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### LAPAROSCOPIC APPENDECTOMY VERSUS OPEN APPENDECTOMY: A RANDOMIZED PROSPECTIVE COMPARATIVE STUDY

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#### ABSTRACT

**Introduction:** Laparoscopic Appendectomy confers advantages to the patient in terms of fewer wound infections, less pain, faster recovery and earlier return to work. The aim of this study was to evaluate and compare advantages and disadvantages between laparoscopic Appendectomy and open Appendectomy in general surgical practices.

**Materials and methods:** A two year randomized, prospective comparative study of Laparoscopic Appendectomy versus Open Appendectomy was done in the Department of Surgery, M.G.M medical college & L.S.K. hospital, Kishanganj, Bihar. SPSS software was used for data analysis. Chisquare test was applied.

**Results:** Wound infections in LA group was 9% and OA group was 20%. Intra- abdominal abscess in LA group was 9% and OA group 1.8%. Adhesive ileus in LA group was 4.5% and OA group was 1.7%. Caecal leak was seen only in LA group. Pneumonia was not reported in both the groups. Operation time in LA group was 60 mins and OA group was 30mins. Duration of Hospital stay in LA group was 3 days and OA group was 5 days. Mean duration of return to normal activity in LA group was 5.4 days and OA group was 7.1 days. Mean duration of return to heavy work was 12.2 days in LA group and OA group was 16.8 days.

**Conclusion:** Laparoscopic Appendectomy was found to be both feasible and safe in comparison with open Appendectomy

**Key words:** Laparoscopic appendectomy, open appendectomy

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#### INTRODUCTION

The human vermiform appendix is usually referred to as “a vestigeal organ with no known function”. Currently available evidence suggests that appendix is a highly specialized part of the alimentary tract. Lymphoid tissue first appears in the human appendix about 2 weeks after birth<sup>1</sup>. Its importance in surgery is due only to its propensity for inflammation that results in the clinical syndrome known as acute appendicitis. Acute appendicitis is the most frequent cause of persisting progressive abdominal pain in all ages. The only way to reduce the morbidity and to

prevent the development of appendicitis is to perform appendectomy before perforation or gangrene has occurred. Open Appendectomy although safe and effective for acute appendicitis for decades, however, several authors have proposed that laparoscopic Appendectomy should be the treatment for acute appendicitis<sup>2</sup>.

Mc Burney’s point Mc Arthur (Gridiron) incision for open Appendectomy remained the procedure of choice until 1983, Kurt Semm offered an alternative “laparoscopic Appendectomy”<sup>3</sup>.

Laparoscopic Appendectomy has been shown to be both feasible and safe in randomized

comparisons with open Appendectomy, in addition to improve diagnostic accuracy<sup>4</sup>.

Laparoscopic Appendectomy confers advantages to the patient such as fewer wound infections, less pain, faster recovery and earlier return to work<sup>4-10</sup>. However, laparoscopic Appendectomy is more time consuming and is associated with increased hospital costs. It has been also argued that the advantages of laparoscopic Appendectomy are marginal compared with open Appendectomy which can also be performed through a short, cosmetically acceptable incision with minimal complications and a short hospital stay<sup>6,11</sup>.

Laparoscopic Appendectomy has reduced the chances of “negative laparotomy” Obese patients require relatively large laparotomy incisions but laparoscopy can be accomplished by the same small trocar incisions that are used for thin patients<sup>5,12</sup>.

The aim of this study was to evaluate and compare advantages and disadvantages between laparoscopic Appendectomy and open Appendectomy in general surgical practices.

## MATERIAL AND METHODS

This prospective randomized controlled study was carried out in the department of General Surgery of M.G.M medical college & L.S.K. hospital Kishanganj, Bihar after taking approval by institutional review board. The study was done over a period from November 2011 to November 2013. The total population group included 144 patients with a mean age of 39 years. Patients between 18 yrs and 60 yrs of age were candidates for randomization. For Randomization, a stratified random sampling method was used. Every patient coming to the OPD who was diagnosed as acute appendicitis and planned for operation was numbered 1, 2, 3, 4, 5 and so on. Every 3<sup>rd</sup> number and 4<sup>th</sup> number were selected irrespective of sex, co-morbid factors. Every 3<sup>rd</sup> patient was planned for open Appendectomy and every 4<sup>th</sup> patients was planned for lap Appendectomy. Thus the patients were not given the opportunity to voluntarily opt for the operative procedure they would like to undergo and this was probably the main cause in the exclusion criteria. All the patients allocated to the two groups underwent the assigned procedure. The Assigned procedure

included History taking as per proforma → clinical examination → pre-anesthetic check for general Anesthesia → operation [ laparoscopic Appendectomy and open Appendectomy] → examination of operative findings gross → Histopathological examinations.

