Original Article

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Epidemiology of Secondary Peritonitis: Analysis of 545 Cases

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Abstract

Introduction: Secondary peritonitis is one of the most common emergencies encountered in day to day surgical practice. Very few studies have been done on the epidemiology of this surgical entity in the Indian subcontinent.

Aims and Objectives: This study was done to collect and analyze data from patients with secondary peritonitis at one of the major hospitals in eastern India to throw some light into the related epidemiologic and etiopathologic factors.

Materials and Methods: All the patients who were diagnosed as having secondary peritonitis and who underwent laparotomy for the same were included in our study. Data on different epidemiological parameters, etiological factors, and outcome variables were collected and analyzed.

Results: In a cohort of 545 patients, 48.44% had gastroduodenal (GD) perforation. 84.58% of our patients were males. 36.51% of our patients had wound infection. We had a mortality of 8.4%.

Conclusion: Comparing our results with available world literature, we could figure out few striking differences. Acid peptic GD perforation is the most common cause of secondary peritonitis in this series which is in contrary to appendicular perforation, which tops the list in most of the available international data. The majority of our patients were from younger age group with lesser comorbidities. Wound infection was the most common complication encountered. The overall mortality of our series was 8.4%, which is on the lower side of the range of available data.

Key words: Complication, Epidemiology, Etiopathology, Peritonitis

INTRODUCTION

Secondary peritonitis (henceforth called peritonitis) is one of the most common causes of acute abdomen requiring emergency laparotomy. Despite tremendous advancements in medical care, it still remains a potentially fatal affliction. With a wide range of etiologies, peritonitis declares itself in a variety of ways. Diverse epidemiology and etiopathology are noted among populations of different socioeconomic, geographic, and climatic conditions. Although the demographic profile of the population in our part of the country is different from the rest of India in several aspects, e.g., dietary habits, the prevalence of infectious disease, etc., any robust study on peritonitis from this part of the country is lacking until date.

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Aims and Objectives

World literature is rich with volumes of publications on peritonitis. Few important studies were done in Indian subcontinent also. Most of them have showed important epidemiological and etiopathological differences from their western counterpart. The population in eastern part of India is different in several ways (diet, occupation, and climate) from those in the rest of the country. Certain pathologies and infections are more prevalent in this geographical region while others are less common. The aim of this study was to identify the epidemiological and etiopathological differences in the disease pattern in the

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background of diverse socioeconomic, geographic and climatic conditions.

MATERIALS AND METHODS

This prospective, longitudinal, observational study was done between July 2008 and June 2011 with a minimum follow-up period of 1-year, at a high volume tertiary care teaching hospital located in a densely populated metropolitan city in eastern India. The subjects of this study were all the patients with peritonitis who fulfilled the inclusion/exclusion criteria and who underwent exploratory laparotomy for the same. The patients were admitted under six different general surgical teams of our department who have rigidly followed the hospital protocol in treating these cases. Unit wise data were collected and compiled every fortnightly. Final compilation and statistical analysis were done at the end of study period.

Inclusion Criteria

All patients of peritonitis (≥12 years) who underwent laparotomy for the same.

Exclusion Criteria

i. Cases of primary peritonitis/spontaneous bacterial peritonitis/peritonitis associated with chronic ambulatory peritoneal dialysis;
ii. Cases of localized peritonitis (e.g., localized collection of bile, managed by percutaneous aspiration and/or stenting, localized collection of pus from acute appendicitis, etc.);
iii. Laparotomies performed for blunt trauma and subsequently found to have hemoperitoneum from solid organ injury;
iv. Laparotomies performed on clinical suspicion of peritonitis and subsequently found to have acute pancreatitis;
v. Pediatric patients and;
vi. Those died before the operation.

