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Research Article

Prognostic factors in perforative peritonitis: an observational study

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ABSTRACT

Background: Perforative peritonitis is the most common surgical emergency in India that requires prompt and optimum surgical attention. Despite advances in surgical techniques, antimicrobial therapy and intensive care support, management of peritonitis continues to be highly demanding, difficult and complex. This study was aimed to identify factors in patients with peritonitis which have a significant bearing on morbidity and mortality.
Methods: The study was a single center, prospective observational study conducted in Lokmanya Tilak Municipal Hospital, Sion, Mumbai. 50 patients with perforative peritonitis presented to the emergency were included in our study. Detailed history & clinical examination performed, routine blood investigation were done followed by the use of appropriate diagnostic procedures such as X-ray erect abdomen, with additional help of abdominal ultrasound and abdominal CT scan. Different parameters were studied and analyzed.
Results: 50 patients studied with age range 18-60 years with mean age of presentation 36.80 years and mortality rate was 16%. Majority of cases were male 88%. Tuberculosis was the most common co-morbidity (16%), most common site of perforation was gastroduodenal perforation (61%) [duodenum (48.9%) gastric (12.8%)] with peptic ulcer as the most common histopathology. We found most of the patients having no growth in peritoneal contamination followed by E. coli (34%) highly sensitive to amikacin. Most common complication was wound infection. We found delayed presentation >24 hrs, blood pressure <90 mmHg, respiratory rate >/=24/min, number of perforation, size of perforation >/=1 cm, site of perforation, amount of contamination >1000 ml and Mannheim's peritonitis index were the prognostic factors associated with morbidity. We could not find association between older age, sex, creatinine and hemoglobin but they were associated morbidity.
Conclusions: The late admission to the hospital a very important cause of adverse outcome, leads to deterioration of patients. Tachycardia, tachypnea, hypotension, anemia, renal failure and septicemia, amount of contamination, size and number of perforations are the factors significantly predicting death (each significant at 5%). Thus, if patients having above mentioned symptoms could be detected early and prompt treatment could be provided accordingly; mortality can be reduced.

Keywords: Perforative peritonitis, Prognostic factors, Mortality, Morbidity, Observational study

INTRODUCTION

Peritonitis due to hollow visceral perforation is commonly encountered in surgical practice. It is defined as inflammation of the serosal membrane that lines the abdominal cavity and the organs contained therein.[1]

Peritonitis is often caused by introduction of an infection into the otherwise sterile environment through perforation of bowel or introduction of a chemically irritating material, such as gastric acid from a perforated ulcer. The different modes of presentation of cases may be misleading to the diagnosis of its origin. In contrast to western countries where lower gastro-intestinal tract

perforations predominate, upper gastro intestinal tract perforations constitute majority of the cases in India.[1] Smoking, use of non-steroidal anti-inflammatory drugs, chronic Helicobacter pylori infection, excessive alcohol, coffee, and stress are important risk factors for perforation.[2-5]

Diagnosis is usually made clinically and confirmed by the presence of pneumoperitonium on radiographs and CT scans.[5] The investigations should be such that it gives a definitive diagnosis in a short time. Treatment revolves around two components, early resuscitation and surgical interventions like primary closure, resection and anastomosis, staged procedure (drainage followed by laparotomy) or diversion procedure (creation of a stoma). Non-operative management is successful in patients who have been identified to have a spontaneously sealed off perforation; proven by a water soluble contrast CT scan.[2,3,6] Operative management of peptic ulcer perforation consists of time honored practice of omental patch closure, but this can also be done by laparoscopic method.[3,6]

Now-a-days, operative management of peritonitis consists of simple closure of the perforation with a thorough peritoneal lavage and if required, a resection and anastomosis, ostomies may be done in a small or large bowel perforation.[3,7]

In colonic cancer presenting with a gross contamination of the peritoneum, resection of the pathologic part with a diversion procedure like Hartmann's procedure is considered.[8] Peritonitis secondary to perforation of the gastro intestinal tract, a common occurrence in this country, requires emergency surgical intervention and is associated with significant morbidity and mortality rates.

Aim

The present study was aimed at the effect of prognostic factors on mortality and morbidity in perforation peritonitis.

METHODS

A single center, prospective observational study was designed in Lokmanya Tilak Municipal Hospital, Sion, Mumbai, a tertiary care hospital in the city from May 2012 to May 2014. 50 cases were observed.

