Original Article

PERFORATED APPENDIX: CONTRIBUTING FACTORS

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ABSTRACT

Objectives:
Study the various risk factors contributing in perforation of appendix and improve our management of patients by early detection of risk factors.

Materials and methods:
This is a simple descriptive study and was conducted in the Surgical Unit Madina Teaching Hospital during the period from January 2008 to June 2010. Patients of all ages and both sexes operated for appendicitis were included in the study. The history, clinical features, investigations and operative findings were noted and recorded on the standard proforma. Surgical procedures performed and complications were recorded and managed accordingly.

Results:
The incidence of perforated appendicitis is higher in males (69.17%) as compared to females (30.82%). The incidence of perforated appendicitis is higher in the extreme of ages. In the first decade it is 46.15% and in the elderly it is 56.61% of the patients presenting with appendicitis. The mean delay from the onset of symptoms to surgery for perforated appendix is 4.2 days. Most of the patients (60.90%) were admitted with complaints of pain right iliac fossa with fever. 27 patients (20.30%) operated for perforated appendicitis presented with generalized peritonitis. The obstructive appendicitis due to faecolith is strongly associated with the perforated appendicitis. The patients with diabetes have more incidence of perforation of the appendix. Similarly, the incidence of perforation of appendix is higher in patients who are taking steroid therapy. The most common postoperative complications after appendicectomy for perforated appendicitis were fever (33.83%) and wound infection (30.07%).

Conclusions:
Perforated appendicitis is associated with high morbidity and mortality rates especially in children, elders, pregnant woman, diabetics, steroid dependent and immunocompromised patients. We should be aggressive in the treatment of appendicitis in the high risk patients. So once acute appendicitis is diagnosed, the expedient surgery and appropriate use of perioperative antibiotics can help to minimize the morbidity and mortality.

Keywords: Perforated appendix, contributing factors, delayed presentation

INTRODUCTION

Acute appendicitis is one of the most common diseases presenting in emergency ward. Acute appendicitis is recognized as a clinical entity since 1500s, at that time it was called as "perityphlitis"[1]. The first appendicectomy was reported in literature in 1736.[2] Then the Reginald Fitz in 1863 established the role of appendectomy in the management of acute appendicitis. After that Charles McBurney has established the definite role of early surgical intervention in the management of acute appendicitis.[3]

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The acute appendicitis is the most common surgical disease. The peak incidence of the appendicitis is in the early childhood.[4] Then it decreases with the age. The male to female ratio is 1.3:1. The incidence of perforated appendix is higher in males and also at the extremes of ages.[5]

The obstruction of the lumen of the appendix is the main causative factor in the perforation of appendix. The main culprit for the obstruction of the lumen of appendix is considered the fecolith.[6] Fecoliths are responsible for the perforation of appendix in about 90% of cases of perforated appendix. Although there are certain other causes of luminal obstruction such as seeds of fruits and vegetables, lymphoid hyperplasia, intestinal worms especially Ascaris, malignancy and foreign body etc.[7] The mortality and morbidity is increased in cases of perforated appendix.[8]
There are many contributing factors in the perforation of appendix. The most important factor is the late presentation of the patients, since the onset of symptoms.[9] As the more time lapses between the symptoms and the treatment, there are far more chances of complications.
The age is also considered as a significant risk factor in the perforation of the appendix. Age less than l0 years and more than 40 years is associated with significant mortality and morbidity. Children under the age of l0 years have 20% incidence of perforated appendix. The incidence of acute appendicitis is lower in the elderly as compared with younger age group.
Diabetes a metabolic disorder, when accompany the acute appendicitis increases the mortality and morbidity significantly. Pregnancy with acute appendicitis also increases the morbidity and mortality.[10] As the pregnancy progresses, uterus enlarges and appendix is pushed upwards. Thus the pain and tenderness shift to upper abdomen creating confusion with pyelitis and cholecystis.[11]
In our prospective study we will evaluate the role of different risk factors (extremes of age, delayed presentation, obstructive appendicitis, diabetes and pregnancy) and their importance in the management of acute appendicitis so that we may be able to suggest any helpful change in the management for example approach, pelvic generous toilet, antibiotic regimen etc.

MATERIAL AND METHODS

Our study included all the 641 patients which presented between 1 Jan 2008 to 30 June 2010 and operated for appendicitis in Surgical Department, Madina Teaching Hospital, Faisalabad.

Type of study:
Simple descriptive study

Inclusion criteria:
Patients of all ages and both sexes operated for appendicitis were included in the study.

Exclusion criteria:
Patients treated conservatively are excluded in this study.
All the patients admitted were assessed pre-operatively by thorough history, physical examination, laboratory and radiological investigations. Following investigations were performed:

1. Hb, TLC, DLC, ESR
2. Urine complete examination
3. Blood sugar
4. Blood urea
5. Serum creatinine
6. LFTs
7. Anti HCV antibody, anti HbsAg
8. X-Ray chest
9. X-Ray abdomen in patients presenting with generalized abdominal pain.
10. ECG in patients above 40 years of age.
11. Ultrasonography

Preoperative antibiotics given to all patients. All the patients were operated under general anesthesia and operative findings were noted. The clinical and operative findings were recorded on a standard proforma.

