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Original Article

Risk Factors of Perforation of Appendix and Unfavorable Outcome in Delayed Presentation of Acute Appendicitis: A Cross-Sectional Analysis

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Abstract

Background: Perforated or gangrenous appendicitis in patient with a lately presented acute appendicitis remains a challenge for practicing surgeons and continues to be associated with more deadly complications. Results might improve with earlier consideration of the diagnosis followed by prompt surgical intervention. Objective: To identify the risk factors of appendiceal perforation, gangrene and other sequelae in patients with delayed presentation of acute appendicitis and its effects on the prognosis. Patients and Methods: This cross-sectional study was carried out from January, 2015 to July, 2017 (2½ years) in Rajshahi medical college hospital and also it's neighboring several private hospitals. Those patients of both genders between 12 years to 65 years old, admitted during that period with signs and symptoms of acute appendicitis for more than 48 hours but otherwise healthy (i.e. not having any other comorbidities) were subjected to the present study. The parameters of our study were incidence of appendiceal perforation or gangrene, peri-appendiceal abscess formation, generalized peritonitis, length of hospital stay and post-operative complications. Results: During the study period, a total of 73 patients underwent appendicectomies and 23 patients were excluded, leaving 50 who met the inclusion criteria, 23 males (46%) and 27 females (54%). Of all the risk factors studied, the patient's pre-hospital time delay was the most important risk factor for perforation (43 patients i.e. 86%) and there were little number of patients with the in-hospital delay (7 patients i.e. 14%). The reasons behind this pre-hospital as well as in-hospital delay were multifactorial. Overall appendiceal perforation occurred in 22 (44%) patients, patients presented with gangrenous appendicitis were 14 (28%), periappendiceal abscess formation was found in 9 (18%) patients, and patients presented with generalized peritonitis were 5 (10%). The duration of hospital stay ranged from several days to several weeks. Post-operative complications occurred in 40 (80%) cases. Post-operative complications were monitored and addressed as: prolonged ileus, wound sepsis as major and minor wound infection, intra-abdominal sepsis as pelvic abscess and faecal fistula. Conclusion: As the time course increases from the initiation of the first symptoms to the definitive management, the complication rate increases and acutely inflamed appendicitis gradually converts to more lethal forms.

Keywords: Acute appendicitis, delayed presentation, unfavorable outcomes

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Introduction

Acute appendicitis is still the commonest abdominal surgical emergency with a lifetime incidence of 8.6% for males and 6.7% for females, with maximal incidence at age 10–14 years in males and 15–19 in females.[1] Appendicitis is known to be the disease of the younger age groups with only 5-10% of cases occurring in the elderly population. However, the incidence of the disease in this age group seems to be rising due to recent

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increase in the life expectancy.[2] The conventional disease model for acute appendicitis was described in the early 20th century[3,4] which proposes a progressive inflammatory process triggered by luminal obstruction of the appendix and culminating in perforation resulting from infection and ischemic necrosis. The prognosis of uncomplicated appendicitis in all age groups is nearly equal. However, perforation worsens the condition dramatically resulting in higher rates of morbidity and mortality.[2,5] It is still difficult to make a correct preoperative diagnosis early because of the often atypical presentation, fewer complaints of right lower quadrant pain, lacking a thorough physical examination or those who received intramuscular opioid analgesic. In addition, attempts at seeking a correct diagnosis and avoiding unnecessary appendicectomies may actually cause the delay of surgery and increase the possibility of perforation and morbidity.[6] Acute appendicitis should still be considered as a surgical disease but not a medical disease. Early appendectomy is safe and feasible for patients with appendicitis and the clinical outcomes of delayed appendectomy are not superior to those of early appendectomy. Therefore, it is suggested that, surgeons would decide the appropriate timing of appendectomy with consideration of other situations such as available hospital resources.