Consecutive patients with perforative peritonitis admitted to the emergency and those who were fitting into the eligibility criteria included in the study. A detailed history and clinical examination and blood investigation performed followed by use of appropriate diagnostic procedures such as X-ray, CT-scan with additional help of USG and diagnostic paracentesis if required and according to the need of the hour. Depending on the clinical and imaging findings, patients primarily resuscitated and according to hemodynamic status either staged procedure or exploratory laparotomy performed. Intra-operative findings noted and peritoneal fluid sent for culture and sensitivity and ulcer biopsy or resected specimen for histopathology. On the basis of intra-operative findings and amount of contamination decisions were taken to perform primary closure or resection and anastomosis or diversion. Post-treatment, patients were evaluated and overall complications, number of hospital days (morbidity) and final outcome (death/discharged) were determined.

Eligibility criteria

Consecutive patients of perforative peritonitis during the period of May 2012 to May 2014 admitted to emergency ward with following inclusion and exclusion criteria.

Inclusion criteria

- Of either sex
- 18-60 years of age
- Willing to participate in the study with valid consent
- Patients presenting with acute abdomen with pneumoperitonium on X-rays and/or CT scan, USG.
- Patient presenting with acute abdomen and perforation diagnosed intraoperative.
- Positive diagnostic aspirations (abdominal paracentesis)

Exclusion criteria

- Patients with perforative peritonitis not willing to participate in the study.
- Traumatic perforations
- Iatrogenic perforations
- Not coming under 18-60 years of age
- Pregnancy and lactation.

Organization of work elements

Main parameters studied were age, sex, stage of presentation (early <24 h /late >/=24 h), addiction, comorbid diseases (HTN/DM/BA/TB /COPD), mean systolic blood pressure at admission (<90 mmHg/>/=90 mmHg), heart rate (<100 per min/>/=100 per min), respiratory rate (<24 per min/>/=24 per min), hemoglobin (<10 mg/dl / >/=10 mg/dl), serum creatinine (<1.4 mg/dl />/=1.4 mg/dl), number of perforations (single/multiple), size of the perforation (<1 cm />1 cm), site of perforation, amount of peritoneal contamination (<1000 ml />1000 ml), operative procedure (primary closure/resection anastomosis/stoma/staged procedure), MPI (Mannheim Peritonitis Index), histopathology report, pus culture and sensitivity, number of hospital day, outcome (death or discharge), complications, consecutive patients with diagnosis of perforation peritonitis were asked to take part in this study which was approved by the local research ethics committee. The diagnosis of perforation peritonitis was made by clinical examination supported by X ray/CT/abdominal paracentesis/USG.

The preoperative resuscitation was followed by evaluation included history and clinical examination. Routine blood investigation included Hb-CBC, serum creatinine and ABG done. According to hemodynamic status either staged procedure or exploratory laparotomy performed. Intra-operative findings noted and peritoneal fluid sent for culture and sensitivity and ulcer biopsy or resected specimen for histopathology. On the basis of intra-operative findings and amount of contamination decisions were taken to perform primary closure or resection and anastomosis or diversion. Above mentioned factors noted preoperatively. Post- treatment, patients were evaluated & overall complications, number of hospital days, complications and final outcome noted.

Data collection and tabulation of findings

All patients presenting to the tertiary health centre with perforation peritonitis with inclusion criteria were assessed and aforesaid parameters were entered in case record performa. The patients were handed out an informed consent form and Patient's Information Sheet. Then the findings of the study were analyzed under a set of fixed parameters as described and the observations were thus tabulated.

Statistical analysis

The results are presented in terms of percentage. The values were analyzed using the Chi-square test of significance. All the statistical tests were interpreted at 5% significance level.

RESULTS

50 consecutive cases of perforation peritonitis were studied at the tertiary health centre and the data was collected and tabulated in the form of a Master chart and various parameters studied. The results of the demographic data showed that the mean age of the patients was 36.80 years and range was 18 – 60 years.

This result reveals that 33.33% of the mortality rate in age group 41-50 years which is highest followed by the deaths in age group 51-60 years is 28.6%. There is increasing trend in mortality with age except there is slight drop in age group 51-60 and 60% of >10 day hospital stay was found in that age group. However, the percentage is decreasing with the decreased age range. Out of 44 male patients 13.63% were found mortal when 33.33% were mortal out of 6 female patients. This study also revealed that 39.5% male had >10 days hospital stay which was less as compared to 75% of females, but the difference was not statistically significant.

In this study, 3.3% mortality rate in patients with <24 hrs presentation which was less as compared to 35.0% mortality rate with >/=24 hrs presentation and the difference is statistically significant and 37.93% patients had >10 days hospital stay with <24 hrs stage of presentation which was less as compared to 53.84% patients with >/=24 hrs stage of presentation, but the difference was not statistically significant.

26.11% of the addicted cases died in hospital which was more as compared to 11.43% of not addicted, but the difference was not Statistically Significant and 45.45% of the addicted had hospital stay >10 days which was more as compared to 41.94% of non-addicted, but the difference was not statistically significant.

