SCIENTIFIC ARTICLE

Perforation peritonitis: a clinical profile and management

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Keywords: Perforation; peritonitis; peptic ulcer; culture; omental patch

Abstract

Perforative peritonitis is the most common surgical emergency in general surgical practice[2]. The Indian aetiological spectrum of perforation continues to differ from that of the Western world and there is the paucity of data regarding its aetiology, prognostic indicators, morbidity and mortality pattern. In the majority of cases, delayed presentation to the hospital occurs with well-established generalized peritonitis and varying degree of septicaemia.

This descriptive cross-sectional study was conducted at Dr D. Y. Patil Medical College from 2017 to 2019 with a sample size of 30 patients. All details of the patients including clinical history, examination findings, laboratory and radiological investigations, intra-operative findings, and post-operative complications were studied.

Perforation peritonitis had a male: female ratio of 3.29:1; and was more commonly seen between the age group of 21-30 years, whereas peptic ulcer perforation had a bimodal distribution (21-30 years and 51-60 years). Appendicular perforation was seen in the younger age group. Small bowel perforation commonly occured after 3rd decade of life. Descending order of perforation sites: duodenum and stomach, appendix, ileum, jejunum, colon and gall bladder. Commonest aetiology was peptic ulcer perforation, followed by appendicitis and enteric fever. Majority of patients presented after 48 hours, in the stage of established generalised peritonitis.

The diagnosis was possible by pneumoperitoneum on X-ray abdomen standing in 70% and only a few needed CT for diagnosis. Laparotomy followed by primary closure of perforation with or without live omental patch was the commonest procedure. Appendicectomy was done in appendicular perforation whereas occasionally, resection anastomosis of involved small bowel segment was required. Proximal diversion was not routinely necessary; only if there are severe contraindications to a primary RA. E. coli was the most common peritoneal contaminating organism followed by Klebsiella and Proteus mirabilis. The post-operative complication rate was 53.3% (wound infection 30%) and the mortality rate was 3.3%.

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Received: 22-10-2019 Accepted: 23-02-2020
https://orcid.org/0000-0002-5685-908X
DOI: http://doi.org/10.4038/sljs.v38i1.8649

Introduction

Peritonitis is known from the days of Hippocrates who described the Hippocratic facies that is seen in the terminal stages of diffuse peritonitis, which is even recognised today as a most valuable prognostic sign [1].

Perforative peritonitis is the most common surgical emergency in general surgical practice [2]. The Indian aetiological spectrum of perforation continues to differ from that of the Western world and there is paucity of data regarding its aetiology, prognostic indicators, morbidity and mortality pattern. In the majority of cases, delayed presentation to the hospital occurs with well-established generalized peritonitis and varying degree of septicaemia [3, 4].

Various etiological conditions include peptic perforation, appendicular perforations, typhoid, intestinal tuberculosis, Meckel's diverticulum, diverticulitis, trauma, gastrointestinal carcinomas, foreign body ingestion, gall bladder perforation secondary to gall stones, perforation due to obstruction, iatrogenic perforation.

Perforation of a hollow viscera leads to escape of the visceral contents into the peritoneal cavity. Although the initial content may be sterile, eventually it will be contaminated due to direct bacterial invasion. In elderly women, spontaneous uterine rupture is a rare cause of perforative peritonitis particularly in the absence of a history of abdominal tuberculosis or chronic analgesic intake [4].

The signs and symptoms are typical and therefore a clinical diagnosis of peritonitis is usually possible. The mainstay of treatment is adequate resuscitation, antibiotics and surgical intervention [5,6] to eliminate the source of bacterial contamination by treating the underlying pathologic process, to decrease the degree of bacterial contamination in the peritoneal cavity and to prevent recurrent or residual infection. This is achieved by either repairing the perforated

segment, resecting and anastomosing it or exteriorising it. Both immediate (wound infection/dehiscence, intraperitoneal abscess, paralytic ileus) and late (entero-cutaneous fistula, adhesive intestinal obstruction, incisional hernia) complications can occur.

The mortality of perforation peritonitis is highly dependent on early approach to the hospital, quick diagnosis and prompt surgical treatment as it correlates with the duration and degree of peritoneal contamination, the patient's age, the general health of the patient and the nature of the underlying aetiology. This study was conducted to identify the various clinical presentations, aetiology, management and post-operative complications that can occur in perforative peritonitis.