RESULTS AND OBSERVATIONS

In our study that is completed in two and half year we operated total 641 patients for appendicitis. In this 338 patients were male (52.73%) and 303 patients were females (47.26%). According to my study acute appendicitis is more common in males.
Perforated appendix was found in 133 patients (20.74%). The incidence of perforated appendicitis is high in males 92 out of 133 (69.17%) as compared to females 41 out of 133 (30.82%). The incidence of perforated appendicitis is higher in the extreme of ages. In the first decade it is 46.15% and in the elderly it is 56.61%. Thus according to my study as shown in Table 1 extreme of age (age <10 yrs & >40 yrs) is strongly associated with the perforated appendicitis ($p<0.001$ chi-squared test).
Patients with perforated appendix who presented in emergency ward on the first day of the onset of symptoms were 6 (4.5%).

Table 1. Age distribution of perforated appendicitis

Sr. No.	Age group	Total cases	Perforated appendicitis	Percentage (%)	Affected males (%)	Affected females (%)
1.	1–10	39	18	46.15	14 (15.21%)	04 (09.75%)
2.	11–20	315	47	14.92	34 (36.95%)	13 (31.70%)
3.	21–30	178	18	10.11	14 (15.21%)	04 (09.75%)
4.	31–40	49	16	32.65	10 (10.86%)	06 (14.63%)
5.	41–50	29	16	55.17	11 (11.95%)	05 (12.19%)
6.	>50 above-ward	31	18	58.06	09 (09.78%)	09 (21.95%)

Table 2. Incidence of contributing factors for perforated appendicitis

Sr. No.	Risk factor	No. of cases	Percentage (%)
I.	Extreme of age<10yrs & >40yrs	54	40.60
2.	Delayed Presentation >72hrs	87	65.41
3.	Obstructive a ppend icitis(Fecolith)	58	44.06
4.	Diabetics	14	13.53
5.	Steroids dependency	9	6.76
6.	Jaundice	0	0.00
7.	Immunocompromised	0	0.00
8.	Pregnancy	0	0.00

Patients presented on day 2 were 18 (13.53%). Patients who presented on third day were 21 (15.78%). Maximum patients with perforated appendix presented on day 5 i.e. 44 patients (30.30%). The delay in presentation ranges from fourth day to about thirteen days. The mean delay from the onset of symptoms to surgery is 4.2 days.

The presentation of the perforated appendicitis in surgical ward varied from pain right iliac fossa only to generalised peritonitis. Most of the patients (60.90%) were admitted in ward with complaints of pain right iliac fossa with fever. 25 patients (18.79%) presented with pain only without fever. 27 patients (20.30%) were operated for generalized peritonitis due to perforated appendicitis.

Faecolith was found preoperatively in 58 patients out of 133 patients. Thus obstructive appendicitis due to faecolith is strongly associated with the perforated appendicitis ($p<0.001$ chi-squared test).

The patients with diabetes have more incidence of perforation of the appendix. Out of 133 patients of perforated appendix 14 patients were diabetics (13.53%). Diabetes is an important risk factor for the patients presenting in the surgical emergency ward with perforated appendicitis.

In our study 9 patients out of 133 operated for perforated appendix were taking steroids for other illnesses like asthma and rheumatoid arthritis etc. Steroids as immunosuppressive agent mask the symptoms of patients. The incidence of perforation of appendix is higher in patients who are taking steroid therapy. 8 patients operated for appendicitis were pregnant, but no one found having perforated appendix.

Various approaches were opted for appendicectomy in cases of perforated appendicitis. In most of cases the right lower quardrant incisions made. Grid-iron incision made in 40 patients (30.07%) and Ruther Ford Morrison is given in 66 patients (49.62%). In cases of generalised peritonitis right paremedian incision made in 20 patients (15.03%) and Midline incision given in 7 patients (5.26%).

The most common postoperative complications after appendicectomy for perforated appendicitis were fever (33.83%) and wound infection (30.07%). The overall morbidity and mortality was 40% and 1.50% respectively in cases of perforated appendicitis.

The hospital stay of the patients suffering from perforated appendicitis is significantly prolonged (mean hospital stay 7.0 days). Prolonged hospital stay was seen in elderly patients, diabetics, and in patients who

suffered from postoperative complications like wound infection or had midline and right paramedian incisions.

DISCUSSION

Acute appendicitis, the most common cause of abdominal surgical emergency, shows a different pathogenesis, clinical causes, course and outcome in different patients.[12] When acute appendicitis progress to perforation, the consequences often lead to prolonged and difficult convalescence or even to death.

The result of our study showed that perforation of the appendix is strongly influenced by the patient factors, the time lapse between the symptoms and the treatment, phase of illness, age, presence of the fecolith, pre-existing clinical condition such as diabetes, steroid dependency and immune status of patients.