Table 1 reveals that number of cases with no co-morbidity had death of 7.5% and no of death in hypertension and DM are 100% & 50%, in TB 33.33% which is statistically significant. Due to small sample size we can't generalize the statement to whole population but it is as obvious that presence of co morbidity will increase the hospital stay.

7.69% of the cases with heart rate <100/min died which was significantly less as compared to 25% of cases with heart rate>/=100/min, but difference was not statistically significant and 29.17% of the cases with heart rate <100/min had hospital stay >10 days which was less as compared to 61.11% of cases with >/=100 heart rate, and the difference was statistically significant.

This result shows that 35.71% of the cases with blood pressure <90mmHg died which was significantly more as compared to 8.33% of cases with blood pressure >/=90 mmHg, and the difference was statistically significant and 77.77% of the cases with blood pressure <90 mmHg had hospital stay >10 days which was more as compared to 33.33% with Blood Pressure >/=90 mmHg, and the difference was statistically significant.

This result indicates that, 8.57% of the cases with respiratory rate <24/min died which was less as compared to 33.33% of the cases with respiratory rate >/=24/min, and the difference was statistically significant and 31.25% of the cases with respiratory rate <24/min had hospital stay >10 days which was les as compared to 80.00% of the cases with respiratory rate >/=24/min, and the difference was statistically significant.

This result shows that, no cases with hemoglobin <10mg/dl died so, as such we can't comment on association between low hemoglobin and mortality as there is no mortality in cases with hemoglobin >/=10mg/dl and 100% of the cases who belong to hemoglobin <10 mg/dl had hospital stay >10 days which was more as compared to 36.8% cases with hemoglobin >/=10 mg/dl, and the difference was statistically significant.

Table 1: Various parameters and their association with the cases of mortality and morbidity.

	Number of cases N=50 (%)	Mortality		P value	Number of cases (N=42)	Hospital stay >10 days (morbidity)		P value
		Number	%			Number	%	
Age (years)								
12--20	8 (16)	0	0	P=0.099*	8	2	25	P=0.789*
21-30	9 (18)	0	0		9	4	44.44	
31-40	11 (22)	1	9.1		10	4	40	
41-50	15 (30)	5	33.33		10	5	50	
51-60	7 (14)	2	28.6		5	3	60	
Gender								
Male	44 (88)	6	13.63	P=0.217*	38	15	39.5	P=0.172*
Female	6 (12)	2	33.33		4	3	75	
Stage								
<24 hrs	30 (60)	1	3.3	P=0.003	29	11	37.93	P=0.335*
>/=24 hrs	20 (40)	7	35		13	7	53.84	
Addiction	15 (30)	4	26.67	P=0.178*	11	5	45.45	P=0.839*
No Addiction	35 (7%)	4	11.43		31	13	41.94	
Co-morbidity								
No co-morbidity	40 (80)	3	7.5	P=0.003		15	40.5	P=0.473*
Hypertension	01 (2)	1	100			-	-	
DM	02 (4)	1	50			1	100	
TB	06 (12)	2	33.33			2	50	
Coronary artery Disease	01 (2)	1	100			-	-	
Heart Rate								
<100	26 (52)	2	7.69	P=0.095*	24	7	29.17	P=0.038
>/=100	24 (48)	6	25		18	11	61.11	
Blood pressure								
<90 mmHg	14 (28)	5	35.71	P=0.018	9	7	77.77	P=0.017
>/=90 mmHg	36 (72)	3	8.33		33	11	33.33	
Respiratory Rate								
<24/min	35 (70)	3	8.57	P=0.029	32	10	31.25	P=0.007
>/=24/min	15 (30)	5	33.33		10	8	80	
Hemoglobin								
<10 mg/dl	4 (8)	0	0	P=0.363*	4	4	100	P=0.015
>/=10 mg/dl	46 (92)	8	33.33		38	16	36.8	
Serum creatinine								
<1.4mg/dl	32 (64)	4	12.5	P=0.368*	28	9	32.14	P=0.047
>/=1.4mg/dl	18 (36)	4	22.22		14	9	64.28	
No. of Perforation								
1	46 (92)	4	8.7	P=0.003	42	18	42.86	
>1	1 (2)	1	100		0	0	-	
Size of Perforation								
<1 cm	36 (72)	1	2.8	P=0.002	35	12	34.3	P=0.012
>/=1 cm	11 (22)	4	36.4		7	6	85.7	
Site of Perforation								
Gastric	6 (12.8)	1	16.7	P=0.000	5	1	20	P=0.385*
Duodenum	23 (48.9)	0	0		23	11	47.8	
Ileum	12 (25.5)	1	8.33		11	5	45.5	

