

## Original Research Article

# Preoperative predictive factors for difficult laparoscopic appendectomy

Anubhav Goel<sup>1\*</sup>, Ankur Bansal<sup>2</sup>, Anil Baliyan<sup>1</sup>

<sup>1</sup>Department of Surgery, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India

<sup>2</sup>Department of Surgery, S. R. Hospital, Agra, Uttar Pradesh, India

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### \*Correspondence:

Dr. Anubhav Goel,

E-mail: [dranubhav1234@yahoo.com](mailto:dranubhav1234@yahoo.com)

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## ABSTRACT

**Background:** An appendectomy is the surgical removal of the appendix. Appendectomy may be performed laparoscopically or as an open operation. Laparoscopy is now often used as patient resumed normal activity within a shorter period than had been experienced with open appendectomy. Patients had a superior cosmetic result and experienced significantly less postoperative discomfort. In this study, we attempted to determine the predictors for difficult appendectomy using history and clinical examinations, preoperative laboratory data, ultrasonography findings and intraoperative finding.

**Methods:** The study was conducted in Sarojini Naidu Medical College, Agra. All patients who underwent laparoscopic appendectomy from 1<sup>st</sup> January 2016 to 30<sup>th</sup> June 2017 were included in the study. A detailed performa was developed to record information regarding patient history, physical examination, laboratory parameters, ultrasonography (USG) findings and intra-operative details. Laparoscopic appendectomy done in more than 120 minutes, converted into open due to difficulty in surgery and not due to complications, severe adhesions were considered to be a case of difficult appendectomy.

**Results:** We found that the difficult laparoscopic appendectomy can be predicted preoperatively based on age >60 years, history of previous lower abdominal surgery, time of onset to surgery >24 hours, acute appendicitis and peri appendicular collection.

**Conclusions:** There are very few reports to determine the predictors of difficult appendectomy and more research is required to establish it.

**Keywords:** Difficult appendectomy, Laparoscopic appendectomy, Predictors

## INTRODUCTION

An appendectomy is the surgical removal of the appendix. It is a common emergency surgery that is performed to treat appendicitis, an inflammatory condition of the appendix. It should be performed immediately otherwise it could burst and the bacteria and fecal particles within the organ can spread into the abdomen. This may lead to a serious infection called peritonitis. It can also develop into an abscess if appendix ruptures. Both are life-threatening situations that require immediate surgery. Appendectomy may be performed

laparoscopically (in minimally invasive surgery) or as an open operation. Laparoscopy is now often used as patient resumed normal activity within a shorter period than had been experienced with open appendectomy.

Patients had a superior cosmetic result and experienced significantly less postoperative discomfort.

In this study, we attempted to determine the predictors for difficult appendectomy using history and clinical examinations, preoperative laboratory data, ultrasonography findings and intraoperative finding.

## METHODS

The study was conducted in Sarojini Naidu Medical College, Agra. All patients who underwent laparoscopic appendectomy from 1<sup>st</sup> January 2016 to 30<sup>th</sup> June 2017 were included in the study. A detailed performa was developed to record information regarding patient history, physical examination, laboratory parameters, ultrasonography (USG) findings and intra-operative details.

Inclusion criteria were age older than 18 years and diagnosis based on an ultrasound scan. We exclude those having appendicular lump, pregnancy, inflammatory bowel disease, appendicular abscess and perforation peritonitis.

A retrospective analysis was done by reviewing the medical records of the included patients. Patient gender, age, BMI, preoperative laboratory markers (white blood cell (WBC), neutrophil proportion, total bilirubin,

aspartate aminotransferase (AST), and alanine aminotransferase (ALT), and abdominal ultrasound findings (appendiceal maximal diameter and peri-appendicular collection) were recorded.

Laparoscopic appendectomy done in more than 120 minutes, converted into open due to difficulty in surgery and not due to complications, severe adhesions were considered to be a case of difficult appendectomy.