Materials and Methods

This study was designed as a cross-sectional descriptive analysis in Rajshahi medical college hospital and also it's neighboring several private hospitals from January 2015 to July 2017. Those patients of both genders between 12 years to 65 years old, admitted during that period with signs and symptoms of acute appendicitis for more than 48 hours but otherwise healthy (i.e. not having any other co-morbidities) were subjected to the present study. They were diagnosed as acute appendicitis after history, physical examination, investigations and operation. Parameters of evaluation were:1) incidence of perforation or gangrene at surgery, 2) periappendiceal abscess formation and generalized peritonitis, 3) length of hospital stay and 4) post-operative complications.

Delayed diagnosis was considered as: 1) discharge from the hospital at the first visit or,

2) a time from initial symptom(s) to surgery of 48 hours or more. We excluded the following patients:1) those who were under 12 years or over 65 years old of both genders, 2) those with a clinically palpable appendicular mass, 3) pregnant women and 4) malnourished and those with severe other medical diseases requiring intensive care.

Outcome measures: Outcome measures were white blood cell (WBC) count on the first postoperative day, time to soft diet, complication rate, surgical site infection (SSI), length of hospital stay, and readmission within 6 months. Data Analysis: As it was a cross-sectional descriptive case study, so no statistical test was applied. Collected data may be analyzed by comparing it to available local and international data.

Results

During the study period, a total of 73 patients underwent emergency appendicectomies and 23 patients were excluded, leaving 50 who met the inclusion criteria, 23 males (46%) and 27 females (54%). Our data came in agreement that, perforation rate was correlated mostly with the pre-hospital delay (43 patients i.e. 86%) and there were little number of patients with the in-hospital delay (7 patients i.e. 14%). The reasons behind this pre-hospital as well as in-hospital delay were multifactorial (Table 1) including

1. Pre-hospital delay: The high rate of complicated appendicitis with its subsequent sequelae of increased morbidity is primarily the direct result of patient's delay:

(a) Delayed diagnoses and misdiagnoses- due to reluctant attitude of the patients going to a doctor, atypical presentation, presenting late after first symptom along with illiteracy, fewer complaints of right lower quadrant pain, absence of expertise opinion, lack of a thorough physical examination, absence of investigation facilities in the periphery, improper use of intramuscular opioid analgesic, situs inversus (appendix in the left iliac fossa) etc.

(b) Delayed presentation of a diagnosed acute appendicitis- due to dwelling distantly from the hospital, low socio-economic status, lack of transport opportunities, vacations and public holidays, unfamiliarity with the medical facilities and religious interdict.

(c) The pattern of delay in presentation of a diagnosed acute appendicitis- was also observed either as the patient's refusal for appendicectomy or the time wasting referral to the surgeons from the physicians, gynecologists, rural clinics, village doctors and quacks or their attempt to cure the patients by medical treatment.

2. In-hospital delay: The timing of surgery was actually affected by some other factors in the hospital such as limited availability of the operating room and anaesthesia, tight operation schedule, delayed or inadequate availability of the sterilized equipments, frequent power supply interruption, limited skilled manpower etc. Therefore, waiting time to appendectomy has been naturally lengthened although early appendectomy was planned.

Table 1: Multifactorial patterns of delayed presentation and operation

Pattern of delay			Number	Percentage
Pre-hospital delay	Delayed diagnoses and misdiagnoses- admitted after 48 hours of initiation of pain		12	24
	Dwelling distance	Outside the 50 km radius of the hospital	28	56
		Inside the 50 km radius of the hospital	22	44
	Socio-economic status and literacy level	Poor class	23	46
		Lower middle class	14	28
		Middle class	8	16
		Wealthy class	5	10
	Obstacles in conveyance		9	18
	Patients agitated on the vacations and public holidays		3	6
	Unfamiliarity with the medical facilities		7	14
	Forbidden by social custom or moral or religious grounds		2 (Females)	4 (Females)
	Patient's refusal for appendicectomy		4	8
	Delayed referral to the surgeons		6	12
In-hospital delay			7	14

