between two group.

Relief of symptoms

Table 9: Relief of symptoms

| Symptom relief | LA(n=15) | | OA(n=32) | |
|----------------|----------|-----|----------|-----|
| | No. | % | No. | % |
| Yes | 12 | 80 | 25 | 75 |
| No | 3 | 20 | 8 | 25 |
| Total | 15 | 100 | 32 | 100 |

80% and 75% patients in laparoscopic and open appendectomy respectively had complete relief of symptoms. There was no significant difference.

Diagnosis of additional pathologies

Table 10: Diagnosis of Other Intra Abdominal Condition

| | LA =18 | OA =32 |
|--|--------|--------|
| Number of cases with additional findings | 2 | 0 |

Thus, no additional findings were detected in open appendectomy. Whereas, PID was diagnosed in one case. The evidence of a stricture in the ileum was found in one case of LA.

Table 11: Subjective cosmesis

| Symptom relief | LA(n=15) | | OA(n=32) | |
|-----------------|----------|------|----------|------|
| | No. | % | No. | % |
| Does not matter | 1 | 6.6 | 3 | 9.3 |
| Not satisfied | 1 | 6.6 | 16 | 50 |
| Satisfied | 13 | 86.8 | 13 | 40.7 |
| Total | 15 | 100 | 32 | 100 |

$\chi^2 = 0.10, P \text{ value} < 0.009$

Thus, a very high number of patients were not satisfied with scar they got after open appendectomy. In contrast maximum patients of the LA group were satisfied with their post operative scars. There was a statistically significant difference between the two groups in this aspect. P value < 0.009

Discussion

laparoscopic and open appendectomy have been compared several times, since the introduction of minimally invasive

technique as a diagnostic as well as a therapeutic measure, in an effort to establish the supremacy of one above the other. While the case has been strong enough for laparoscopic cholecystectomy as the preferred method of treatment for symptomatic gall stone disease, it has not been the same for laparoscopic appendectomy. Our study compared a total of 50 cases (32 open appendectomies and 18 laparoscopic appendectomies) to evaluate the safety and efficacy of the laparoscopic appendectomy and to evaluate our results in comparison with those of other reported series.

Laparoscopy for diagnosis. The very definition of 'Acute appendicitis' and an objective evaluation of the 'severity of acute appendicitis' is highly variable in the several reports that were studied. At least 11 scores^[8] have been proposed to help the clinician to decide whether the patient has appendicitis and if appendicitis is severe. Several scores have been applied with some success allowing a reduction in the negative laparotomy rate. We used the Alvarado scale of appendicitis to define the presence of acute appendicitis in each case. This result is comparable to the one shown by Majekwski *et al*^[9] according to which non-therapeutic laparotomy was avoided by laparoscopy in 2% of cases. In this context, laparoscopy gains an upper hand over open appendectomy and should be recommended. However, laparoscopy cannot reduce the diagnostic uncertainty while avoiding general anesthesia and risk associated with the laparoscopic procedures. In this view, and with regard to cost effectiveness, more benefits are to be expected from non-invasive diagnostic tool such as sonography^[10]. Although, we did not encounter any mishaps with the laparoscopic procedure there is no reason to believe that they cannot happen. In our view, laparoscopy should be offered only when the decision to intervene surgically has already been taken.

Laparoscopy for Treatment

Duration of Operation-The definitions of operating times in the various randomized controlled trials done so far have been highly variable. Minne^[11] didn't count the time necessary for setting up the laparoscopic equipment. Kum *et al*^[12] and Williams *et al*^[13] mentioned the exact duration from incision to dressing. Apart from this, most studies show a significantly longer operation time for laparoscopic appendectomy. In our study duration of operation was defined as the time taken from the moment of making an incision to the time of last stitch to close the incision. The time difference that may arise from the difference between times taken for induction of anesthesia, set up of laparoscopic instruments and Foley's catheterization (for laparoscopic appendectomy) and regional anesthesia (for open appendectomy) was not considered. This time difference, however, does not have any bearing, if only the actual time difference taken for surgical procedure is to be considered. We demonstrated a range of 45 min. to 145 min. with mean time being 60.8 min for laparoscopic appendectomies which were completed successfully and 25 min. to 90 min. with mean of 45.7 min for open appendectomy, with a mean time difference of 15.1 min between the two procedures, laparoscopic appendectomy being relatively more time consuming. Statistical analysis shows the P value <0.001 thus the difference being significant. However, this excludes the laparoscopic cases where the operating time was long but ultimately the procedure was converted to open surgery. In such cases

attempt at laparoscopy has actually increased the operation time considerably. In present study the mean operating time was 60.8/45.7 min. for laparoscopic/open appendectomy, in comparison to various studies under review where the mean operating time varied from 102/81.7 to 43/40 min^[14].

Postoperative Pain -Use of visual analogue scores as end points to study the pain is ethically criticizable. However the patient himself is the best judge for the degree of his pain, with the extreme points of 0 and 10 being fixed as no pain and pain which the patients had at the start of his or her treatment. The difference in the degree of pain between laparoscopy and open procedure was significant in our study. Thus, post-operative pain is on an average more intense after open appendectomy. In present study mean pain score for appendectomy was 3.2 and 4.8 for the laparoscopic and open approach respectively. Thus, post operative pain is on an average more intense after open appendectomy. But on statistical analysis the P value is equal to 0.093 thus suggesting a non significant association, this finding may be due to small sample size and the subjective nature of the VAS.

