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RESEARCH ARTICLE

OUTCOMES OF LAPAROSCOPY IN COMPLICATED APPENDICITIS AND CHANCES OF CONVERSION TO OPEN APPENDICECTOMY

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Abstract

Laparoscopic appendectomy (LA) was performed mostly on uncomplicated appendicitis due to opinions about its safety when it was first introduced. Nevertheless, there are still concerns about surgical difficulties in managing complicated appendicitis with laparoscopy, possible post-op complications and conversion to an open appendectomy (OA) during the surgery.

Aims and Objectives: To study outcomes of laparoscopy in complicated appendicitis and chances of conversion to open appendicectomy.

Methods: The study consists of 50 patients who underwent laparoscopic appendectomy in department of General Surgery at Navodaya Medical College hospital and research center, Raichur.. The study population was enrolled after fulfilling the selection criteria from department of General Surgery. Informed consent was taken from all the patients who are involved in this study. Patients diagnosis was based on clinical findings, complete blood counts, abdominal sonography and CT in selected cases.

Result: Fifty patients underwent laparoscopic appendectomy for complicated appendicitis. Of the 50 patients, perforated appendix cases are 31, gangrenous appendix are 15, acute appendicitis with abscess were 4 cases.Three patients were converted to open appendicectomy. Post operation wound infection, conversion rate and hospital stay rate are very less.

Conclusions: The present study proved that laparoscopic appendectomy is the best approach in complicated appendicitis. Most cases of complicated appendicitis can be treated laparoscopically. Laparoscopic appendicectomy is a useful method for reducing hospital stay, post operativepain,complications and return to normal activity.

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Introduction:-

- Appendicitis is the one of the most commonest abdominal surgicalemergency with in the world which can cause complications like appendicular abscess or mass, gangrene, perforation and peritonitis.

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- About seven percentage of the residents developed appendicitis in their lifetime, with highest occurrence amid the ages of 10 and 30 years, thus building appendicectomy the mainly often executed abdominal operation.
- Complicated appendicitis has been associated with a important danger of postoperative septic difficulties, with wound infections and intra-abdominal abscess formation.[1]
- The possibility and strength of the laparoscopic approach has reason important argument mostly owing to premature information of the augmented occurrence of intra-abdominal abscess rates, on the other hand, quite a few further fresh trials have establish a statistically significant lessening in premature postoperative complications with the laparoscopic approach to the end that it has really been future as the technique of option for complicated appendicitis.
- Better access and good visualisation of the peritoneal cavity through small incisions give LA advantage when comparedwith OA.
- Accordingly, complicated appendicitis is better managed by LA. OA for complicated appendicitis, compared with that for uncomplicated appendicitis, requires a larger abdominal incision and longeroperating time, giving more surgical stress to the patients. Moreover, as the wound is exposed to contaminated fluid for longer time which may result in an increased rate of wound infections. Hence, it is logical that LA could have advantages over OA in patients with complicated appendicitis, because LA is associated with less wound surface area exposed to contamination and potentially facilitates direct visualisation during peritoneal lavage.
- Laparoscopic appendicectomy may need to be converted to open appendicectomy sometimes if intra operative complications or severity of the disease hinders with a safe laparoscopic intervention. This might be in the form of abnormal position of appendix, adhesions due to previous inflammations, appendix mass/ abscess, perforated appendix and diffuse peritonitis, other pelvic or right iliac fossa pathologies or technical problems like lack of space for dissection.
- Even though these pathologies can be dealt with minimal access surgery, conversion to open surgery may become mandatory in a small number of cases.

Laparoscopic Versus Open Appendectomy

- The debate about the choice of open versus laparoscopic appendectomy for the treatment of appendicitis was historically a major point of controversy among surgeons. Although no level I data exist to support one approach over another, a study published in 2010 examined this issue in detail.
- Ingraham and colleagues[36]analyzed results from 222 hospitals comparing laparoscopic versus open appendectomy using the American College of Surgeons National Surgical Quality Improvement Program.
- In all, 24,969 laparoscopic and 7714 open procedures were included in the analysis. Although the data were limited by the retrospective nature, the investigators observed that laparoscopic appendectomy was associated with lower risk of wound complications and deep surgical site infection in uncomplicated appendicitis.
- In complicated appendicitis, laparoscopic appendectomy was associated with fewer wound complications but a slightly higher incidence of intraabdominal abscess. The overall conclusion, however, was that the laparoscopic approach was associated with an overall lower incidence of complications than the open procedure.
- The conclusions evident from a number of studies indicate that both approaches are acceptable and that the advantages with laparoscopy, although small, were a lower overall morbidity, reduced wound complications, reduced postoperative pain, and perhaps a slightly shorter recovery time.
- The slightly higher risk of intraabdominal abscess formation after laparoscopic appendectomy in cases of complicated appendicitis was a negative aspect of laparoscopic appendectomy, although the authors acknowledged that this has not been observed in all studies.In fact, literature published since the Ingraham study suggest equal or even lower rates of intraabdominal abscess with the laparoscopic approach.
- We prefer the laparoscopic approach for several reasons. Laparoscopy allows examination of the entire peritoneal space, making it exceptionally useful to exclude other intraabdominal disease that may be manifested in a similar fashion, such as diverticulitis or tubo-ovarian abscess, whereas visualization of these structures would not be possible through a right lower quadrant incision. We f ind it to be technically simpler in most patients, particularly the obese, and have been impressed with our ability to discharge patients within several hours of the operation.