Table 2 shows that, the overall appendiceal perforation occurred in 22 (44%) patients, patients presented with gangrenous appendicitis were 14 (28%), periappendiceal abscess formation was found in 9 (18%) patients and patients presented with generalized peritonitis was 5 (10%). The duration of hospital stay

ranged from several days to several weeks and it was directly proportional to the severity particularly the gangrenous appendicitis**.**

Table 2: Distribution of complications among the delayed cases

Complications	Number	Percentage (%)	Duration of post operative hospital stay
Perforated appendicitis	22	44	Several days to several weeks (5 to 27 days)
Gangrenous appendicitis	14	28	
Periappendiceal abscess	9	18	
Generalized peritonitis	5	10	
Grand total	50	100	

Table 3 shows post-operative complications occurring in 40 patients (i.e. 80%). The mean WBC count on the first postoperative day was lower and time to soft diet was relatively earlier in those 10 patients (20%) who were uneventful than that of these 40 patients. Postoperative complications were monitored and addressed as shown in this table. All patients with gangrenous appendicitis were affected with these complications. Major wound infection occurred whose wounds were primarily closed. The position of the appendix at the time of exploration in this study exhibited that, 66% of the appendices (33 patients) were of the retrocaecal type while pelvic appendix was present in 10% (5 patients) cases. Only 1 patient (i.e. 2%) presented with situs inversus (i.e. appendix in the left iliac fossa). Other types were also present in 22% (i.e. 11 patients) cases which revealed that the complication rate was also more common in unusual types of appendices.

Table 3: Distribution of post-operative complications among the delyed cases

Complications	Number	Percentage (%)
Prolonged ileus	8	20
Major wound infection	12	30
Minor wound infection	14	35
Pelvic abscess	4	10
Faecal fistula	2	5
Grand total	40	100

Table 4: Distribution of late post-operative complications observed on follow-up

Follow-up schedule	Mode of complications	Number of affected patient	Percentage (%)	Place of management
First month	Off and on wound site pain	7	14	Outdoor
	Subacute intestinal obstruction	2	4	Indoor

				(Readmission)
Third month	Vague abdominal pain	5	10	Outdoor
	Subacute intestinal obstruction	1	2	Indoor (Readmission)
Sixth month	Incisional hernia	1	2	Indoor (Readmission)

Table 4 shows the follow-up of our study on the first, third, and sixth months scheduled as outdoor check-up. The highest incidence of complications was at the first month of follow-up. All patients who presented with these problems during the follow-up period were managed conservatively with an uneventful recovery except 1 patient who entered the indoor with incisional hernia that was repaired successfully.

Discussion:

Physicians from a wide range of medical specialties, gynecologists as well as surgeons encounter patients with acute appendicitis in their daily practices. Appendicectomy has still been the most common non-elective surgical procedure performed by general surgeons.[7,8] It is usually prepared at the time of diagnosis as appendicitis and done within hours to prevent the progression of inflammation. It is obvious in the present study that, perforation rate was correlated mostly with the pre-hospital delay (43 patients i.e. 86%) and there were little number of patients with the in-hospital delay (7 patients i.e. 14%).The reasons behind this pre-hospital as well as in-hospital delay were multifactorial (Table 1). In the present study, we showed that, 12 patients (i.e. 24%) out of 50 with delayed diagnoses and misdiagnoses of acute appendicitis were associated with a more advanced stage of disease and a serious interruption of patient's daily activities and considerable waste of hospital resources. Here, we are stressed on the higher index of suspicion, better surgical training, and better senior supervision to avoid preventable morbidity and mortality in acute appendicitis.