The sample size for this study was 545. Clinical diagnosis of peritonitis was starting point of data collection. All the patients presenting with clinical features of generalized peritonitis underwent clinical, biochemical (sugar, urea, creatinine, amylase, lipase, and electrolyte), and hematological (total leukocyte count, differential leukocyte count, and hemoglobin) evaluation. Straight X-ray lower chest and abdomen (in erect posture or lateral decubitus) was done in all the cases. Ultrasonography and/or contrast-enhanced computed tomography scan were done wherever considered necessary. All the patients had initial resuscitation with intravenous (IV) fluid, analgesia (IV tramadol - 2 mg/kg), and antibiotic (third generation cephalosporin and metronidazole). Further to initial evaluation and optimization, the patients underwent laparotomy as a definitive measure. Exploratory laparotomy was done following the standard principles. Drains were used in all the cases. Depending on the clinical indications stoma was constructed in some patients. All patients received standard post-operative care in the form of IV fluids, antibiotics (changed if indicated by culture report of peritoneal fluid), analgesics, nasogastric tube aspiration, etc., as per the clinical situation. ITU support was provided wherever indicated. Post-operative complications were noted along with their time of onset since the operation. Patients were discharged when clinically indicated. The collected data were compiled, and statistical analysis was done using Cochran–Mantel–Haenszel Chi-square test.

RESULTS

Spanned over a period of 3-year, we had 545 cases in our series. A clear male predominance was found in our cohort (n = 461; 84.58%). Gastroduodenal (GD) perforation due to acid peptic disorder (henceforth called GD perforation) remained the most common cause of peritonitis in our series (n= 264; 48.44%). Among 264 cases of GD perforation, 251 (95.07%) were males and only 13 were females (Table 1); clearly showing significant male preponderance ($P < 0.0000001$). Similarly, peritonitis from appendicular perforation, gangrenous intestinal obstruction, abdominal trauma, and typhoid ulcer perforation was also found to be much more common in males. The majority of the trauma patients were also males (89.18%) (Table 1). The age range (Table 1) of our patients was 16-87 years with mean age being 31.9 years. Analysis of month wise incidence of cases failed to reveal any notable seasonal variation.

Apart from peritonitis due to gangrenous changes or perforation of hollow viscus, other causes of peritonitis in our series (grouped as "miscellaneous") were ruptured liver abscess (n = 5), septic abortion with uterine perforation (n = 8), anastomotic dehiscence (n = 8), and post-cholecystectomy bile leak with generalized peritonitis (n = 4). This group was unique in the present series for showing a clear female predominance against the overall trend. The inclusion of peritonitis following septic abortion was the key factor behind this female predominance.

The majority of the traumatic perforations resulted from blunt trauma (n = 56, 75.67%) with the remainder from penetrating type (stab, firearm, splinter, and rectal impalement). The range of injuries following penetrating trauma included jejunoileal, gastric, pancreaticoduodenal, colonic, and rectal perforations. 12.16% of the patients with traumatic perforation also had concomitant solid

organ injuries ($n = 09$) and 21.62% had bowel perforations at multiple sites ($n = 16$). We had 2 pancreaticoduodenal injuries among the 56 cases of blunt trauma (3.57%) and 3 such cases among the penetrating trauma group ($n = 18$, 16.66%). In our series, we had only 7 cases of gastric perforation among all the trauma cases (9.45%), all of which were following penetrating trauma.

Typhoid ulcer perforation and peritonitis secondary to gangrenous and/or perforated intestinal obstruction were the fourth and fifth important causes in our series. Among the 34 cases of peritonitis following intestinal obstruction, we had 14 cases of the gangrenous small gut (41.17%) and 13 cases of gangrenous sigmoid volvulus (38.23%). Gangrenous small gut was predominantly due to strangulating obstructions by bands. Sigmoid volvulus is a very common cause of intestinal obstruction in this geographical region.

It was found that 34.86% ($n = 190$) of our patients presented to the hospital within 24 h and 48.44% ($n = 264$) of them presented in between 24 and 72 h of onset of abdominal symptoms (Table 2). It was also observed that there was a trend among trauma patients to present early, whereas intestinal obstruction and typhoid ulcer perforation patients more often presented late.