Laparoscopic Appendectomy In Complicated Appendicitis.

- Due to the risk of intra-abdominal abscess formation there is a strong controversy among surgeons regarding the use of the laparoscopic procedure in complicated appendicitis (gangrenous or perforated).

- There are several reports which state that if gangrene or perforation is found at the time of laparoscopic appendectomy than the procedure should be converted.
- In contrast, there is a group of laparoscopic surgeons, who are now gaining confidence in handling complicated cases of appendicitis. AamnaNazir after a prospective randomized study by randomly allotting the laparoscopic or the open appendectomy technique to 130 patients of complicated appendicitis by the lottery method concluded that, In comparing the mean operating time in both groups, the mean operating time for the laparoscopic surgery group was 46.98 ± 2.99 minutes, which was significantly shorter than the 53.02 ± 2.88 minutes from the open surgery group ($p<0.000$). The mean length of hospitalization was 4.38 ± 1.09 days in laparoscopic surgery and 4.18 ± 0.77 days in the open surgery group ($p=0.23$). Seven port sites (10.77%) in the laparoscopic group and 18 (27.69%) in the open surgery group were infected ($p= 0.01$).
- Some believe that even if the patient presents with fresh lower abdominal early peritonitis or even if there is chance of fresh abscess formation, laparoscopic appendectomy is not only justifiable but also even recommended as the procedure of choice. In generalised peritonitis laparoscopic usually is not advocated.

Methodology:-

Method Of Collection Of Data:

All patients who were admitted to Navodaya Hospital with the diagnosis of acute appendicitis between September 2019to August 2021 were evaluated. All patients suspected to have complicated appendicitis were subjected to clinical examination and imaging that includes ultrasonography in all cases computed tomography in selected cases. All the patients were subjected to laparoscopic appendectomy. The patients confirmedto have complicated appendicitis by the following features.

1.Clinical Examination:

History of acute onset of right lower abdominal pain, vomiting, nausea andFever.
Abdominal examination reveals the presence of a tenderness in theright iliac fossa, or generalized guarding and rigidity.

2.Ultrasound Findings Of Perforated Appendicitis:

Perivesical mass with no bowel peristalsis, associated with pericecal or perivesical free fluidor an echogenic fluid collection.

An appendix measuring more than 6mm in its greatest diameter,bowel loops thickened with reduced peristalsis, anappendicolith, interloop fluid collections, fluid collections in thesub hepatic or sub diaphragmatic spaces or diffuse collections.

3.Computerised Tomographic Findings Of Perforatedappendicitis

Fat streaking,an appendix more than 7 mm in diameter and focal caecal apical thickening, appendiocliths, abscesses, an arrowhead sign, pockets of fluid in the pericecal area, pelvis etc.

Periappendiceal fluid or air is also indicative of appendicitis and suggests perforation.

4) White Blood Cell Count:

If white blood cell count exceeds 15,000 cells /uL, the patient is very muchlikely to have a perforation.

Procedure Done:

Laparoscopic Appendectomy – This procedure is done under general anesthesia (GA) ; port placement consists of a 5 mm – 10 mm port in the umbilicus as an optic port, two 5 mm working ports, one in the left lower abdomen and the other in the right lower abdomen. Presence of gangrenous / perforated appendix, appendicular mass / abscess, localized or generalized peritionitis are documented. Appendectomy is done followed by a thorough peritoneal levage with warm saline. Perioperative & postoperative antibiotics are administered for a period of 5-7 days depending on the severity of the disease process.

All procedures were done by consultants (2 in number) with me being an assistant.

Follow Up
Patients were followed up with respective to Postoperative analgesic requirement, duration of antibiotic administration, complications if any, such as port site infection, persistent fever, prolonged paralytic ileus, development of adhesive obstruction, postoperative intraabdominal abscesses are documented. Thepatients would be followed up till suture removal.

Ultrasound would be done for patients in suspected cases to look for intraabdominal collection.

Inclusion Criteria:
- ✓ Patients in the age group 10-50 years
- ✓ All cases of complicated appendicitis

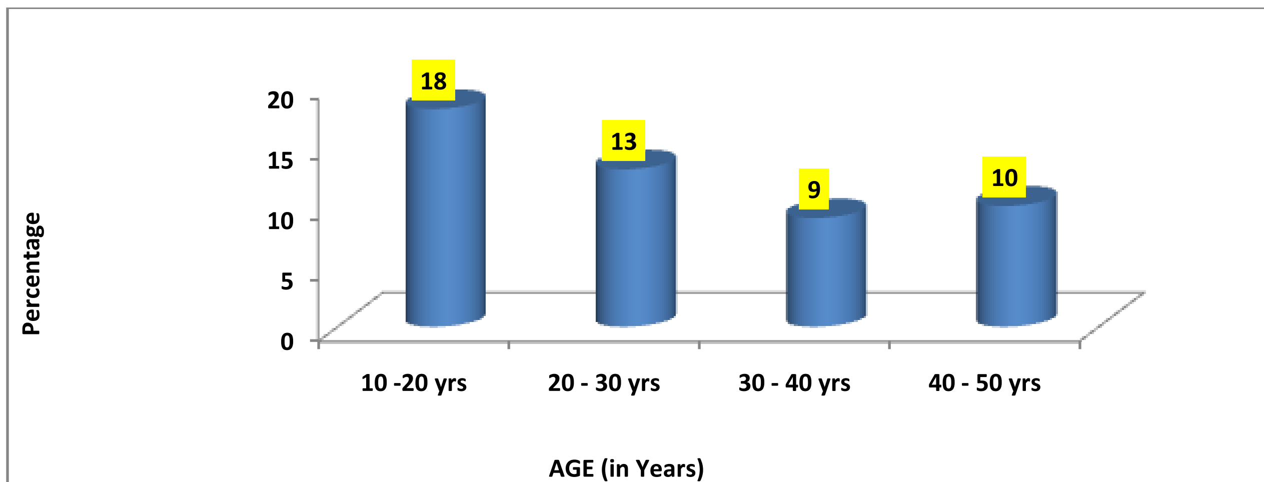
Exclusion Criteria:
- ✓ Non complicated acute appendicitis
- ✓ Gross peritonitis with tense abdomen, patients with low cardiopulmonary reserve where creating a pneumoperitoneum would be a risk
- ✓ Moribund patients who would be a risk for laparoscopic surgery
- ✓ Previous abdominal surgeries with significant adhesions