Materials and methods

Thirty patients of perforative peritonitis were included in this descriptive cross-sectional study conducted at Dr D. Y. Patil Medical College, Hospital and Research Centre, Pimpri, Pune from May 2017 to October 2019.

Inclusion criteria: All patients presenting with perforative peritonitis.

Exclusion criteria:

- Primary peritonitis
- Iatrogenic peritonitis
- Post-operative peritonitis

Approval of the Institute Ethics Committee was obtained before the commencement of the study. Informed written consent was obtained from all patients prior to their enrolment in this study. All these patients were studied with respect to their various clinical presentations at the time of diagnosis, the various causes, radiological correlation, intra-operative findings, management, peritoneal exudate cultures, post-operative prognosis and complications. All patients were taken up for emergency surgery after adequate resuscitation. The peritoneal toilet was performed in all irrespective of site or aetiology, with the mandatory placement of at least one abdominal drain. Post-operatively, the patients were followed up at one month, three months and six months.

Results

The age of patients in this study ranged from 16 to 78 years; the commonest age group was 21-30 years (43.3%). The oldest patient had a sigmoid perforation, whereas the youngest patient had an appendicular perforation. Mean age was 36.6 years. Twenty three patients (76.7%) were male and 7 patients (23.3%) were female with a male to female ratio of 3.29:1.

The commonest site of perforation was peptic perforation accounting for 36.7% of cases, followed by appendicular perforation (23.3%). Other sites included: 10% jejunal, 20% ileal, 6.7% sigmoid and 3.3% gall bladder.

Commonest aetiology was peptic ulcer perforation (36.7%), especially duodenal, followed by appendicular perforation (23.3%). Traumatic (6.7%) jejunal perforation occurred in 2 patients (1 blunt abdominal trauma and 1 penetrating abdominal trauma. There was only 1 case (3.3%) each of perforated gall bladder (empyema), tuberculosis, obstruction due to malignancy (sigmoid adenocarcinoma), obstruction due to stricture, colonic diverticulosis and jejunal diverticulosis.

Both appendicular and peptic perforation are commonest in the age group 21-30 years followed by 51-60 years. Enteric perforation is common in third and fourth decades of life. Tuberculosis is noted in third decade of life. Malignant perforation, stricture perforation and gall bladder perforation are common in the elderly (>60 years).

Thirty percent of patients presented with symptom duration of 2 days. Only 33.3% of patients presented within 24 to 48 hours of onset of symptoms. All patients had abdominal pain as presenting complaint regardless of aetiology, whereas vomiting was present in 70%, fever in 66.7% and abdominal distension in 43.3%. Only 10 patients (33.3%) had complaints of altered bowel habits; out of which, only 3 had complaints of obstipation (two of which had obstruction due to malignancy and stricture).

The majority (56.7%) had localised pain (right iliac fossa pain in 100% of appendicular perforations, right hypochondrial pain in 100% of gall bladder perforation and epigastric pain in 63.6% peptic perforations) vs. generalised pain (43.3%). Vomiting was common (72.7%) in peptic perforation. Fever was present in all cases of appendicular perforation whereas

Table 1. Aetiology of perforation

Aetiology	Number	Percentage
Peptic gastric ulcer	5	16.7%
Peptic duodenal ulcer	6	20%
Appendicitis	7	23.3%
Enteric perforation	4	13.3%
Tuberculosis	1	3.3%
Trauma	2	6.7%
Empyema gallbladder	1	3.3%
Obstruction due to malignancy	1	3.3%
Obstruction due to stricture	1	3.3%
Diverticulosis of Colon	1	3.3%
Diverticulosis of Jejunum	1	3.3%