The patients with late presentation living outside the 50 km radius of the hospital were 28 in number (56%) and inside the 50 km radius the number was 22 (44%). This small difference was due to the communication facilities as the longer distance with better communication, the late presentation was relatively earlier than the shorter distance with worse communication. Socio-economic status and literacy level reflected the distribution of the patients as the incidence of poor and lower middle class {23+14=37 (74%)} was about 3 times more in lately presented cases than the middle and the wealthy class {8+5=13 (26%)}. Poor communication is also a proven factor not to get access 9 (18%) patients in the available medical facilities timely. Therefore, better communication facilities are the mainstay for better utilization of available resources. Vacations and public holidays (3 patients i.e. 6%), unfamiliarity with the medical facilities (7 patients i.e. 14%), social custom or moral or religious grounds (2 female patients i.e. 4%) all were not only consistent with the delayed presentation but also contributed to the increased perforation or gangrene seen at exploration, thereby increased rate in delayed recovery resulting in longer hospital stay and increased rate of local and systemic complications observed at follow-up.

The pattern of delay in presentation of a diagnosed acute appendicitis was also observed either as the patient's refusal for appendicectomy (4 patients i.e. 8%) or the time wasting referral to the

surgeons (6 patients i.e. 12%) from the physicians, gynecologists, rural clinics, village doctors and quacks or their attempt to cure the patients by medical treatment. Regarding the role of surgical and non-surgical residents in delayed diagnosis of patients with acute appendicitis, we found that, the surgical residents were well-oriented to the clinical data and their diagnosis was based primarily on the patient's history and the physical examination. While the non-surgical residents depended on the laboratory tests and imaging studies as complimentary aids to the clinical data.

The timing of surgery was actually affected by some other factors in the hospital such as limited availability of the operating room and anaesthesia, tight operation schedule, delayed or inadequate availability of the sterilized equipments, frequent power supply interruption as well as limited skilled manpower. In our hospital, we preferred early appendectomy and we performed appendectomy within a few hours after diagnosis except midnight, if possible. Therefore, waiting time to appendectomy has been naturally lengthened although early appendectomy was planned. Also found in the study was the absence of sex predilection for perforation; 23 (46%) patients were males and 27 (54%) were females. It indicates that, the health concerns of our female populations are seriously taken in accordance with the social influence of the male dominance in our society.

A perceived complicated appendicitis and its delay to definitive treatment stressed mostly on the pre-admission delay on the part of the patient and a little on the post-admission delay on the part of the surgeon. Both shared in causing a more advanced stage and a higher morbidity (Table 2) proven as the overall appendicular perforation occurred in 22 (44%) patients, 14 (28%) patients presented with gangrenous appendicitis, periappendicular abscess formation was found in 9 patients (18%), and patients presented with generalized peritonitis were 5 (10%). The duration of hospital stay ranged from several days to several weeks. Post-operative complications occurred in 40 (80%) cases (Table 3) that were monitored and addressed as: prolonged ileus, major and minor wound infection, intra-abdominal sepsis as pelvic abscess and faecal fistula. The follow-up of our study was on the first, third, and sixth months scheduled as outdoor check-up (Table 4). The highest incidence of complications was on the first month of follow-up. 7 patients (14%) with off and on wound site pain and treated as outpatients and 2 patients (4%) got admitted by the emergency department to the ward with subacute intestinal obstruction and managed conservatively. On the 3rd month, out of 6 patients (12%), vague abdominal pain was seen in 5 patients (10%) and 1 patient (2%) was hospitalized with subacute intestinal obstruction and managed conservatively. On the 6th month of follow up, 1 patient (2%) entered the indoor with incisional hernia that was repaired successfully.The result of this study should be read with limitations. Firstly, those who were under 12 years or over 65 years old of both genders were out of the study though no age is exempt from appendicitis. Secondly, pregnant women and those with severe medical diseases requiring intensive care were not included. Thirdly, in order to highlight the risk factors leading to appendiceal perforation one would ideally collect clinical data before and not after perforation occurred. Fourthly, optimal timing of appendicectomy could not be elucidated. We expect to solve these limitations through the large prospective randomized trial in the near future.

Conclusion: As the time course increases from the initiation of the first symptoms to the definitive management, the complication rate increases and acutely inflamed appendicitis gradually converts to more lethal forms. Therefore; results might improve with earlier consideration of the diagnosis followed by prompt surgical intervention.

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