Results:-

Study Design:
- A prospective study with 50 patients is undertaken to study theoutcome of laparoscopic appendectomy in complicatedappendicitis.
- In our study, patients were included based on the inclusion and exclusion criteria .
- All patients underwent laparoscopic procedure.
- Procedure was done by consultants (2) with me being an assistant.
- Patients were chosen between the age group of 10-50years..
- 62% of patients were between the age group of 10-30 years.

Statistical Analysis
Table No 2:-Age Distribution.

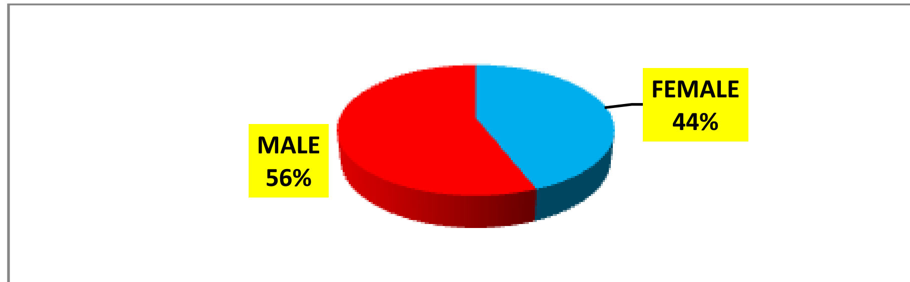
AGE (In Years)	NO. OF CASES	PERCENTAGE
10 -20 yrs	18	36
20 - 30 yrs	13	26
30 - 40 yrs	9	18
40 - 50 yrs	10	20
TOTAL	50	100



In our study 56% were males and 44% were females as shown in table 3.

Table No 3:-Genderdistribution Of Patients Studied.

SEX	NO. OF CASES	PERCENTAGE
FEMALE	22	44
MALE	28	56
TOTAL	50	100

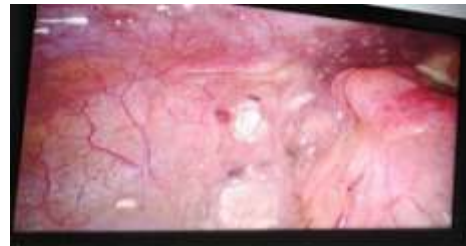


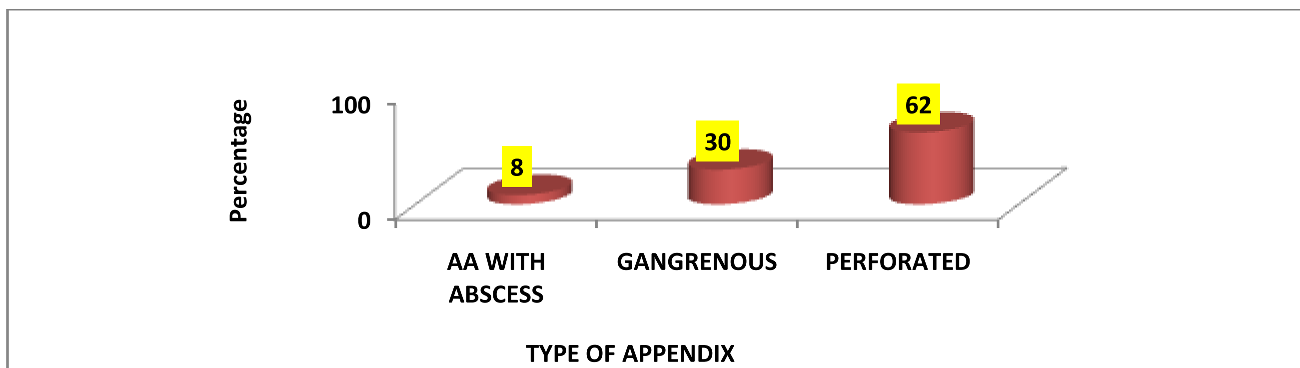
Gender

Patients only with complicated appendicitis were included in our study of which 62% were perforated appendix,30% were gangrenous and 8% were acute appendicitis with abscess.

Table No 4:-Type Of Appendix Of Patients Studied.