Perforated appendicitis may occur when appropriate treatment for acute appendicitis is delayed for a number of reasons, including problems with access to health care, failure by the patient to interpret symptoms as important, misdiagnosis and other delays in treatment.[13] Gofrit ON and Abu-Daluk conducted a study on 581 patients and they found that total delay from symptom onset to surgery was 33 hrs in the non perforated group, 60 hrs in the perforated appendicitis group and 176 hrs in the intra-abdominal abscess group.[14] In our study the mean delay from onset of pain till surgery was 4.2 days (100.8 hrs). It has been observed that elders, diabetics and steroid dependent patients presented late for treatment as compared to other patients, that's why these patients have higher rates of perforation of appendix.

Perforated appendicitis in children continues to be associated with significant morbidity. The most likely explanation is that, delay in diagnosis is more likely in children and a higher proportion are admitted in the hospital with established peritonitis. A study by Brender JD shows that mean delay for the group with perforation of appendix was 66.7 hrs compared with 35.8 hrs for the group without perforation.[15] Mean professional delay was significantly longer in the group with perforated appendicitis than in the group having appendicitis without perforation but mean parental delay was not. It is important to recognize that the clinical picture of acute appendicitis in young children is often atypical and confusing.[16]

Appendicitis is a more serious situation in elderly patients than in young one. The higher morbidity and mortality rates among the elderly undoubtedly reflect an increased prevalence of pre-existing cardiovascular and other diseases as well as a predictable decline in many physiological functions. Gurleyik G described that morbidity and mortality rates in elder patients with perforated appendicitis are comparatively higher than the other age groups and are 35.5% and 5.5% respectively.[17] A delay in the presentation of the elder patients to the hospital may result from difficulties in leaving home, fear of hospitalization, alteration in usual symptoms and diminished perception of them or diminished ability to express themselves effectively.

Appendicitis is the most frequently encountered disease requiring surgical treatment during pregnancy.[18] Doberneck reported a series of 29 appendicectomies carried out during pregnancy without maternal or fetal death.[19] However, the risk of death of maternal or fetus increases considerably in cases of perforation of the appendix. It is the peritonitis, and not the appendicectomy that poses the risk to mother and fetus, and therefore, early operation is advised in the pregnant woman with suspected appendicitis to reduce the maternal and fetal morbidity and mortality.

Diabetes a metabolic disorder, when accompany the acute appendicitis increases the morbidity and mortality because it impairs immunity. The progression of disease from acute appendicitis to perforated appendicitis is more rapid in diabetic patients as compared to non diabetics. According to our study the un-controlled diabetes is strongly associated with perforated appendicitis and wound infection is common in such patients.

Appendicitis is difficult to diagnose in the steroid dependent patients who are taking steroids for other illnesses like asthma and rheumatoid arthritis due to anti inflammatory and immunosuppressive effects of steroids. Steroid dependent patients usually present in hospital with advance stage of appendicitis. Wound infection is common and wound healing is delayed in these patients.

Binderow SR and Shaked AA in New York carried out a study on nine HIV positive

patients presented in hospital with appendicitis.[20] According to the study most of the patients did not have elevation in WBC count preoperatively, perforated appendix found in four patients, seven patients had postoperative fever, while all nine had a significant lack of leukocytosis after study. They concluded that a desire to avoid operating on these patients resulted in an undue delay prior to exploration but use of diagnostic laparoscopy helps in earlier and more accurate diagnosis.

Although the mortality of perforated appendicitis declined due to better preoperative care, operative treatment and postoperative management but the overall morbidity from perforated appendicitis continues to be high. In the presence of gangrenous appendicitis, the morbidity increases four to five times. The morbidity in our study is 40%. Wound infection is the most common post operative complication. Elders, diabetics and steroid dependent patients with appendicitis are more prone to perforation as compared to normal population due to delayed presentation, obscure symptoms and low immune response. They are also more prone to have wound infection and other septic complications.

In a study conducted by Lord RV and Sloane SR, patients were discharged 48 hours after appendicectomy for acute appendicitis. Whereas the mean hospitalization time in case of perforated appendicitis was 8.7+/-3.2 days. According to our study, the mean hospital stay in perforated appendicitis cases is 7.0 days ranging from 4 days to 20 days.

Death is usually attributed to uncontrolled sepsis-peritonitis, intra-abdominal abscesses, necrotising fasciitis, or gram-negative septicemia. Sepsis may impose metabolic demands of such magnitude on the cardiovascular or respiratory systems that they cannot be met, in which case cardiac and respiratory insufficiency is the direct cause of death. Pulmonary embolism continues to account for some deaths. Aspiration causing the patient to drown in his or her own vomitus is a significant cause of death in the older age group. The mortality rate is 1.50% and both patients who died had a severe co-morbid medical condition with uncontrolled sepsis.

CONCLUSION

Perforated appendicitis is associated with high morbidity and mortality rates especially in children, elders, pregnant woman, diabetics, steroid dependent and immunocompromised patients. We should be aggressive in the treatment of appendicitis in the high risk patients. So once acute appendicitis is diagnosed, the expedient surgery and appropriate use of perioperative antibiotics can help to minimize the morbidity and mortality.

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