Table 2. Distribution of cases according to age and aetiology

Aetiology	16-20	21-30	31-40	41-50	51-60	61-70	≥71
Peptic gastric ulcer	2 (40%)	1 (20%)	0	0	1 (20%)	1 (20%)	0
Peptic duodenal ulcer	0	3 (50%)	0	0	2 (33.3%)	1 (16.7%)	0
Appendicitis	2 (28.6%)	4 (57.1%)	0	0	1 (14.3%)	0	0
Enteric perforation	0	2 (50%)	1 (25%)	1 (25%)	0	0	0
Tuberculosis	0	1 (100%)	0	0	0	0	0
Trauma	0	2 (100%)	0	0	0	0	0
Empyema gallbladder	0	0	0	0	0	1 (100%)	0
Obstruction due to malignancy	0	0	0	0	0	0	1 (100%)
Obstruction due to stricture	0	0	0	0	0	1 (100%)	0
Diverticulosis of Colon	0	0	1 (100%)	0	0	0	0
Diverticulosis of Jejunum	0	0	0	1 (100%)	0	0	0

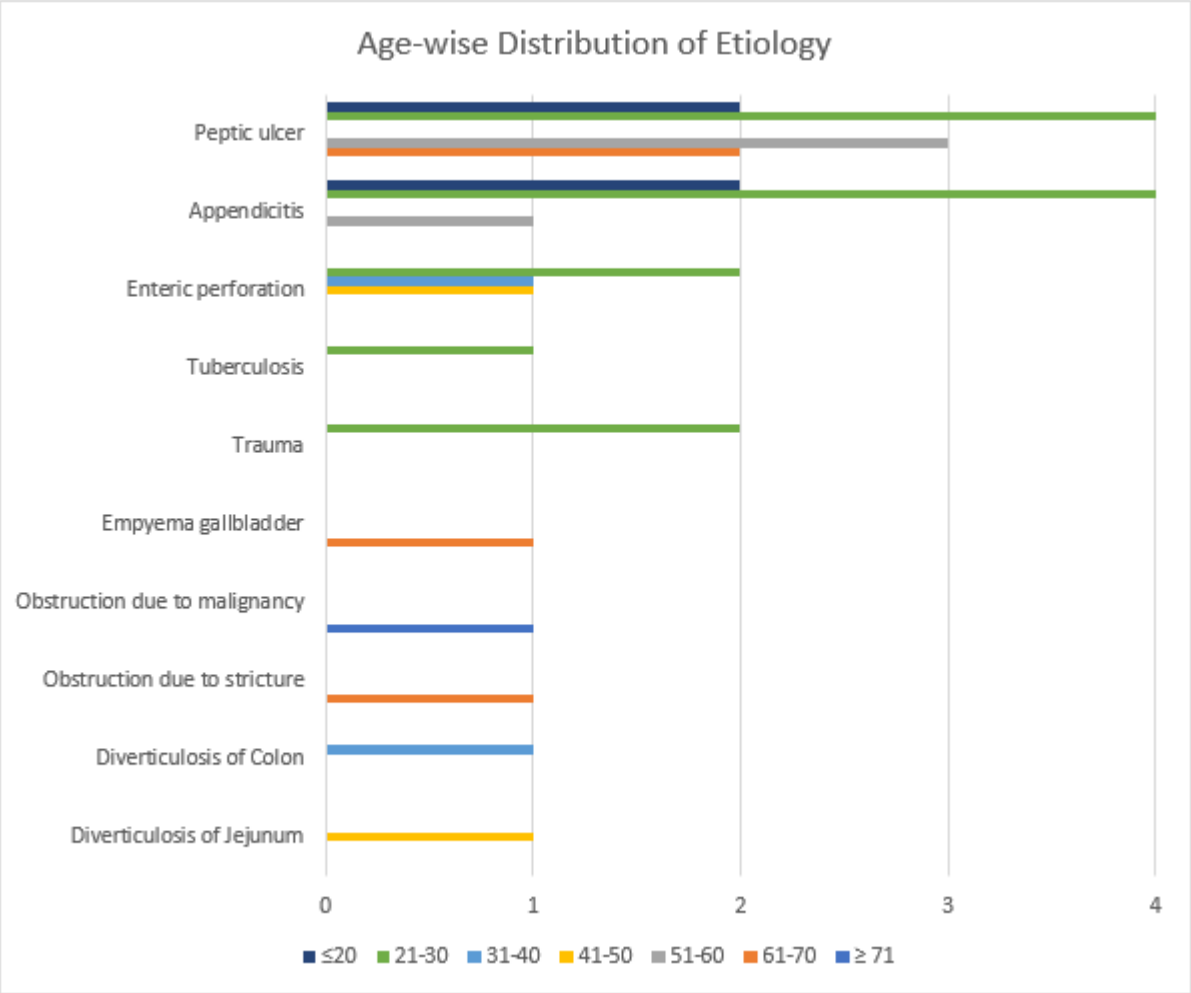

Figure 1. Distribution of cases according to age and aetiology

Table 3. Symptoms in relation to aetiology

Aetiology	Pain	Vomiting	Distension	Fever	Altered bowel habits
Peptic gastric ulcer	5 (100%)	3 (60%)	2 (40%)	3 (60%)	1 (20%)
Peptic duodenal ulcer	6 (100%)	5 (83.3%)	1 (16.7%)	1 (16.7%)	0
Appendicitis	7 (100%)	3 (42.9%)	0	7 (100%)	2 (28.6%)
Enteric perforation	4 (100%)	3 (75%)	3 (75%)	3 (75%)	3 (75%)
Tuberculosis	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Trauma	2 (100%)	1 (50%)	2 (100%)	0	0
Empyema gallbladder	1 (100%)	1 (100%)	0	1 (100%)	0
Obstruction due to malignancy	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Obstruction due to stricture	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Diverticulosis of Colon	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Diverticulosis of Jejunum	1 (100%)	1 (100%)	1 (100%)	1 (100%)	0