Appendix	2 (4.3)	0	0		2	0	0	
Colon	4 (8)	3	75		1	1	100	
Amount of Contamination								
<1000 ml	34 (68)	3	8.8	P=0.044	31	9	29	P=0.002
>/=1000 ml	16 (32)	5	31.2		11	9	81.8	

*- Statistically not significant

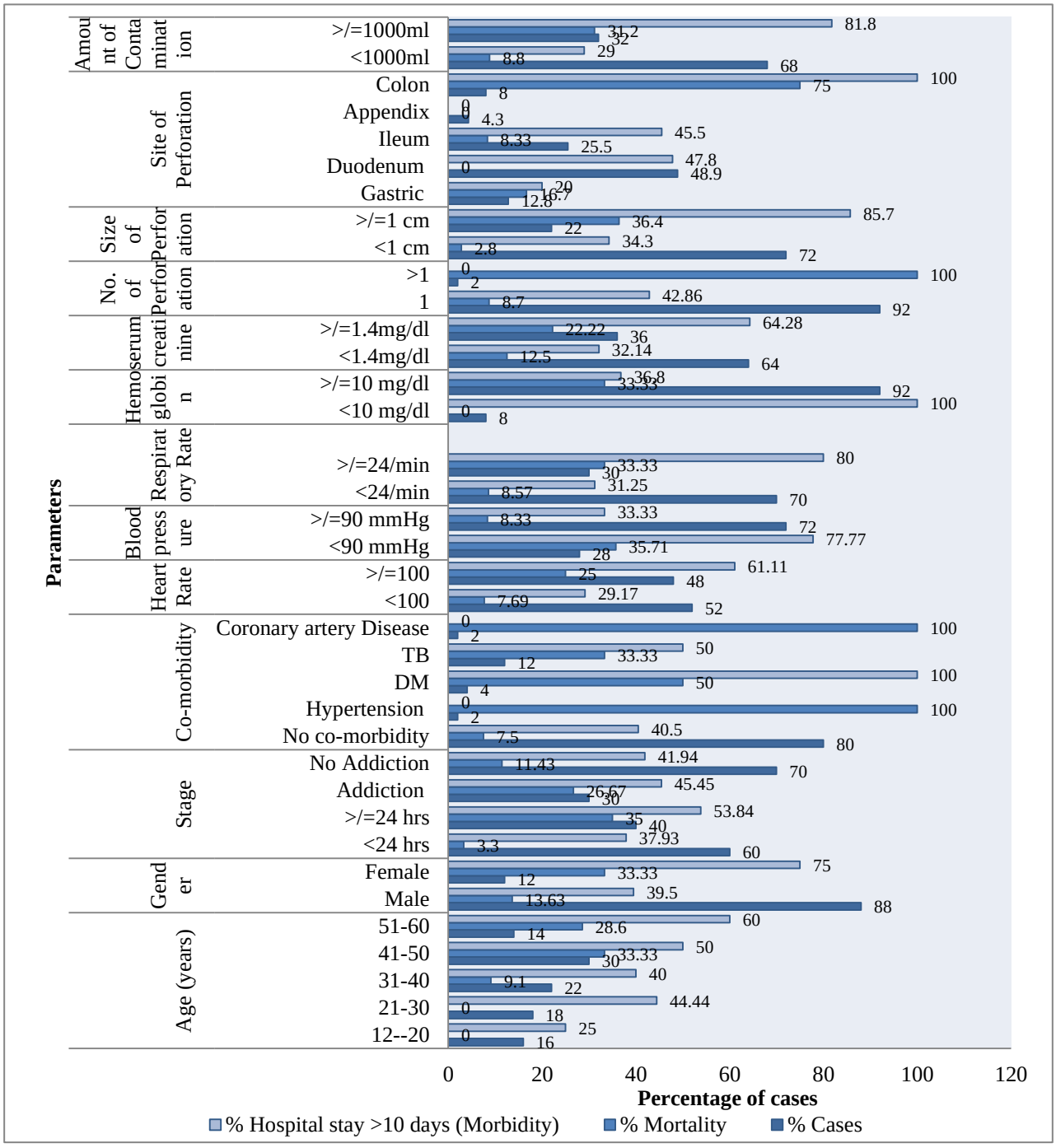

Figure 1: Comparison of percentage of cases with mortality and morbidity.

12.5% cases with creatinine <1.4 mg/dl died which was less as compared to 22.22% cases with creatinine >/=1.4 mg/dl, but the difference was statistically not significant and 32.14% cases with creatinine <1.4 mg/dl had hospital stay >10 days which was less as compared to 64.28% of cases with creatinine >/=1.4 mg/dl, and the difference was statistically significant.