Hospital stay-Minne *et al* reported a median hospital stay of LA 1.1 vs OA 1.2 days^[11] compared with means of 5.3 vs 7.6 days for Hebebrand *et al* in Germany^[15] and 5.3 vs 49 for Mutter *et al* in France^[16]. This underscores that this parameter may be affected by hospital^[17] or cultural^[18] biases rather than reflecting differences due to the technique itself. Interestingly, Lejus *et al* showed significant differences in the postoperative course concerning pain, analgesic requirements and time to normal walking when abscessed vs non-abscessed appendices were analyzed independent of the technique^[19]. This signifies that the post-operative pain, time to return to normal activity and the hospital stay may all be related to the severity of appendicitis along with the type of method used for appendectomy. The similar fact has been highlighted by our study where operating time and hospital stay, for cases with severe acute gangrenous appendicitis or for interval cases with adhesions due to severe appendicitis attack at the onset, were much longer than usual cases. In our study, difference in the postoperative stay in the hospital was 14 hours between the laparoscopic and open appendectomy groups, open appendectomy patients on an average taking more time than laparoscopic group. The range of postoperative stay in the hospital was 24 to 55 hours for the laparoscopic group. On the other hand, the range of postoperative stay in the hospital for the open appendectomy group was 24 to 130 hours.

Complications-We found no significant difference in the post operative complications between the two procedures. Fever occurred in 2 patient of interval open appendectomy group. We encountered wound infection in 2 cases of laparoscopic and 3 cases of open appendectomy group. Overall, there was no significant difference in the incidence of complications between the open and laparoscopic groups. 2 out of 15 (13.4%) patients had complications in the laparoscopic group while 5 out of 32 (15.7%) had complications in the open appendectomy group. Wound infection was seen in 2 (13.4%) cases of laparoscopic appendectomy and 3 (9.4%) cases of open appendectomy. The P value was 0.57 thus showing the difference in complications in OA and LA being non significant.

Return To The Full Activity Or Work -This parameter depends much more on country's culture and reimbursement systems [20] than any other thing. A study of open hernia repair has shown that return to work depends on complementary insurance than any other variables [10]. In our study, data for this purpose was available for 100% of studied subjects showing a significant difference between the two group. The mean time to return to normal activity was 9.6 and 10.9 days in the laparoscopic and open appendectomy groups respectively. This difference can be beneficial in financial terms for the patients as well as the country. Our results demonstrate a significantly earlier return to full activity for laparoscopic than with open appendectomy. P value<0.003, there is significance difference in between two group thus showing the difference to be statistically significant meaning the patients undergoing LA returned to the normal activity earlier than those undergoing OA.

Conversion Rate-One concern about any laparoscopic surgical procedure is the need to convert it into an open procedure. Out of 18 cases of laparoscopic appendectomy, in 3 patients the procedure had to be converted to open operation. Causes of conversion were:

1. Retrocecal densely adherent appendix making dissection difficult in two cases.
2. Grossly gangrenous appendix with edematous mesentery, getting torn with manipulation leading to bleeding.
3. Unsure anatomy due to adhesions.

The cases which were converted were not considered for subsequent analysis. It appears that the difficult cases are the ones with severe appendicitis or subsequent adhesions. In the study conducted by Hellberg, Rudberg, Enochsson *et al* [21] led to the conclusion that the most common cause of conversion from laparoscopy to open was difficult anatomy. Three patients (17%) out of the 18 considered for laparoscopic appendectomy had to be converted to open surgery.

Diagnosis of Additional Pathologies; Laparoscopy helps in detection of other abdominal pathologies also. This is of importance in patients who do not have definite history of appendicitis in the past. The incision in right iliac fossa is excellent for appendectomy; but does not allow the surgeon to view the peritoneal cavity. In our study, 1 case was found to have ileal stricture and procedure was converted to open and PID was diagnosed in one case. These cases reinforce the use of laparoscopy as an investigational tool. Considering these cases the diagnostic capability of laparoscopic procedure assumes special significance, as no additional findings were detected in open appendectomy.

Cosmesis -Laparoscopic appendectomy in general had better cosmetic results both subjectively and objectively. The post operative scars are small and hide easily as compared to a relatively longer scar in the right iliac fossa after open appendectomy. In present study a very high number of patients were not satisfied with scar they got after open appendectomy. In contrast maximum patients of the LA group were satisfied with their post operative scars. There was a statistically significant difference between the two groups in this aspect.(p<0.009).

Conclusions

We conducted a prospective study on fifty patients of appendicitis within affixed protocol. The purpose of the study was to assess and compare the role of laparoscopic appendectomy and traditional open appendectomy. Thus we conclude that LA is a considerably better procedure as compared to OL, the advantages of LA being as follows

- Less operating time
- Less post operative pain
- Less hospital stay
- Earlier return to normal activity
- Better cosmetic acceptability of scar
- Diagnosis of other abdominal pathology

The power of study was low as the sample size was small, therefore we recommend a study with a larger sample size to validate the results of our study in order to establish laparoscopic appendectomy as a gold standard procedure.

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