Table 4. Various risk factors in peptic ulcer perforations

Risk Factor	Number	Percentage
Smoking	2	18.2%
Medications	3	27.3%
Alcohol and smoking	1	9.1%
Smoking and medications	1	9.1%
Alcohol, smoking and medications	3	27.3%
No risk factors	1	9.1%

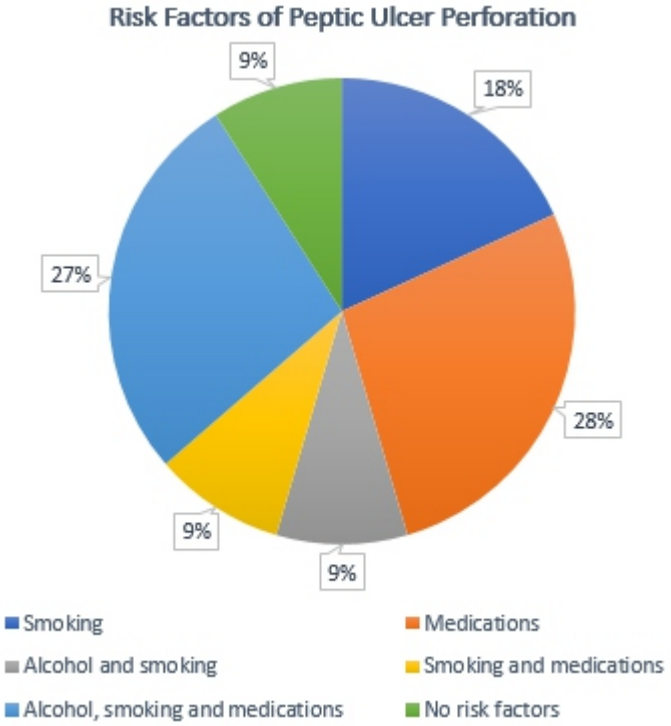

Figure 2. Risk factors of peptic ulcer perforation

Table 5. Abdominal signs in relation to aetiology

Aetiology	Tenderness	Guarding / Rigidity	Distension	Mass palpable	Reduced bowel sounds
Peptic gastric ulcer	5 (100%)	5 (100%)	3 (60%)	0	3 (80%)
Peptic duodenal ulcer	6 (100%)	5 (83.3%)	4 (66.7%)	0	5 (83.3%)
Appendicitis	7 (100%)	4 (57.1%)	3 (42.9%)	3 (42.9%)	4 (57.1%)
Enteric perforation	4 (100%)	4 (100%)	3 (75%)	0	4 (100%)
Tuberculosis	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Trauma	2 (100%)	1 (50%)	2 (100%)	0	1 (100%)
Empyema gallbladder	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Obstruction due to malignancy	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Obstruction due to stricture	1 (100%)	1 (100%)	1 (100%)	0	1 (100%)
Diverticulosis of Colon	1 (100%)	1 (100%)	1 (100%)	0	1 (100%)
Diverticulosis of Jejunum	1 (100%)	1 (100%)	1 (100%)	0	1 (100%)

vomiting was there in only 42.9%. Vomiting, abdominal distension altered bowel habits and fever were present in 75% of enteric perforations. Empyema perforation and appendicular perforation did not cause any abdominal distension. Similarly, no alteration in bowel habits was noted in peptic duodenal ulcer perforation, trauma, empyema gall bladder and diverticulosis of jejunum.