The operative procedures were carried out under strict asepsis and performed by ten different surgeons from three different units with extensive experience. The post-operative findings and histopathological findings were meticulously collected and subjected to detailed study and analysis. the operation time was noted in minutes. VAS was used for the assessment of post-operative pain and the minimum clinically significant difference was calculated in both the groups. The same scale was used for the assessment of cosmeses during follow up in OPD. Out of 144 patients the total numbers of patients after randomization were 100. Of these, 44 patients underwent laparoscopic Appendectomy and 56 patients underwent open Appendectomy finally. The two treatment groups were well matched with regards to age and sex.

Cases were scored by Alvarado scoring system during admission and later reviewed after 6-8 hrs for a second scoring when the laboratory tests reports were available the final scoring were taken for evaluation.

A final decision regarding operative intervention was made for all cases of appendicitis. The patients were explained in details about the operative modalities and an informed consent was taken for laparoscopic Appendectomy and open Appendectomy.

Pregnant females, patients with severe cardiopulmonary diseases and generalized peritonitis were excluded. Some patients who refused to undergo operation because of personal problems and financial problem and refused to give consent were excluded.

## RESULTS

A total of 144 patients attended the outdoor who were suspected for appendicitis during the period of study, the remaining 44 patients could not be randomized the main reason was stratified sampling was done. However, a total of 10

patients from the study population could have been randomized by stratified sampling. But these patients were not selected due to certain contraindications (n=2), patients refusal for procedure (n=3), age limitations (n=3) and other diagnosis (n=2). The study group (n=100) included 69.45% of the population group.

Out of 100 patients, 44 patients were randomized to laparoscopy the procedure was successfully completed in 40 patients while 2 patients had the procedure converted to open.

Reasons for conversions were mainly difficulty in defining the anatomy and dissection due to extensive adhesion following previous abdominal operation eg. TAH BSO and LSLS.

In one case, it was due to caecal perforation so plan to do Right hemi colectomy by open procedure and due to extensive hemorrhage in another case.

In 4 patients; laparoscopy revealed non- inflamed appendix. 3 were left in place and one underwent laparoscopy Appendectomy to compare its advantages over open appendectomy.

Of the 56 patients randomized to open Appendectomy 10 patients had a non- inflamed appendix that was removed.

#### **Post- operative morbidity (Table 1)**

##### **1.Wound infections**

Patients randomized to laparoscopy had significantly fewer wound infections but more intra – abdominal abscess than patients randomized to open Appendectomy.

In open Appendectomy, a wound infection was present in 11 patients in the post- operative period. All these patients included the subgroup of patients with gangrenous or perforated appendicitis. There were 4 wound infections in the laparoscopic group.

##### **2.Intra- Abdominal Abscess**

There were four cases of intra- abdominal collection after laparoscopic appendectomy and one case after open operation. Two patients had persistent fever after operation and one patient discharged on day 4, presented on the 8<sup>th</sup> day with local signs. None of the patents had a mass. but ultrasonography showed a pericaecal fluid collection measured 2cm× 4 cm. Two patients were treated by needle aspiration and one was managed conservatively. Resolution was

confirmed by follow –up ultrasonography in all cases.

One patient with open Appendectomy group had a pelvic abscess.

This was successfully treated by ultrasonography guided tranvaginal aspiration and drainage.

##### **3.Caecal leak**

There was one case of perforation related to the laparoscopic procedure which required conversion and underwent, Right hemi colectomy.

##### **4.Operating time**

There was a significantly shorter operating time in patient randomized to open Appendectomy compared with laparoscopic Appendectomy. (30 minutes versus 60 minutes].

##### **5.Convalescence**

There was a significantly shorter period of convalescence in the laparoscopic group.

##### **6.Cosmoses**

Judged on a visual analogue scale both groups scored well, but patients randomized to laparoscopy were more satisfied with the cosmetic result.