## RESULTS

During this period of 18 months 86 cases went laparoscopic appendectomy of which 4 had abnormal bleeding and were excluded from the study. Out of 82 cases there were 23 (28%) cases of difficult appendectomy out of which 9 (10.9%) took more than 120 minutes and 11 (13.4%) converted into open procedure and 9 (10.9%) have severe adhesions of which 4 also took more than 120 minutes and 2 were converted into open procedure.

**Table 1: Demographic details.**

| Parameters    | N  | Simple appendectomy (n=59) | Difficult appendectomy (n=23) | p value |
|---------------|----|----------------------------|-------------------------------|---------|
| Age <60 years | 70 | 55 (93%)                   | 15 (65%)                      | <0.005  |
| Age >60 years | 12 | 4 (7%)                     | 8 (35%)                       | <0.005  |
| Male          | 53 | 39 (66%)                   | 14 (60%)                      | 0.465   |
| Female        | 29 | 20 (34%)                   | 9 (40 %)                      | 0.347   |
| BMI <25       | 19 | 14 (24 %)                  | 5 (22%)                       | 0.512   |
| BMI 25.1-28   | 34 | 26 (44%)                   | 8 (34%)                       | 0.023   |
| BMI >28       | 29 | 19 (32%)                   | 10 (44%)                      | 0.043   |

BMI: Body Mass Index

**Table 2: History and clinical examination.**

| Parameters                              | N  | Simple appendectomy (n=59) | Difficult appendectomy (n=23) | p value |
|-----------------------------------------|----|----------------------------|-------------------------------|---------|
| History of previous operation           | 10 | 2 (3.3%)                   | 8 (34%)                       | <0.005  |
| 1 <sup>st</sup> attack of appendicitis  | 55 | 35 (59%)                   | 20 (87%)                      | <0.005  |
| No of attacks >1 (chronic appendicitis) | 27 | 24 (41%)                   | 3 (13%)                       | <0.005  |
| Total leucocyte count >11000            | 60 | 44 (74%)                   | 16 (69%)                      | 0.523   |
| Neutrophil count >80                    | 77 | 49 (83%)                   | 18 (78%)                      | 0.471   |
| Serum Bilirubin >2 gm                   | 8  | 5 (8%)                     | 3 (13%)                       | 0.502   |
| AST >250                                | 5  | 3 (5 %)                    | 2 (8.6 %)                     | 0.312   |
| ALT>250                                 | 5  | 3 (5%)                     | 2 (8%)                        | 0.312   |
| Time of onset to surgery <24 hours      | 58 | 51 (87%)                   | 7 (30%)                       | <0.005  |
| Time of onset to surgery >24 hours      | 24 | 8 (13%)                    | 16 (70%)                      | <0.005  |

AST: aspartate aminotransferase; ALT: alanine aminotransferase

The mean age of simple appendectomy was 45.7 years and of difficult appendectomy was 56.8 years respectively. Difficulty of laparoscopic appendectomy significantly increases with age more than 60 years. Total number of males was 53 out of which 39 had simple appendectomy and 14 had difficult appendectomy. Out of

29 females 20 had simple appendectomy and 9 had difficult appendectomy. Thus, males have more incidence of appendicitis than females. There is statistically no difference of Body Mass Index (BMI) in predicting the difficulty of laparoscopic appendectomy. 10 cases had history of previous operations, out of which 2 had simple

appendectomy and 8 had difficult appendectomy. Thus, history of previous operation increases the chances of difficulty. First attack of acute appendicitis increases the chance of difficulty than chronic appendicitis.

Increase in total leucocyte count (TLC) and increased neutrophil count is used in diagnosing acute appendicitis

but are not statistically significant in predicting the difficulty. Serum bilirubin, aspartate aminotransferase (AST) and alanine aminotransferase (ALT) does not help in predicting the difficulty of laparoscopic appendectomy. Delay in surgery for more than 24 hours statistically increasing the difficulty of laparoscopic appendectomy ( $p < .005$ ).