The study results that, 8.7% cases with single perforation died which was significantly less as compared to 100% cases with >1(multiple) perforation, and the difference is statistically significant. As we have small number of cases we cannot apply this data to whole population. 3 patients died before surgical intervention so those perforation cases are not involved. We cannot comment on whether number of perforation has any association with morbidity since we have small sample size and this study does not have survived cases of >1 perforations.

This result reveals that 2.8% of the cases with <1 cm size of perforation died which was significantly less as compared to 36.4% of cases with >/=1 cm size of perforation, and the difference was statistically significant. 3 patients died before surgical intervention, so those perforation cases are not involved and 34.3% of cases with <1 cm of perforation had >10 days hospital stay which was significantly less as compared to 85.7% cases with >/=1 cm, and the difference was statistically significant.

Most common site of perforation is gastro-duodenal affecting 61% of population followed by ileum. Mortality rate is higher for colonic perforation. Mortality in colonic perforation is 75% which is statistically significant. Morbidity in colonic perforation is 100% which is more but not statistically significant. This result reveals that, 8.8% of cases with <1000 ml of contamination died which was significantly less as compared to 31.2% of cases with >/=1000 ml, and the difference is statistically significant and 29.0% of the cases with <1000 ml contamination had >10 days hospital stay which was significantly less as compared to 81.8% of cases with >/=1000 ml and the difference is statistically significant.

Table 2 reports that histopathology study shows that 60% of deaths in malignancy perforation are more and it is statistically significant.

The result given in Table 5 reports that 45.5% of the cases with >29 MPI died more which was more as compared to 11.5% with MPI 21-29, and the difference is statistically significant. Table 6 describes that most commonly performed surgery is primary closure 74% followed by diversion 14%. Above study reports that 63.6% of cases treated by damage control (diversion and staged procedure) procedure died, as compared to 2.6% of cases treated by definitive method (primary closure and resection and anastomosis) and the difference was statistically significant and 42.1% of cases treated by damage control (diversion and staged procedure) procedure had >10 days hospital stay as compared to 50% treated by definitive method (primary closure and resection and anastomosis) and difference was not significant. As shown in Figure 3 the most common complication is wound infection between the patients.

Table 2: Histopathology in perforation peritonitis.

Histopathology report	Number of cases	Died	%	>10 days hospital stay cases	%
Peptic ulcer perforation	28 (59.6%)	1	3.6	11	40.7
Enteric fever perforation	8 (17%)	0	0	4	50
Tuberculosis perforation	4 (8.5%)	1	25	1	33.33
Malignancy perforation	5 (10.6%)	3	60	2	66.7
Appendicitis perforation	2 (4%)	0	-	0	-
Chi-square test	P=0.003 statistically significant			P=0.641 not significant	

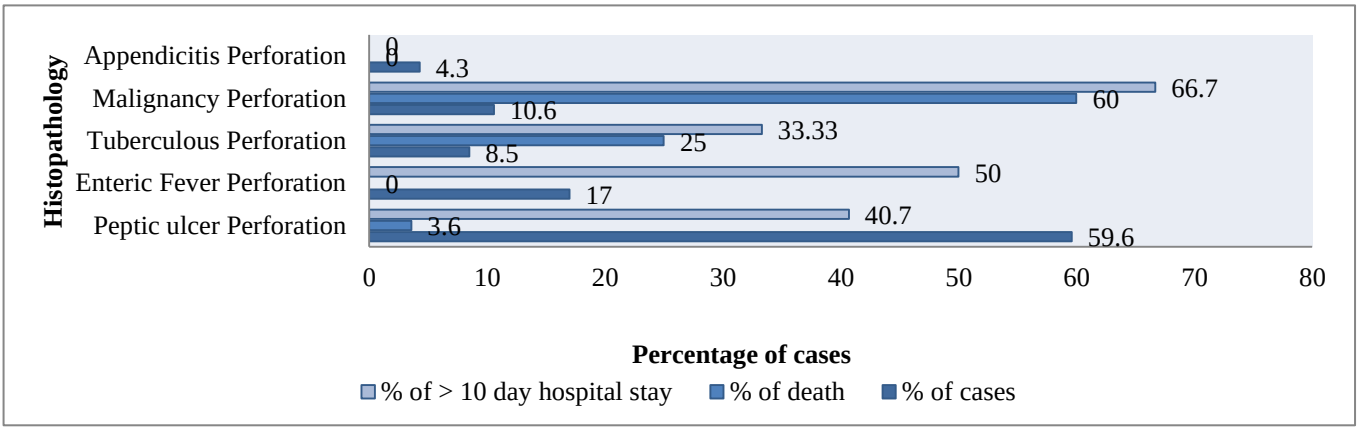

Figure 2: Study of histopathology in perforation peritonitis.