TYPE OF APPENDIX	NO. OF CASES	PERCENTAGE
AA WITH ABSCESS	4	8
GANGRENOUS	15	30
PERFORATED	31	62
TOTAL	50	100

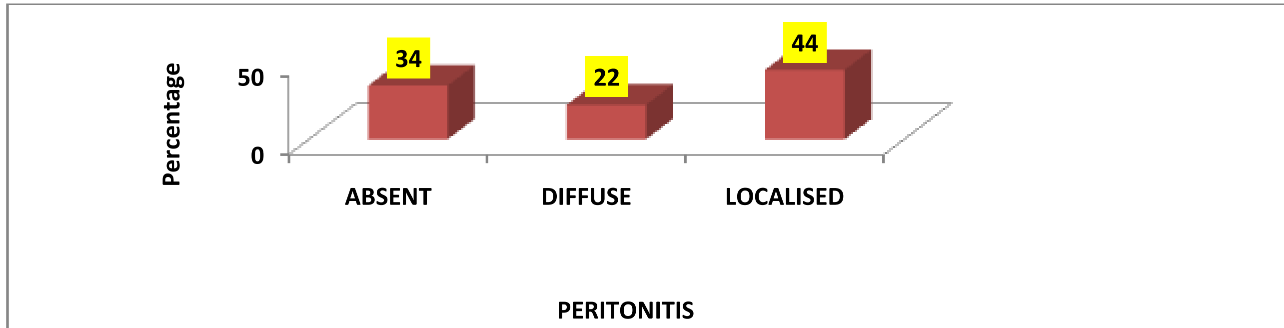




Of these complicated cases 44% had evidence of localized collection at surgery whereas 22% had diffuse collection and 34% percent had no collection.

Table No 5:- Type Of Peritonitis.

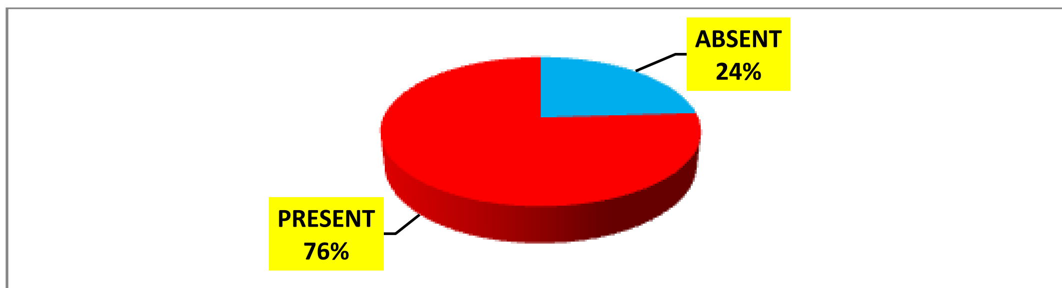
PERITONITIS	NO. OF CASES	PERCENTAGE
ABSENT	17	34
DIFFUSE	11	22
LOCALISED	22	44
TOTAL	50	100



76% of patients presented with complaints of fever and 24% had no history of fever.

Table 6:- Elevated Temperature.

ELEVATED TEMPERATURE	NO. OF CASES	PERCENTAGE
ABSENT	12	24
PRESENT	38	76
TOTAL	50	100

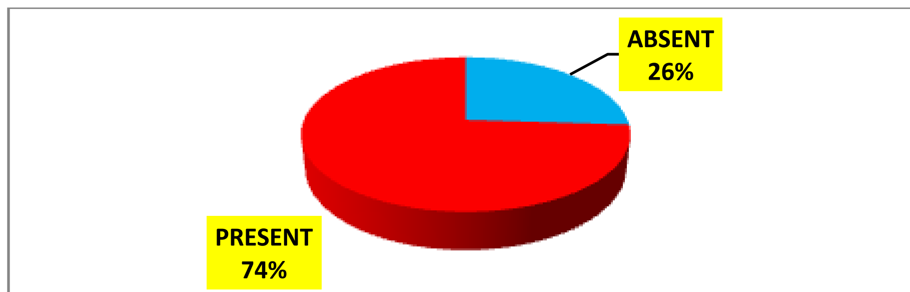


Elevated Temperature

74% of the patients presented with complaints of nausea/vomiting.

Table 7:- Nausea/ Vomiting.

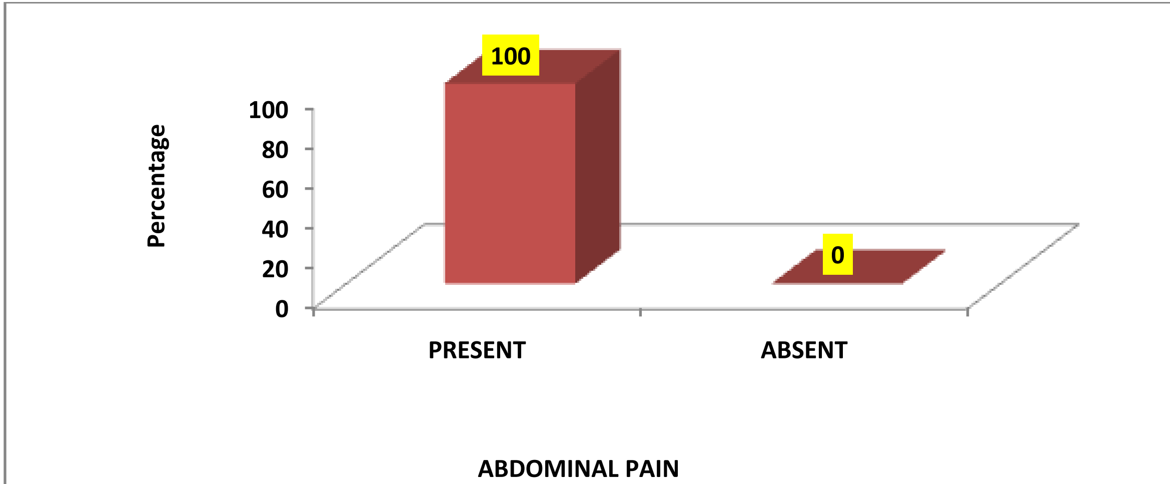
NAUSEA/ VOMITING	NO. OF CASES	PERCENTAGE
ABSENT	13	26
PRESENT	37	74
TOTAL	50	100