Chronic abdominal pain was seen in 46.7% cases; of which, 57.1% had peptic perforation; 21.4% had appendicular perforation; 14.3% had enteric perforation and 7.1% had empyema gallbladder. Previous recent history of typhoid fever was found in 75% of enteric perforation.

Smoking, medication and alcohol are the major risk factors in peptic ulcer perforation. Medications (NSAIDs and oral steroids) alone were present in 27.3% of cases of peptic perforation and contributory in another 36.4%. Smoking and medications were present in 9.1%, alcohol and smoking in 9.1%; alcohol, smoking and medications in 27.3%. Other risk factors noted were the previous history of peptic ulcer and intake of spicy food. Positive family history of peptic ulcer was present in 18.2%.

Tachycardia (heart rate >100/min) was present in 70% but only 16.7% had hypotension (systolic blood pressure <100 mm Hg). Four patients (13.3%) had concomitant icterus.

Although tenderness was present in 100% of cases, only 83.3% had guarding or rigidity. Distension was noted in 70% of patients versus 43.3% patients complaining of distension, more commonly observed with more distal sites of perforation. A palpable mass was noted in 20% of patients (3 cases of appendicular perforation, 1 case of tubercular perforation, 1 case of empyema gall bladder and 1 case of perforation in sigmoid malignancy). Reduced bowel sounds were present in 46.7% patients and 30% had absent bowel sounds.

Chest X-ray and erect abdominal X-ray showed pneumoperitoneum in 70% of the cases. False negative X-ray was noted in appendicular perforation and perforated empyema gall bladder. X-ray was not done in 1 patient with an open abdominal wound with bowel extruding. Ultrasound was done in all patients and was positive for features of perforative peritonitis in only 63.3% of patients. CT scan of the abdomen was not done in 63.3% of patients as it was not required for diagnosis. In the remaining 36.7% patients CT was diagnostic.

Majority of cultures from the peritoneal fluid collected intra-operatively yielded no growth of micro-organisms (56.7%). Of the micro-organisms isolated, Escherichia coli was the most common (23.3%). Majority had purulent peritoneal fluid intra-operatively (56.7%) and faecal peritonitis in 10%.

All patients underwent peritoneal toilet regardless of the operative procedure performed, 40% underwent simple closure with omental patch. Proximal diversion was required in 13.3% patients. One case of enteric fever perforation required closure with omental patch and proximal diversion due to severe oedema. Simple closure with proximal diversion (colostomy) was done in 1 case of sigmoid diverticulitis.

Only drainage was done in one case of tubercular perforation

Table 6. Various microorganisms cultured from peritoneal fluid

Microbe Grown	Number	Percentage
No growth	17	56.7%
E. coli	7	23.3%
Klebsiella	4	13.3%
Proteus	2	6.7%

with abscess formation and one appendicular perforation.

53.3% of patients had at least one post-operative complication; commonest complication was wound infection (30%) followed by paralytic ileus (more than 2 days). Mortality was only one patient secondary to sepsis and MODS.

Table 7. Post-operative complications

Complication	Number	Percentage
No complications	14	46.7%
Wound infection	9	30%
Wound dehiscence	4	13.3%
Paralytic ileus (>2 days)	5	16.7%
Intra-peritoneal Abscess	1	3.3%
Pulmonary complication	1	3.3%

Discussion

In our study of 30 cases, the incidence of peptic ulcer perforation was highest constituting 36.7%. This was followed by appendicular perforation (23.3%) and enteric fever (13.3%) perforation. Trauma was a cause of perforation in 6.7%. Tubercular perforation, obstruction secondary to malignancy leading to perforation, perforation due to obstruction caused by stricture and perforation of empyema gall bladder constituted 3.3% each. Diverticulosis was a cause of colonic perforation in 1 (3.3%) case and jejunal perforation in 1 (3.3%) case. Trauma was a cause of perforation in 6.7%.