##### **7.Pain**

Judged on a VAS the minimum clinically significant in visual analogue scale did not differ much after 12 hours. after operation Median value[ MCSD] for laparoscopy Appendectomy. (12). And Median value [MCSD] for open Appendectomy was (11) (P>0.05) How ere there was difference in pain found 24 hours after operation.

The number of pethidine (1mg/kg) required in the immediate post= operative period did not differ between the two groups but the number of does of oral analgesics required was less in patients undergoing laparoscopic appendectomy after 24 hours.

##### **8.Hospital Stay**

The median value for hospital stay after laparoscopic Appendectomy was 3 as compared to hospital stay after open Appendectomy was 5 Thus reintroduction of normal diet and discharge from the hospital occurred earlier after laparoscopic than open surgery (P<0.1)

##### **9.Adhesive ileus**

There were two cases of adhesive ileus after laparoscopic Appendectomy and one case of adhesive ileus after open Appendectomy (p<0.05)

**10. Pneumonia**

However, no case of pneumonia in the post – operative period was reported.

**11.** There was no report of mortality i.e. death in the study. All the patients followed up in the OPD as advised after 5 days from the day of discharge or earlier if required for any emergency.

**Table 1**

| Randomized                          | Laparoscopic Appendectomy (n=44) | Open Appendectomy (n=56) | Probability Value     |
|-------------------------------------|----------------------------------|--------------------------|-----------------------|
| <b>1. Operation Time</b>            | 60(15-100) minutes               | 30(30-60) minutes        | <0.001                |
| <b>2. Post –operative Morbidity</b> |                                  |                          |                       |
| <b>A) Wound infection</b>           | 4(9%)                            | 11(20%)                  | <0.05                 |
| <b>B) Intra- Abdominal Abscess</b>  | 4(9%)                            | 1(1.8%)                  | <0.05                 |
| <b>C) Caecal Leak</b>               | 1(2.2%)                          | 0(0. 0%)                 | Non-Significant       |
| <b>D) Adhesive Ileus</b>            | 2(4.5%)                          | 1(1.8%)                  | <0.05                 |
| <b>E) Pneumonia</b>                 | 0(0. 0%)                         | 0(0. 0%)                 | Non-Significant       |
| <b>3. Comesis (VAS)*</b>            | 1(0-3)                           | 2(1-8)                   | <0.01                 |
| <b>4. Pain (VAS)*</b>               |                                  |                          |                       |
| <b>A) After 12 Hours (MCSD)</b>     | 12(10-20)                        | 11 (9-16)                | >0.05 not significant |
| <b>B) After 24 Hours (MCSD)</b>     | 10(5-20)                         | 10(5-25)                 | >0.05 not significant |
| <b>5. Hospital Stay* (days)</b>     | 3 (3-8)                          | 5(3-10)                  | <0.1                  |
| <b>6. Convalescence (days)</b>      |                                  |                          |                       |
| <b>Normal Activity*</b>             | 5 (2-10)                         | 5(4-14)                  | <0.05                 |
| <b>Heavy Work*</b>                  | 9 (2-20)                         | 10 (2-26)                | <0.01                 |
| <b>7. Death</b>                     | Nil                              | Nil                      | Nil                   |

**DISCUSSION**

Prior studies report a median hospital stay of 2-5 days of laparoscopic or open surgery. The present study revealed a significantly shorter hospital stay for patients undergoing laparoscopic Appendectomy.

A significant decrease in length of hospital stay were found by other trials.<sup>12, 13,14</sup>

Another metaanalysis failed to show a statistically significant difference between laparoscopic Appendectomy and open Appendectomy.<sup>5</sup>

The difference may be attributed to hospital factors or social habits rather than resulting from the operative technique itself. Moreover, it may arise from diverse health care policies in different countries.

In the present study more operating time was noted for laparoscopic Appendectomy. Significant variation in operating times was noted in various controlled studies. Statistically significant

difference in mean operating time ranging from 8.3 to 29 minutes has been observed in prior studies and was longer for laparoscopic Appendectomy in all studies.<sup>14,15</sup>

Another study revealed no difference in the operating time<sup>16</sup>.

In experienced hands, conversion rates approximating 5 percent have been claimed.<sup>6,13</sup>

Similar results was found in the present study of conversion rate. The main reasons for conversion was difficult due to dense parietal adhesions due to previous lower abdominal surgery. In one case there was an associated caecal perforation so a Right hemicolectomy had to be performed.