Nausea/ Vomiting
All patients presented with complaints of pain abdomen.

Table 8:- Pain Abdomen.

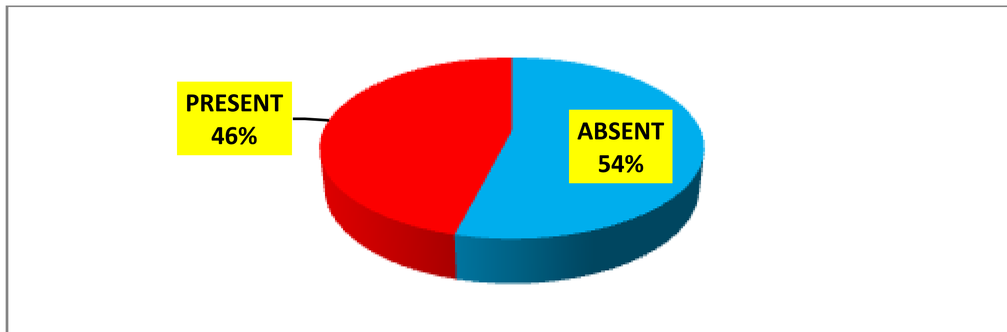
ABDOMINAL PAIN	NO. OF CASES	PERCENTAGE
PRESENT	50	100
ABSENT	0	0
TOTAL	50	100



46% of the complicated appendicitis patients presented with Guarding or rigidity where 54% had no evidence of guarding or rigidity.

Table 9:-Guarding / Rigidity.

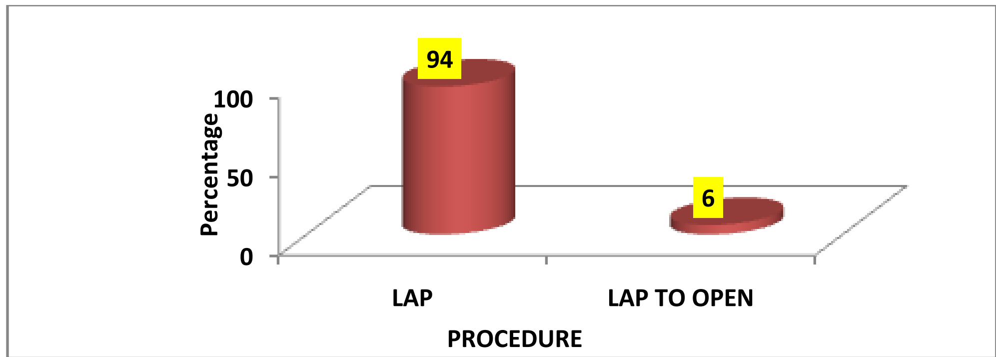
GUARDING/ RIGIDITY	NO. OF CASES	PERCENTAGE
ABSENT	27	54
PRESENT	23	46
TOTAL	50	100



Guarding / Rigidity
All 50 complicated appendicitis patients were subjected to laparoscopic appendicectomy initially and 3 were converted to open appendicectomy.

Table 10:- Procedure Done.