Table 3: Profile of culture finding in perforation peritonitis.

Pathogens	No. of cases	%
No growth	23	46
E. coli	17	34
Klebsiella	08	16
Enterococus	03	6
Proteus	01	2
Pseudomonas	-	-
Acinetobacter	01	2

Table 4: Profile of sensitivity of drug in perforation peritonitis.

	Amikacin	Ceftazidime	Ceftriaxone	Piperacillin+tazobactum	Imipenam	Ciprofloxacin
E. coli (N=17)	17 (100%)	16(94. 11%)	7 (41.17%)	8 (47.05%)	3 (17.64%)	3 (17.64%)
Klebsiella (N=08)	6 (75%)	6(75%)	6(75%)	-	2(25%)	3(37.5%)
Enterobacter (N=3)	1 (33.33%)	-	-	1 (33.33%)	2 (66.67%)	-
Proteus(N=1)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	
Acineitobacter (N=1)	-	-	-	1(100%)		1(100%)

Table 5: Association between Mannheim's peritonitis index (MPI), mortality and morbidity in study cases.

MPI	Number of cases (N=50)	Mortality		Number of cases (N=42)	>10 days hospital stay(morbidity)	
		Number	%		Number	%
<21	13	0	0.0	13	2	15.4
21-29	26	3	11.5	23	11	47.8
>29	11	5	45.5	6	5	83.3
Chi-square test		P=0.007 Statistical Significant		Chi-square test	P=0.016 statistical significant	

Table 6: Association of surgery with the cases of mortality and morbidity.

Surgery	Number of cases (N=50)	Mortality		Number of cases (N=42)	>10 days hospital stay(morbidity)	
		Number	%		Number	%
Definitive	39	1	2.6	38	16	42.1
Damage control	11	7	63.6	4	2	50
Chi-square test		P=0.000 statistical significant		Chi-square test	P=0.762 statistical not significant	

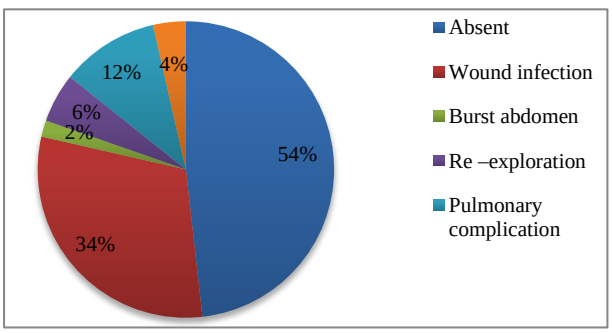

Figure 3: Study of complications.

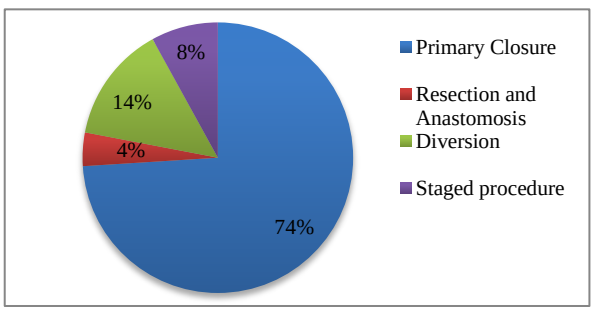

Figure 4: Study of surgical management in study cases.

DISCUSSION

A total of 50 patients admitted to emergency with perforation peritonitis and those fitting inclusion criteria during fixed specified period were studied in Lokmanya Tilak Municipal Hospital, Sion, Mumbai. The results obtained in the present study were compared with previously conducted similar studies.

Perforation Peritonitis is a common surgical emergency. The incidence of various types of perforation is variable.[9-11] There is definitely a regional variability in the frequency and incidence of gastrointestinal perforations with enteric perforations being encountered more frequently in the developing countries of south east Asia and colonic perforations in the far East. In India, peptic ulcer perforation is the commonest followed by enteric, tubercular, appendicular, traumatic and malignant perforations.[9,10] Enteric and upper intestinal pathology is common in developing nations as in Asia due to poor socio-economic conditions and stressful lifestyles. In western countries due to life styles and dietary habits along with genetic predisposition, large bowel pathology is common.[9]

Age

In our study of 50 patients, Incidence occurred almost same in all age groups (7-11 cases) except slightly higher in age group 41-50 and 31-40 i.e. 30% and 22% respectively. Average age of presentation was 36.80 yrs. Older age group is having relatively higher mortality and morbidity. Similar results were reported by AL-Zubayadi et al and other resaerchers.[12,1]

Sex

Out of 50 patients, 88% were male and 12% female. The ratio of male female is 7.33:1. The majority of males were probably explained by lifestyle and risk factors that contribute to ulcerations and later perforations of GI tract. These factors include cigarette smoking, consumption of food and beverages containing caffeine, alcohol abuse and physical stress. Men are more prone to these effects so the ratio favours men.[9] The study reported more mortality and morbidity in females.