The maximum incidence of perforation irrespective of pathology was seen between 21-30 years. Other studies observed an age trend between 31-40 years. In this study, peptic ulcer had a bimodal distribution being more common in the third and sixth decades. Sillakivi T et al [7] observed an age trend in the fifth to sixth decades. In this study, most enteric perforations occurred in the third decade of life, as compared to the study of ARK Adesunkunmi et al [8] in which a maximum number of cases occur in the second decade of life. The mean age of 25 years was observed by Dasgupta A et al [9] in his study of 56 cases of abdominal tuberculosis, and our cause of tuberculous perforation was in a 22-year-old.

Male preponderance is seen, with a male to female ratio of 3.29:1. This is consistent with ARK Adesunkunmi et al [8] and Lee FY et al [10] who has ratios of 4:1 and 5.1:1.

Peptic ulcer perforation was predominantly seen in males in this study. A similar observation was noted by W. T. Siu et al [11] in his study of 33 cases. Abdominal pain, vomiting and fever were the predominant symptoms in our study. Abdominal pain was reported by 100% patients and similar findings have been reported by Kachroo et al [12] and J C Baid et al [13]. History of fever in the recent past followed by pain in the abdomen and recent history of typhoid was a clinical diagnostic tool for enteric fever perforation. S. K. Nair1 [14] and M. A. Noorani1 [15] have observed similar history. Vomiting was relatively common in appendicular perforation (42.9% cases). Fever was seen in 100% cases with appendicular perforation like the observations of M. C. Dandpat et al [16].

Non-steroidal anti-inflammatory drugs are known to precipitate peptic ulcer disease and even give rise to complications of peptic ulcer as well such as perforation, bleeding, the mechanism being mediated through inhibition of prostaglandin synthesis. Seven of 11 cases (63.6%) of peptic ulcer perforation revealed the history of NSAIDs intake (oral or injectable).

W T Siu [11] found 6 of 33 patients (18.2%) revealed the same. Smoking, medication, and alcohol are the major risk factors in peptic ulcer perforation. Torab FC [17] in his study of 116 cases has described smoking, history of peptic ulcer and use of NSAIDs as common risk factors for perforation. On examination of the abdomen, tenderness was present in 30 cases (100%), guarding and rigidity in 25 cases (83.3%), distension in 21 cases (70%) and reduced bowel sounds in 23 cases (76.7%). J. C. Baid et al [13] reported in 54 cases: 85.2% having distension, 100% having guarding/ rigidity and 53.7% having absent bowel sounds.

Even though the presence of pneumoperitoneum is a hallmark of perforation of hollow viscera, the absence of this does not exclude the possibility of perforation. This sign is visualised only in about 75% of perforation cases. In our study, we found it in 21 (70%) cases. Our study correlates well with T Kempraj et al [18] (75%) and MC Dandpat et al [16] 72.35%).

Out of 30 cases, in 17 cases (56.7%) there was no growth. In 7 (23.3%) cases cultures were positive for E. coli and 4 (13.3%) for Klebsiella. The present study correlates with V. P. N Ramakrishnaiah et al [19] having 23.01% E. coli and 12.21% Klebsiella.

Gastroduodenal perforation is the commonest perforation (36.7%). This is consistent with other studies by Khan et al [20] (38.8%), Doraraijan et al [21] (32%) and Shreshta et al [22] (32.5%). The small bowel is the second most common site of perforation (30%). This is consistent with studies by Qureshi et al [23] (29.4%) and Nishida et al [24] (31%). Appendicular perforation is 23.3% like Shah et al [25] (28.1%). Colonic perforation is 6.7% like Khan et al [20] (7.4%).

Duodenal perforation was noted in 6 cases (54.5%) of gastroduodenal perforations. This present data is consistent with other studies like Sui et al [11] (68.6%).

In the present study, small bowel perforation occurred in 9 cases of which enteric fever perforation occurred in 4 patients (44.4%), whereas remaining 2 (22.2%) patients had traumatic perforation, 1 (11.1%) had diverticular perforation and 1 (11.1%) had perforation secondary to stricture. This data is consistent with other studies like Khan et al [20] (50% enteric fever) and Sharma et al [26] (67.7%). Tuberculosis causing small bowel perforation was seen in 1 patient (11.1%) consistent with Dorairajan et al [21].