In patients, wound infection ($n = 199$; 36.51%) and infective chest complication ($n = 183$; 33.57%) were the two major causes of morbidity (Table 3). Wound infection was the most significant complication in cases with appendicular perforations ($P < 0.0001$) and chest complication was the most common complication for cases with GD perforation (Table 3), which was significantly high ($P < 0.01349$). There was no significant association between the causes of peritonitis and other post-operative morbidities. Unit wise data analysis also showed identical figures without significant difference in wound infection and chest complication rates, range being 36.5 ± 2.2% for wound infection and 33.5 ± 1.9% for chest complications.

The majority of the survivors of GD, appendicular, and traumatic perforation could be discharged before 2 weeks, whereas those with strangulated intestinal obstruction and typhoid ulcer perforation stayed longer in the hospital (Table 2). Re-exploration during the same admission was required in 34 (6.23%) patients (21 for burst abdomen with or without residual abscesses and 13 for residual abscesses only). A total of 14 patients (2.56%) required subsequent re-exploration for complications during the follow-up period. At the end of 3 years, 59 patients were lost to follow-up.

The overall mortality in our series was 8.4% ($n = 46$). The maximum number of deaths ($n = 14$, 29.78%) occurred in patients with typhoid ulcer perforations, closely followed by 9 deaths (26.47%) among the 34 patients of peritonitis secondary to intestinal obstruction group. Delayed presentations, infective complications, and multi organ failure were the main contributors to higher mortality in these patients.

DISCUSSION

Generalized peritonitis is one of the most common surgical emergencies encountered across the world. It remains one of the major causes of mortality and morbidity and warrants

Table 1: Distribution of age and sex

Age (years)	Gastroduodenal	Appendicular	Trauma	Ileal (typhoid)	Peritonitis in intestinal obstruction	Miscellaneous	Total
<30	54	48	37	25	9	12	182
30-50	155	36	30	19	11	11	266
>50	55	17	07	03	14	02	97
Total (M/F)	264 (251/13)	101 (76/25)	74 (66/08)	47 (31/16)	34 (28/06)	25 (09/16)	545 (461/84)

Table 2: Pattern of presentation and hospital stay

Pathology (*n*/%)	After 72 h	24-72 h	Within 24 h	≤7 days	8-14 days	>14 days
GD perforation (264/48.44)	23	131	110	136	106	22
Appendicular perforation (101/18.53)	19	69	13	24	42	35
Traumatic perforation (74/13.57)	03	14	57	23	44	07
Ileal perforation (typhoid) (47/8.62)	20	24	03	09	16	22
Peritonitis with intestinal obstruction (34/6.23)	21	11	02	03	20	11
Miscellaneous (25/4.58)	05	15	05	05	13	07
Total (545/100)	91 (16.69%)	264 (48.44%)	190 (34.86%)	200 (36.69%)	241 (44.22%)	104 (19.08%)
Total deaths	46 (8.44%)					

GD: Gastroduodenal

Table 3: Post-operative complications

Etiology (*n*/%)	*n* (%)						
	Wound infection	Chest problems	Wound dehiscence	Residual abscess	MOF	EC fistula	Death
GD perforations (264/48.4)	85 (32.19)	113 (42.80)	07 (2.65)	06 (2.27)	09 (3.40)	01 (0.37)	11 (4.16)
Appendicular perforations (101/18.5)	59 (58.41)	08 (7.92)	05 (4.95)	04 (3.96)	02 (1.98)	01 (0.99)	02 (1.98)
Traumatic perforations (74/13.6)	22 (29.72)	31 (41.89)	02 (02.70)	02 (02.70)	07 (09.45)	00	08 (10.81)
Ileal perforations (47/8.6)	14 (29.78)	08 (17.02)	04 (08.51)	03 (06.38)	14 (29.78)	00	14 (29.78)
Strangulated volvulus - 13	14 (41.17)	16 (47.05)	03 (08.82)	00	08 (23.52)	01 (02.94)	09 (26.47)
Strangulated small gut - 14							
Perforated intestinal obstruction - 7							
Peritonitis following intestinal obstruction (34/6.2%)							
Ruptured liver abscess – 5	05 (20)	07 (28)	02 (08)	02 (08)	02 (08)	00	02 (08)
Septic abortion – 8							
Anastomotic failure – 8							
Post-operative bile leak – 4							
Miscellaneous (25/4.6)							
Total (545/100)	199 (36.51)	183 (33.57)	23 (04.22)	17 (03.11)	42 (07.70)	03 (0.5)	46 (8.4)