Stage of presentation

Out of 50 cases, 20 patients presented with delayed presentation (>/=24 hr) and out of which 7 died which was statistically more than death rate in <24 hr presentation (p=0.003). Delayed presentation leads to septicemia and thus reduces survival rate. Also delayed presentation leads to wide spread dissemination of localized source of infection leading to more generalized peritonitis, thus making the control of pathology difficult and resulting in poor outcome with complications as reported by Paryani et al.[13] Late presentation may be due to ignorance relating to heart burn, delayed diagnosis, inaccessibility etc.[14]

Addiction

We could not find an association between morbidity (>10 days hospital stay) and addictions. 45.45% cases with addictions had hospital stay >10 days compared to 41.94% of cases of non addicts which is similar findings reported by Morris et al.[15] The authors postulated that nicotine might predispose to inflammatory complications by reducing mucosal immunity in the colon.

Co-morbidity

We could not find statistical significance between co morbidity and number of hospital stay of > 10 day though 60% patients stayed greater than 10 days with co-morbidities which was more than 54.1% patients without co -morbidities. Thus co-morbidity affects mortality but we cannot apply to general population due to small sample size. Similar findings are consistent with the studies done by Ahmed Al Zubayadi et al.[12]

Heart rate

Paryani et al found that heart rate >120/min has significant effect on mortality at 1%.[13] In our study we could not determine statistical significance related to mortality probably because the lower limit for heart rate was set up at 100/min.

Tachycardia is a manifestation of septicemia caused due to inflammatory mediators which cause fluid loss into peritoneal cavity and bowel leading to hypovolemia (third space loss). This leads to tachycardia in order to maintain cardiac output for tissue oxygenation. Peritonitis also cause increase in release of adrenal hormones causing tachycardia. If circulatory state is uncorrected and if there is delay in surgery patient can deteriorate rapidly which increased the morbidity and mortality.[16] This is consistent with our study.

Blood pressure

Paryani et al found that mortality rate was 80% for patients with blood pressure <100 mmHg. [13] The “third space” loss caused due to peritonitis results in hypotension which leads to poor oxygenation of tissues. This promotes metabolic acidosis which depresses cardiac function. Renal insufficiency also develops due to decreased renal perfusion which enhances metabolic acidosis. This eventually contributes to multiorgan dysfunction and ultimately death.[16]

Respiratory rate

Our study determines that respiratory rate affects mortality and morbidity in perforation peritonitis. Katiyar et al also got similar results to our study.[17] Abdominal

distension due to ileus together with restriction of diaphragmatic and intercostal movements due to pain results in a fall in tide volume. This predisposes to atelectasis which in turn results in ventilation perfusion mismatch and fall in partial pressure of oxygen in blood.

Hemoglobin

Our study could not comment on the association between low hemoglobin (Hb) and mortality as no mortality occurred in cases with Hemoglobin less than 10 mg%. Samuel and his coworkers reported that anemia was significantly associated with mortality, but Mishra et al could not find any relation between Hb and mortality, which is consistent with our study.[18,19]

Serum creatinine

Morbidity in cases with creatinine >/=1.4 mg% was 64.28% as compared to 32.14% in those with serum creatinine < 1.4 mg%. Thus, raised creatinine >/=1.4 cm affects the outcome of the patient. Similar findings are seen in the study by Mishra et al.[19]

Number of perforations

Our study reveals that 8.7% of cases having single perforation died which was significantly less as compared to 100% of cases with more than one perforation. We cannot comment whether the number of perforations has any associations with morbidity as there was no survival in cases of greater than single perforation. Number of perforations was a positive predictive factor in a study by Adesunkanmi et al.[20]

Size of perforation

Morbidity was higher for cases of >/= 1 cm of perforation. 85.7% cases with >/=1cm perforation had >10 days hospital stay as compared to 34.3% of those with perforation less than 1 cm. Thus, size of perforation affects mortality and morbidity in perforation peritonitis. Bashir Ahmed et al reported similar results to our studies.[21]

Site of perforation

Our study revealed that most common site of perforation is gastro duodenal followed by ileum, colon and appendix. We could not see site of perforation in 3 patients as they died before surgical intervention. Similar findings were seen by Pariyani et al.[13] Our study co-relates with the fact. Although effective treatment for H. pylori is available it is still not used as frequently in the treatment of peptic ulcer disease in developing world.