There were significantly fewer wound infections in the laparoscopy group in this study. Theoretically, a reduction in wound infection rate can be achieved by extraction of the specimen through a port or leaving non-inflamed appendix in place or with the use of an endobag. This has been confirmed in a recent intention to treat analysis on a large number of patients<sup>16, 17</sup> showing lower wound infection in case of laparoscopic Appendectomy. At a glance the operative cost of laparoscopic was greater than open Appendectomy but this was not included in the present study.<sup>18,19,20</sup>

The prevalence of intra-abdominal abscess following laparoscopic Appendectomy is found to be higher as compared to open Appendectomy. The higher rates of abscess formation is seen after laparoscopic removal of perforated appendices<sup>19,20</sup>. This correlates with the present study in which there were significantly more intraabdominal abscess in patients randomized to laparoscopy. It was associated with gangrenous and perforated appendicitis than with acute phlegmonous appendices.

Although laparoscopy offers the possibility of adequate irrigation and suction of fluid in the peritoneal cavity, it may increase the risk of spreading infection material in the peritoneal cavity.

In the present study, post – operative pain was assessed after 12 hours and 24 hours. In the immediate post – operative period opiate analgesics were used in both. A visual analogue scale was used to assess the post – operative pain, was found to be less in the laparoscopy group with



the same dose of parenteral analgesics as compared to open Appendectomy.

Analgesics requirement were significantly less after laparoscopic Appendectomy in previous studies<sup>13, 15</sup>. In a study by Ortega et al<sup>14</sup> linear analogue pain scores, were recorded in a subgroup of 135 patients. Pain scores were significantly lower after 24 hours. A similar retrospective study of assessment of post – operative pain by visual analogue scale<sup>21</sup> showed no significant difference in pain scores both for open Appendectomy and laparoscopic Appendectomy.

In another retrospective study<sup>6</sup>, the mean number of doses of oral analgesics required was less in patients undergoing laparoscopic Appendectomy.

In 11 of 13 controlled trials that have studied post – operative convalescence was found to be shorter in patients treated by a laparoscopic approach<sup>6, 14, 22</sup>. Post – operative convalescence was found to be similar in both groups in a study by Ignacico et al<sup>23</sup>.

In accordance to retrospective study small bowel obstruction was statistically less common after laparoscopic Appendectomy than open Appendectomy<sup>23</sup>.

According to Lujan et al<sup>9</sup>, bowel obstruction was seen in 4 cases after laparoscopic Appendectomy and 5 cases after open Appendectomy.

In the present study, adhesive ileus after laparoscopic Appendectomy was found to be more than after open Appendectomy. Adhesive related complications such as intestinal obstruction remains the main source of long term morbidity from open Appendectomy.

According to Pedersen<sup>5</sup>, laparoscopy was associated with improved cosmesis.

According to Kamal (2003)<sup>24</sup>, Laparoscopy procedure gives a small scar which is more cosmetic and acceptable.

In the present study, laparoscopic Appendectomy was associated with improved cosmesis when compared with open Appendectomy.

Laparoscopy is a safe, predictable operation and an ideal model for learning the skills and principles required for more advanced laparoscopic colorectal interventions.<sup>25</sup>

Open appendectomy is the gold standard for the treatment of acute appendicitis. Laparoscopic

appendectomy through widely practiced has not gained universal approval.

Few studies compare the outcome of Laparoscopic appendectomy compared with open appendectomy, we investigated clinically outcomes to evaluate the safety and efficacy of laparoscopic appendectomy compared with open appendectomy in pregnant women.

## CONCLUSION

From the present study, we concluded that laparoscopic Appendectomy has been shown to be both feasible and safe in comparison with open Appendectomy.

Laparoscopic Appendectomy and open Appendectomy are comparable for complications, post-operative pain control, length of hospitalization and recovery time. Laparoscopic Appendectomy is associated with increased Operating time. The general perception is that it has marginal advantages and may not be worth the trouble.

Hospital stay and wound infection rates are significantly lower after laparoscopic Appendectomy. Reintroduction of normal diet and discharge from hospital was earlier after laparoscopic Appendectomy faster recovery and earlier return to work was also seen after laparoscopic Appendectomy. Less post- operative pain and improved cosmesis was seen after laparoscopic Appendectomy than open Appendectomy.

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