EC: Enterocutaneous, MOF: Multiple organ failure

early surgical intervention. Literature search showed a few studies from different parts of our subcontinent but robust data on peritonitis from this part of India is still not available. In our patient cohort, GD perforation was the most common cause of peritonitis (48.44%) and this result corroborated with majority of the available studies from India.[1-7] However, some series showed different results with small bowel perforation as their most common cause.[8-11] This difference may probably be due to differential disease prevalence rate and/or availability of basic health facilities such as immunization, safe drinking water, safe disposal of excreta, and health awareness among the study population of those series. Studies from Nepal,[12,13] China,[14] Japan,[15] and Pakistan[16] also revealed GD perforation as the most common cause of peritonitis. However, two other series, one from Pakistan and one from Sri Lanka found small bowel perforation more commonly than GD perforations.[1] According to western experience, acute appendicitis is the most common cause of intra-abdominal infection, and colonic perforation is the second most common cause of peritonitis.[17] Low incidence of infectious diseases, such as tuberculosis and typhoid, and a higher incidence of diverticulitis and inflammatory bowel disease is responsible for this difference.[8] Again, a study among the African population in northeastern Nigeria reported that 64.6% of the perforative peritonitis cases are small intestinal in origin, most of which were following typhoid ulcers.[18] Among the perforated GD ulcers, most were located in the anterior wall of first part of the duodenum. Duodenal ulcer perforation is by far more common than gastric perforation (peptic or malignancy) all over the world, the ratio ranging from 4:1 to 20:1.[8] In our series, this ratio is 20:1. As already mentioned, some of the Indian studies found a high incidence of typhoid ulcer perforations. In contrast, only 47 (8.62%) of our patients had peritonitis from typhoid ulcer perforation. One Chinese series showed 6% of their peritonitis cases were secondary to typhoid ulcer perforation.[14] A very low incidence of typhoid ulcer perforation has also been reported from Thailand.[19]

Appendicular perforation is the second most common cause in our series (n = 101; 18.53%), and it corroborates with the results from other available studies where the incidences ranged between 5% and 41%. In our series, trauma was the third most common etiology of peritonitis and was responsible for 13.57% of the cases. A more recent study from Northern Indian state of Jammu and Kashmir showed 7% cases of peritonitis resulted from trauma and two other studies from Chandigarh showed the incidences of 21% and 9%, respectively.[2,3,20] A study by Noon *et al.* from Texas, a state known for high incidence of violence, showed penetrating trauma as the leading cause of peritonitis (210 out of 430; 48.8%), followed by appendicular (n = 92; 21.3%) and GD perforation (n = 68; 15.8%).[21] This rising pattern of traumatic injury is related to urbanization and industrialization in developing and developed countries.