Amount of contamination

Out of 50 patients 16 patients had >/= 1000 ml of contamination out of which 5 died which was more than the patients died of having <1000 ml contamination. Similar reports are given by Bashir Ahmed et al.[21]

More the amount of contamination means generalized is the peritonitis which will lead to more septic focus finally turning into septic shock. Amount of contamination changes operative management in perforative peritonitis affect morbidity and mortality which is also one of the determinant that strategize whether or not a patient should undergo a primary repair or exteriorization of bowel.[22]

Histopathology

Our study revealed most common histopathology as peptic ulcer perforation 56.6% in which 3.6% was the death rate and 40.76% was the morbidity rate followed by enteric fever perforation 17% with no mortality and morbidity rate 50%, tuberculosis having 8.5% cases with 25% mortality rate and 33.33% morbidity rate. Malignancy accounts for 10.6% cases with mortality rate 60% and morbidity rate 66.7%. Morbidity and mortality rate was higher in malignancy and least in appendicitis, in fact none. Similar reports are given by Khan et al.[23]

Pus culture and sensitivity

We found 46% of patient with perforation peritonitis having no growth. Most common organism was *E. coli* followed by *Klebsiella. E. coli* was sensitive to amikacin followed by ceftazidime and ceftriaxone. Wittmann et al had similar findings with our study.[7]

MPI

In our study out of 11 cases of MPI >29, 5 died which was statistically more than deaths in MPI 21-29 and <21. (P=0.007) i.e. MPI is predictor of mortality. While studying morbidity, we got that patients with MPI >29 had 83.3% > 10 days hospital stay which was more as compared to patients with MPI 21-29 (47.8%) and <21 (15.4%) and the difference was significant (P=0.016). Similar findings are published by Billing et al.[24]

Complications

Our study showed 46% as complication rate. The most common complication was wound infection (34%) followed by pulmonary complications (12%). Bose et al had similar complication rate with wound infection most common complication.[25]

Surgical management

Our study indicated that most common surgical procedure used is primary closure as most common pathology was gastroduodenal perforation. It is followed by diversion procedure, resection, anastomosis and staged procedure. Karabhari et al had almost similar findings.[26]

out of 39 patients with definitive surgical procedure (primary closure and resection and anastomosis), 1 case died which is less compared to 7 cases (63.6%) with damage control (diversion and staged procedure) but this was because cases in whom damage control surgery was performed were in hemodynamically unstable state. bose et al, al-zubaydi et al had consistent findings with our study.[25,12] The choice of the procedure, and whether the ends of resected bowel are anastomosed, exteriorized, or simply closed depends on the anatomic source of infection, the degree of peritoneal inflammation and generalized septic response, and the patient's premorbid reserves.[7]

CONCLUSION

The present study is an observational study on factors affecting mortality and morbidity in perforation peritonitis. An assessment of these factors at presentation can lead to identification of patients in need of intensive care and change in the decision to an approach which includes: early preoperative evaluation, aggressive steps to correct deranged homeostasis, early surgery and vigilant post-operative care.

We have drawn the following important conclusions from our study.

- Perforation peritonitis is most commonly present in males with an average age of 36 yrs.
- Mortality and morbidity is relatively higher in older age groups.
- Upper GI perforations are more common than lower GI perforations as studied.
- The most common site for perforation is gastro-duodenal and the most common cause is peptic ulcer perforation.
- Colonic perforation causes the most morbidity and mortality in comparison to others.
- Inaccessibility to hospitals and delay in resuscitation adds to a worse outcome. So, there is a need to educate health professionals at peripheral centers about this condition in order to make the patients reach the tertiary center as early as possible.
- Co-morbidities increase morbidity and mortality burden, so a thorough history is a must for management of perforation peritonitis.
- Preoperative shock, tachycardia, tachypnea, raised creatinine and anemia affect the outcome of the patient.
- A bigger size of the perforation and multiple perforations affects the outcome of the patient adversely with increase in complications post-operatively.
- The amount of contamination is directly proportional to the morbidity.
- *E. coli* is the most common micro-organism isolated from peritoneal contamination secondary to perforation peritonitis which most sensitive to Amikacin. Hence its usage is advocated if not contraindicated.
- Mannheim's Peritonitis Index has good prognostication value.
- Wound infection is the most common complication post-operatively, which is seen early during hospital stay
- Primary closure with omental patch is the most common operative procedure performed in most hospitals but decision of definitive surgery and damage control is taken on the basis of preoperative hemodynamic status, amount of contamination, number, site, etiology and bowel status.
- The basic principles of early diagnosis, prompt resuscitation and urgent surgical intervention still form the cornerstone of management in perforation peritonitis.

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