**Table 3: Ultrasound finding.**

| Parameters                   | N  | Simple appendectomy (n=59) | Difficult appendectomy (n=23) | p value |
|------------------------------|----|----------------------------|-------------------------------|---------|
| Appendix diameter >1 cm      | 69 | 52 (88%)                   | 17 (73%)                      | 0.432   |
| Appendix diameter <1 cm      | 13 | 7 (12 %)                   | 6 (26%)                       | 0.235   |
| Peri appendicular collection | 29 | 14 (23%)                   | 15 (65%)                      | <0.005  |

Ultrasound is not the diagnostic test for appendicitis. Appendix diameter is not a predictor of difficult appendectomy but peri-appendicular collection significantly associated with difficult appendectomy.

## DISCUSSION

A major benefit of laparoscopy apparently derives from the reduced abdominal wall trauma as compared to traditional open procedures. However, the abdominal wall injury may not be a significant factor for every type of abdominal incision and pathologic process.<sup>2</sup>

The overall conversion rate in the present study was 13%. Hellberg A et al conducted a study which included 244 patients who underwent laparoscopic appendectomy.<sup>3</sup> The overall conversion rate in their study was 12%.

Laparoscopic appendectomy is a safe and feasible technique in acute appendicitis also in the elderly.<sup>4</sup> In the present study age >60 years is a strong predictor of difficult appendectomy.

Males had higher rates of appendicitis than females for all age groups (overall rate ratio, 1.4:1).<sup>5</sup> In the present study male:female ratio was 1.8:1 which is higher in the present study may be due exclusion criteria of study and they are not the predictor of difficult appendectomy.

Obesity is a widespread medical condition in western societies and affects a great percentage of patients undergoing appendectomy. Anecdotal belief that laparoscopic appendectomy should be the procedure of choice in obese patients stands on the fact that the increased wall thickness poses an additional technical challenge during open appendectomy limiting hand movements and visual scope. Recently, published papers have placed harder evidence favoring laparoscopic approach.<sup>6,7</sup> In the present study there was slight difficulty in obese patient but was not statistically significant. Present study data analysis revealed that there was significantly high risk of difficulty and conversion in patients with acute appendicitis than chronic appendicitis.

Shen Z et al, concluded that the mean operation time, the time of first anal exsufflation, and oral intake after operation were longer for acute appendicitis patients than for chronic appendicitis in laparoscopic group.<sup>8</sup>

In the present study history of previous surgery is a strong predictor of difficult appendectomy. However, JM Wu et al, concluded that previous abdominal surgery, whether upper or lower abdominal, has no significant impact on laparoscopic appendectomy for acute appendicitis.<sup>9</sup>

Raised total leucocyte count or raised neutrophil level does not affect the difficulty in performing laparoscopic appendectomy. Similarly raised LFT like serum bilirubin, AST, ALT also has no significant role in predicting the difficulty of laparoscopic cholecystectomy.

Complicated appendicitis is associated with a delay in surgery from symptom onset rather than a delay at hospital arrival. Surgeons should take into account the time from symptom onset when deciding on the timing of appendectomy. Maru Kim et al recommend that appendectomy be performed within 36 hours from symptom onset.<sup>10</sup> We find difficulty increases if laparoscopic appendectomy is performed after 24 hours of onset of symptoms.

It has been shown that the diameter of the normal appendix (mean anteroposterior diameter  $4.4 \pm 0.9$  mm, mean transverse diameter  $5.1 \pm 1.0$  mm) does not change with age and is normally distributed in children.<sup>11</sup> Ultrasound appendix size more than 1 cm does not predict the difficulty in laparoscopic appendectomy whereas peri appendicular collection significantly predicts the difficulty of laparoscopic appendectomy.

## CONCLUSION

We conclude that the difficult laparoscopic appendectomy can be predicted preoperatively based on age >60 years, history of previous lower abdominal surgery, time of onset to surgery >24 hours, acute

appendicitis and peri-appendicular collection. There are very few reports to determine the predictors of difficult appendectomy and more research is required to establish it.

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