In this study, most of the patients were in the age group of 31-50 years (mean age being 31.9 years) which is similar to the observations of most of the authors in this subcontinent. The mean age is one decade higher in western countries which may be accounted for by the fact that colonic perforations secondary to diverticulitis are predominantly seen in the elderly population.[3,8,16,22] Most of our patients of GD perforation were middle-aged (58.71% in the age group of 31-50 years), and the majority of the patients of appendicular and traumatic perforations were below 30 years in our series which was comparable with the experiences of other studies.[1,8,23,24] We observed that ileal perforation was most common in second and third decades, and this is comparable to other series.[25]

Table 4: Pattern of comorbidities

Comorbid conditions	GD perforation	Appendicular perforation	Traumatic perforation	Ileal perforations	Perforations following intestinal obstruction	Miscellaneous	Total (%)
DM	14	04	02	00	03	1	24 (04.40)
HTN	31	10	01	00	13	1	56 (10.27)
COPD	37	05	01	00	06	0	49 (08.99)

GD: Gastroduodenal, DM: Diabetes mellitus, COPD: Chronic obstructive pulmonary disease

All the leading causes of perforative peritonitis in our series were more common in males, but male predominance was even more prominent in GD perforation. This observation is consistent with results of available literature, although the ratio varies from series to series.[1-3,8,18] The majority of our patients presented between 24 and 72 h (48.44%) of onset of abdominal symptoms. Most of the trauma patients reached us within 24 h (77.02%). However, intestinal obstruction and typhoid ulcer perforation patients showed a tendency to present late, more often after 72 h (21 of 34 [61.76%] and 20 of 47 [42.55%], respectively). According to the observations by Jhobta *et al.* in Chandigarh and Gupta *et al.* in Jammu and Kashmir, 47% and 60% of their patients presented within 24 h, respectively, which is a better scenario than ours (overall, 34.86% presented within 24 h).[3] In Nigeria, where the incidence of typhoid ulcer perforation is very high, the mean time lapse between the onset of symptoms and presentation to hospital is 5.4 ± 3.7 days.[18]

The majority of our patients did not have any comorbidity (Table 4), a finding similar to other available literature.[2,3] Hypertension is the most common comorbidity found in our series, closely followed by respiratory disease (chronic obstructive pulmonary disease) and diabetes mellitus. This finding is contradictory to observations of other series from India and abroad where respiratory disease topped the list of a comorbid condition.[3,16] In our series, we did not have any patient with concomitant renal disease which, however, is mentioned as the second most common association in some of the world literature.[3,16]

Wound infection (36.51%) was the most common post-operative complication among our patients, followed by chest complications (33.57%). Chest complication rate was significantly higher in cases of GD perforation, whereas post-operative wound infection was much higher following appendicular perforation. In different kinds of literature, wound infection rate varies from 16% to 42% and chest complication varies from 20% to 26%.[2,3,8,16,18] A few studies identified higher incidences of abdominal wound dehiscence, accounting for up to 11% of their cases.[2,3,8,16] Overall mortality in our series was 8.4%, and the highest mortality rate was found among the patients with ileal perforation due to typhoid ulcer (29.78%). In different series, overall mortality rate varied from 6% to 23%.[1-5,8-11,13,15,16,18,25] Mortality rate among ileal perforation cases varies from 3% to 60% in different series.[1,8,18,25]

We observed a comparatively lower mortality than many of our Western counterparts in spite of working with limited resources. We assume that this was due to the facts that: (i) Main bulk of our patients was with acid peptic GD perforations and (ii) majority of our patients were of younger age group without many comorbidities.

CONCLUSION

We conducted this study on patients with peritonitis to have epidemiological data from our part of the country since none is available so far. Our patient cohort does not represent the entire population from this region and is mainly from the weaker socioeconomic group, and the data is representative of the adult population. Comparing our results with those observed in other available world literature we found that many of our results are similar to other series. However, we noted a few striking differences as well.

Surgical site infection was the most common complication we encountered, closely followed by chest complications especially among patients of GD perforations. The overall mortality of our series was 8.4%, which is on the lower side of the range of other studies. We observed that majority of our patients were from the younger age group with less number of associated comorbidities in comparison to the western patients. GD perforation was the most common cause of secondary peritonitis in our series which is in contrary to appendicular perforation which tops the list of most of the available international data. It was noted that the patients in our series presented relatively late which contributed to some of the mortalities, although it was observed relatively less morbidity and mortality among the patients.

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