PROCEDURE	NO. OF CASES	PERCENTAGE
LAP	47	94
LAP TO OPEN	3	6
TOTAL	50	100



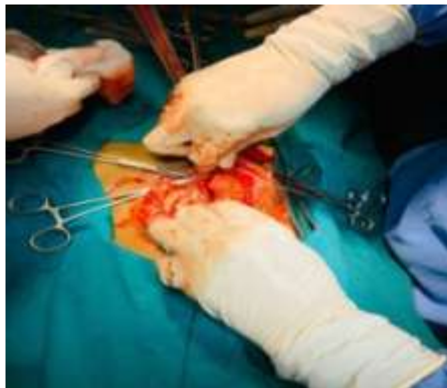
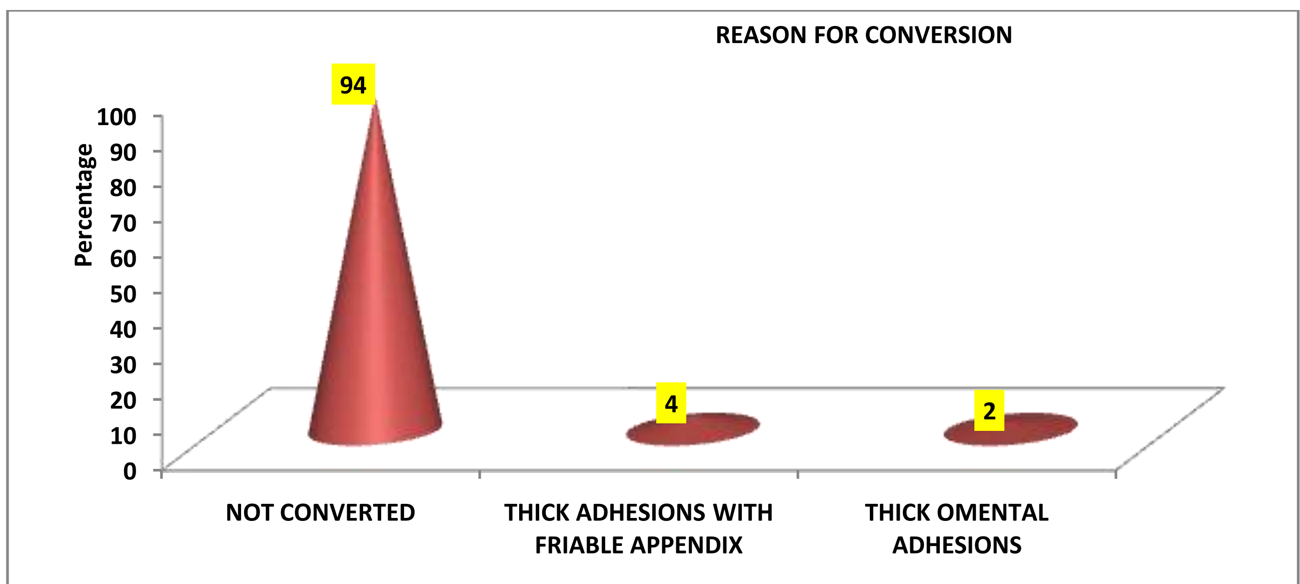


Fig No 34:-Converted Appendicectomy (Lap To Open).

The reasons for conversion are mentioned in table no 11.

Table 11:- Reasons For Conversion.

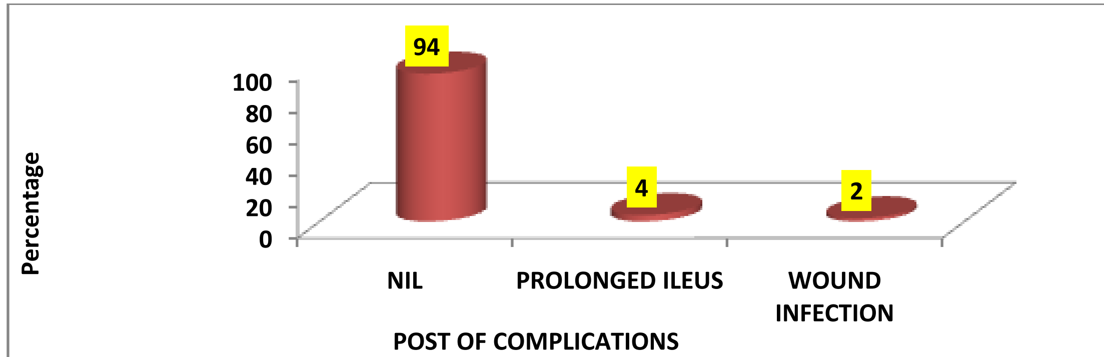
REASON FOR CONVERSION	NO. OF CASES	PERCENTAGE
NOT CONVERTED	47	94
THICK ADHESIONS WITH FRIABLE APPENDIX	2	4
THICK OMENTAL ADHESIONS	1	2
TOTAL	50	100



Post operatively 4% of patients had prolonged ileus and 2% had wound infection.

Table 12:- Post Op Complications.

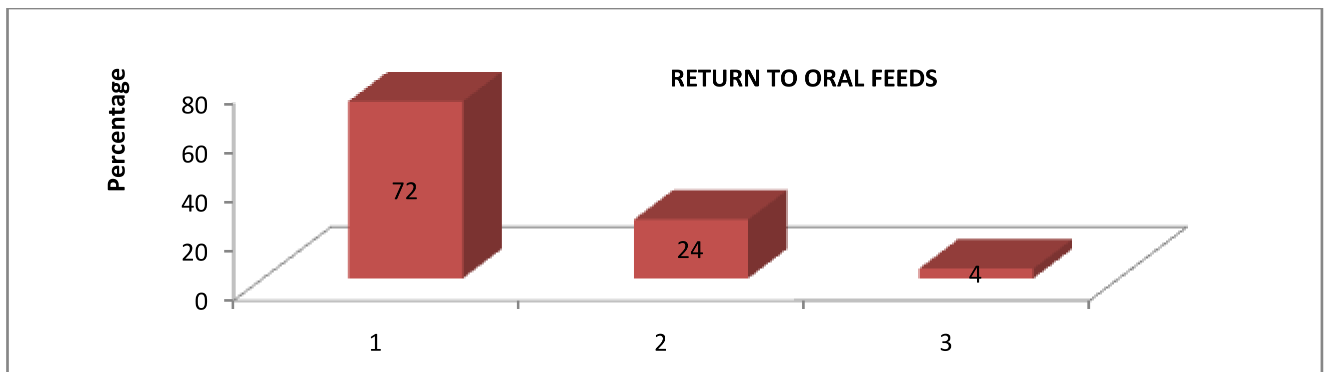
POST OF COMPLICATIONS	NO. OF CASES	PERCENTAGE
NIL	47	94
PROLONGED ILEUS	2	4
WOUND INFECTION	1	2
TOTAL	50	100



Oral feeds were started on post opday 1 in 72% of cases where as 24% of patients were started feeds on post op day 2. 4% of patients were started on oral feeds on post op day 3.