Laparotomy was performed in all 30 cases; the incision was planned according to the site of perforation. Contamination of the peritoneal cavity was noted, and peritoneal fluid sent for culture and viscera inspected and bowel screened for the site of perforation. For all peptic ulcer perforations (5 cases of gastric and 6 cases of duodenal perforation), simple closure of the perforation was performed with live omental patch. Worldwide literature agrees with the same.

M C Dandapat et al [16] in his study of 340 cases did the same. All the gastric ulcers were biopsied, and all turned out to be of benign aetiology. For typhoid perforation, after trimming the edges, simple closure of the perforation was done in 2 cases. Two cases had friable bowel so additional omental patching was done. None required proximal ostomies.

M A Noorani et al [15] have reported simple closure of perforation in 2 layers as the preferred method. For 6 out of 7 cases of appendicular perforation, appendicectomy was done and most literature suggests the same.

M C Dandapat et al [16] also supported appendicectomy in appendicular perforation. However, in 1 of our patient's appendicectomy was not possible due to phlegmon formation with abscess, for which peritoneal toilet was done and a drain kept in situ, followed by interval appendicectomy.

In this study, out of 30 patients, 16 (53.3%) patients developed post-operative complications where wound infection was seen in 9 cases (30%). This is maybe due to contamination of surgical incision occuring during surgery.

M. C. Dandapat et al [16] reported wound sepsis in 13.5% of gastrointestinal perforation. Jhobta et al [4] reported wound infection in 25% of gastrointestinal perforation. One patient had a respiratory infection as a complication (3.3%) which was secondary to MODS. One (3.3%) patient developed an intra-abdominal abscess in the present study which was treated with ultrasound-guided percutaneous extra-peritoneal aspiration. Jhobta et al [4] reported intra-abdominal abscess

Table 8. Mortality rates in various studies

Authors	Total number of patients	Total number of mortalities	Mortality (%)
Chan WH et al[27] (2000)	206	22	10.7
Sillakivi T et al[7] (2000)	394	22	5.6
Lee FY et al[10] (2001)	436	34	7.8
Tonnessen T et al[28] (2001)	84	13	15.5
Nishida et al[24](2002)	229	30	13.1
Quereshi et al[23] (2005)	126	19	15
Jhobta et al[4] (2006)	504	51	10.1
T Kemparaj et al[18] (2012)	369	51	13.8
Present study	30	1	3.3

in 9.1% of gastrointestinal perforation. One (3.3%) patients had features of MODS and septicaemia in the present study.

T Kempraj et al [18] reported this complication in 16% of patients. Jhobta et al [4] reported MODS and septicaemia in 18% of gastrointestinal perforation.

The overall mortality rate in perforation peritonitis is very high ranging from 5.6-15.5% as mentioned in the previous series. In this study, there was only 1 death (3.3%) which is comparatively low in contrast to other series which was due to MODS and septicaemia because of delayed presentation and hence delayed surgical intervention. Poor general condition, anaemia and hypoproteinemia added to the post-operative mortality and morbidity.

Conclusion

Perforation peritonitis had a male: female ratio 3.29:1; and was more commonly seen between the age group of 21-30 years, whereas peptic ulcer perforation had a bimodal distribution (21-30 years and 51-60 years). Appendicular perforation was seen in a younger age group. Small bowel perforation commonly occurs after 3rd decade of life. Descending order of perforation sites: duodenum and stomach, appendix, ileum, jejunum, colon and gall bladder. Commonest aetiology was peptic ulcer perforation, followed by appendicitis and enteric fever. Majority of patients presented after 48 hours, in the stage of established generalised peritonitis. The diagnosis was possible by pneumoperitoneum on X-ray abdomen standing in 70% and only a few needed CT for diagnosis. Laparotomy followed by primary closure of perforation with or without live omental patch was the commonest procedure. Appendicectomy was done in appendicular perforation whereas occasionally, resection anastomosis of involved small bowel segment was required. Proximal diversion is not routinely necessary; only if there are severe contraindications to a primary RA. E. coli

was the most common peritoneal contaminating organism followed by Klebsiella and Proteus mirabilis. The post-operative complication rate was 53.3% (wound infection 30%) and the mortality rate was 3.3%.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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