Table 13:- Return To Oral Feeds.

RETURN TO ORAL FEEDS	NO. OF CASES	PERCENTAGE
1	36	72
2	12	24
3	2	4
TOTAL	50	100



94% of patients were discharged within 4 days and 6% patients were discharged after 6-8 days.

Table 14:- Hospital Stay.

HOSPITAL STAY	NO. OF CASES	PERCENTAGE
2	1	2
3	35	70
4	11	22
6	1	2
7	1	2
8	1	2
TOTAL	50	100

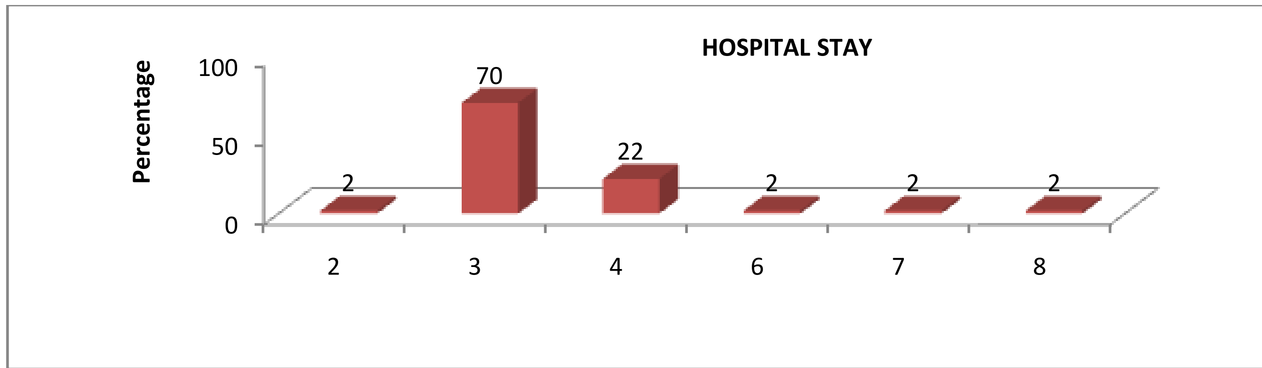
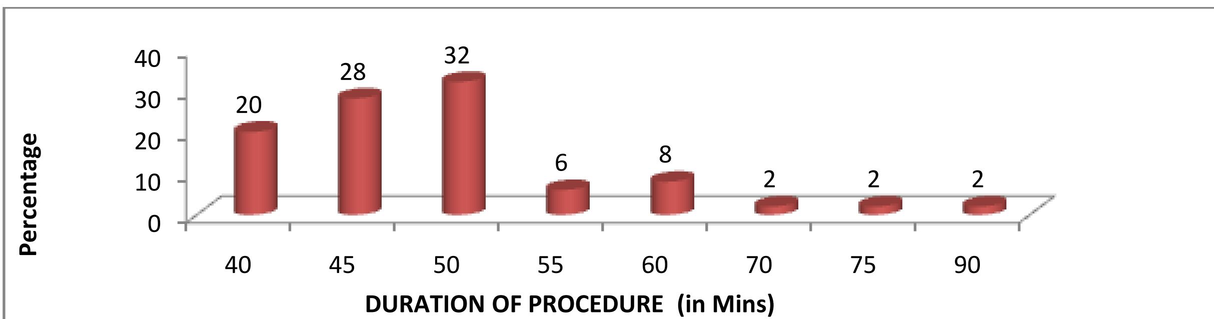
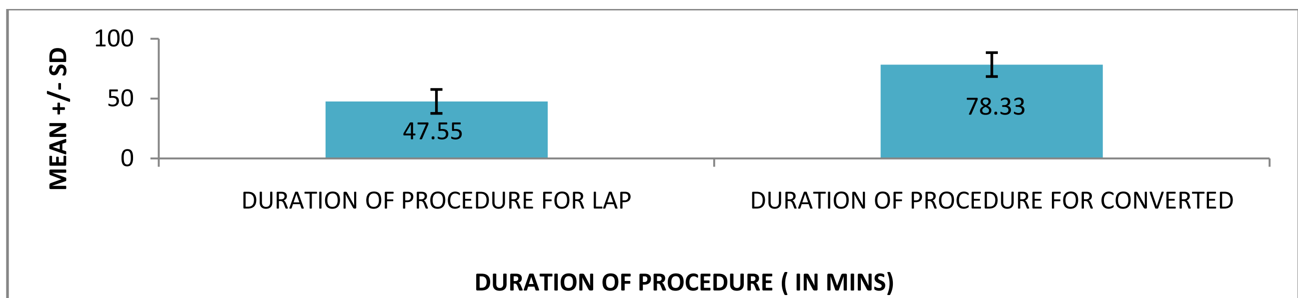


Table 15:- Duration Of Procedure.

DURATION OF PROCEDURE (in Mins)	NO. OF CASES	PERCENTAGE
40	10	20
45	14	28
50	16	32
55	3	6
60	4	8
70	1	2
75	1	2
90	1	2
TOTAL	50	100





Discussion:-

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
AGE	50	12	50	26.92	11.17
WBC COUNT	50	7030	18590	13682.12	2780.11
DURATION OF PROCEDURE FOR LAP	47	40	60	47.55	5.793
DURATION OF PROCEDURE FOR	3	70	90	78.33	10.41

CONVERTED					
RETURN TO ORAL FEEDS	50	1	3	1.32	0.55
HOSPITAL STAY	50	2	8	3.44	1.03

1. The management of complicated appendicitis is continuously developing over the past years. In this century, most importance is given to patient's comfort, cosmetics and a reduced hospital stay. All over the world surgeons usually preferred open approach forappendicectomy in patients with complicated appendicitis
2. Complicated appendicitis is associated with a higher risk of post-operative complications and has been considered a relative contraindication for laparoscopy.
3. However, this concept has been challenged in some studies which compared surgical outcomes of LA for complicated appendicitis.There is lack of good evidence supporting laparoscopic approach for complicated appendicitis. Although some studies comparing LA and OA have shown equivalence of the two procedures as regard morbidity and mortality,most studies reported significant advantages in the laparoscopic group, such as, decreased post-operative pain, rapid recovery, shorter hospital stay, availability of inspection of the entire peritoneal cavity, good debridement, adequate irrigation and lavage under direct visualisation, better cosmesis, less immunologic compromise and fewer chest complications.A major advantage of LA is the decrease in incidence of wound infections.
4. In our study of 50 patients underwent appendicectomy through laparoscopic approach. 31 patients had perforated appendicitis with localized/diffuse collection.15 patients had gangrenous appendicitis and 4 cases were acute appendicitis with abscess. Their results were analysed and compared with similar studies from literature.
5. Laparotomy conversion rate- In patients with complicated appendicitis, laparoscopy is a techniqually demanding procedure when compared in patients with non-complicated appendicitis[54,55] . A laparotomy conversion rate of 0% to 47% have been reported from various studies worldwide[56-60]. The rate of laparotomy conversion was lower in our study and was found to be 6 % (n=3). The reason for conversion being, adhesions causing difficulty in dissection and the appendicectomy was completed after converting the procedure to open.
6. Operative time- The mean operative time was 47.55 mins for laparoscopic group and 78.3 mins for converted cases.In almost all the studies performed on LA comparing OA they have proven that the operative time in LA was more than OA and this was basically based on the surgeon's experience and skill. In studies done to find out the efficacy of LA among various grades of complicated appendicitis like Kiriakopoulos et al [61] have reported a mean operative time of 67 minutes (48-88 mins) which was more than our study.
7. Hospital stays- We observed the mean hospital stay was 3.44 days (2- 8 days). Our results were comparable with study by Yau KK et al in which he reported mean hospital stay of 5 days for patients with complicated appendicitis undergoing LA which was statistically significant ($p<0.001$) comparing to OA which was 6 days. Similar to the above study many studies have concluded that LA has a significantly lesser hospital stay than OA
8. Post-operative complications

    In our study, LA group had less postoperative wound infections than OA group. This may be due to removal of the perforated appendix through a plastic bag thus avoiding direct contact with the trocar wounds. The infected fluid was aspirated thoroughly in the laparoscopic approach. While, in OA, it was difficult to prevent the abdominal incision from being in contact with both the perforated appendix and infected fluid. Indeed wound infection rates of 43.6% in OA have been reported in recent studies.[58]

    Intra-abdominal abscess-Of the 47 patients who underwent lap, we had no patient who had post-operative intra-abdominal abscess.. Many studies have been performed to find out the intra-abdominal abscess rates like Frazee RC et al performed a prospective study on 34 patients in which he showed an intra-abdominal abscess rate of 26% and Krisher SL et al in 170 patients with complicated appendicitis he compared both Laparoscopic and open appendicectomy which he reported 24% in LA and only 4.2% in OA.[65-69]

Wound infection Many studies have proved that wound infection following LA in complicated appendicitis is significantly low, which was comparable with our study where we didn't have a single case of wound infection observed in the post-operative period in lap group. This may be because of removal of appendix with very minimal manipulation and avoiding contact with abdominal wall.

However, theinfection rate was higher in OA (33.3%). This may be due to inability to avoid contact of the abdominal incision with both the appendix and infected fluid. Similar results were demonstrated in other studies

- Prolonged ileus No patient had prolonged ileus more than 48 h in lap group, whereas in the open group two patients had prolonged ileus more than 48 h.

In Laparoscopic appendectomy intestinal wall hematoma and post op bowel paralysis is less in comparison with open appendectomy because of minimal bowel handling which helps in initiation of oral feeds earlier as compared to the convectional technique.
Another advantage of laparoscopic approach is that there is a lower rate of post-operative adhesions.

Conclusion:-

- ✓ Our study has demonstrated that laparoscopic appendectomy is a safe approach for complicated appendicitis. It resulted in shorter hospital stay and lower conversion rate. It reduces the risk of postoperative infections.
- ✓ In conclusion, our study demonstrated that treatment of complicated appendicitis laparoscopically is feasible, safe and can offer a low incidence of infectious complications, less post-operative pain, rapidrecovery and better cosmetics. We recommend that LA should be the initial choice for all patients with complicated appendicitis.
- ✓ The incidence of post-operative intra abdominalabcess was nil in our study probably due to the efforts taken to give a thorough peritoneal lavage and also an adequate course of higher antibiotics. Duration of surgery was dependent on the severity of the peritonitis and the associated paralytic ileus with dilated bowel loops which made the procedure technically challenging

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