

Clinical Study and Management of Secondary Peritonitis due to Perforated Hollow Viscous

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Abstract

Introduction: Secondary peritonitis is an inflammation of the peritoneum caused by another condition, most commonly the spread of an infection from the digestive organs or bowels. This paper aims to present a clinical study and management of secondary peritonitis due to hollow viscous. In this study, peritonitis cases were analyzed with respect to their aetiology; clinical features, treatment, complications and management strategies were discussed.

Material and methods: Fifty cases of secondary peritonitis were studied, who were admitted and treated in various surgical units between January 2003 and November 2004. The cause of secondary peritonitis was diagnosed, initially, based on the symptoms and clinical findings on presentation. Then all cases were subjected to detailed clinical examination and laboratory and radiological investigations for thorough analysis.

Results: It was observed that perforation of peptic ulcer was the most commonly encountered perforation (64%), followed by small bowel perforations (24%) and then appendicular perforations (12%). The highest incidence of secondary peritonitis (32%) was observed in the age group of 21 to 30 years. Males were predominantly affected with a male to female ratio of 9:1. We recorded 14% mortality in this series.

Conclusions: Secondary peritonitis is still a severe disease with high mortality and mandates timely surgical intervention. Perforation of peptic ulcer was the most commonly encountered cause of secondary peritonitis (64%). A variety of operative procedures adopted in this series of patients were fairly successful. Wound infection was the most common complication, occurring in 38% of cases, followed by subphrenic abscess and pelvic abscess (10%).

Key words: secondary peritonitis, hollow viscous, peptic ulcer perforations, enteric perforations, omental graft, wound infection.

Introduction

Despite our better understanding of pathophysiology and advances in surgery and antimicrobial therapy, peritonitis remains a potentially fatal affliction. Peritonitis refers to an inflammatory response of the peritoneum in the abdominal cavity in terms of activation of local mediator cascades by different stimuli [1–4]. Therefore, bacterial, viral and chemical agents may cause inflammation of the peritoneal layer [5–7]. Peritonitis can be classified into three types based on the cause of the inflammatory process: primary, secondary and tertiary peritonitis. Primary peritonitis is defined as a diffuse bacterial infection of the peritoneal cavity occurring without loss of integrity of the

digestive tract [8, 9]. It usually responds to medical treatment and does not require surgical intervention. Secondary peritonitis is usually due to spillage of gastrointestinal or genitourinary microorganisms into the peritoneal cavity as a result of loss of integrity of the mucosal barrier. It is the most frequent form of peritonitis, and is the consequence of a local infectious process within the abdominal cavity, with hollow viscous perforation, and can lead to diffuse peritonitis. It requires timely surgical treatment with appropriate antimicrobial therapy [4, 10]. Tertiary peritonitis is generally referred to as persistent or recurrent peritonitis after initial adequate treatment for secondary peritonitis [11–12].

This paper aims to present a clinical study and management of secondary peritonitis due to perforation of hollow abdominal viscera from peptic ulcer perforations, non-specific ileal perforations, enteric perforation and appendicular perforations. Peptic ulcer perforation is a common surgical emergency and perforation of an ulcer is the second main manifestation of peptic ulcer disease [13]. These perforations are usually encountered along the first part of the duodenum anteriorly and in the pylorus of the stomach. 50 years ago perforated peptic ulcer was a disease of young men, but today it is a problem seen mainly in elderly women and elderly people [14, 15] and the mortality rate ranges from 4.2 to 31% [16, 17]. The diagnosis is usually based on the patient's history, physical examination and demonstration of free subphrenic air on plain erect chest or abdominal films. In patients with perforated ulcers, operative management is preferable to non-operative treatment for various reasons [18].

The next common types of perforations encountered are those arising in the small intestine (enteric ileal and non-specific ileal perforations). Acute generalized peritonitis from typhoid ileal perforation is a potentially life-threatening condition and remains a significant surgical problem in developing nations [19]. One of the most lethal complications of typhoid fever is enteric ileal perforation, which arises from necrosis of Peyer's patches in the terminal ileum [20–22]. It is usually associated with high mortality and morbidity as it occurs mostly in underdeveloped countries in places where medical facilities are not readily available [23, 24].

A 'non-specific' ileal perforation is attributed to small bowel perforation when the perforation cannot be classified on the basis of clinical symptoms, gross examination, culture and histopathological examination [25]. These ulcers are usually single and commonly involve the terminal ileum [26]. Perforation of the terminal ileum is a cause of obscure peritonitis, heralded by exacerbation of abdominal pain associated with tenderness, rigidity and guarding, most pronounced over the right iliac fossa [27, 28]. Appendicitis continues to represent a diagnostic and

therapeutic challenge to surgeons. It is reported that every 15th human suffers from acute appendicitis in his or her lifetime [29, 30]. It has also been reported by numerous authors that mortality and morbidity are largely a function of complication as a result of appendicular perforations [31, 32].

Here we present an analysis of 50 cases of peritonitis secondary to hollow abdominal viscera that were admitted at a large surgical unit with regard to aetiology, investigation of clinical features, treatment, complications and management.

Material and methods

This is a randomized, controlled clinical study. This study was conducted with patients admitted to K.R. Hospital, which is affiliated to the Government Medical College, Mysore, located in the southern part of India. Fifty cases of secondary peritonitis were studied, which were treated in various surgical units, between January 2003 and November 2004. Typically the patient was admitted to the emergency room because of abdominal pain and a systemic inflammatory response. Initially, the diagnosis of intra-abdominal infection was based on the symptoms and clinical findings on presentation. Then all cases were subjected to detailed clinical examination and laboratory and radiological investigations as described below.

After the patient was admitted to the hospital, a detailed history of the patient was taken and the signs and symptoms were recorded along with a variety of information such as: pain – time of onset of pain, mode of onset of pain, site of pain, character of pain; vomiting – vomiting in relation to pain, frequency of vomiting, amount, colour and content; bowels – last evacuation, constipated/normal, dysentery; distention – duration, location, relation to pain; whether accompanied by Borborygmi. In addition, previous personal and family history of the patient was also recorded. A thorough physical examination was done with special emphasis on the abdomen. A local examination including contour of the abdomen, movement with respiration, visible peristalsis, umbilicus, and hernial orifices was recorded. In addition, palpation (temperature, tenderness, muscular rigidity, mass, abdominal girth), percussion (obliteration of liver dullness, shifting dullness) and auscultation (bowel sounds: frequency, character) were also recorded.

Laboratory investigations including blood, urine and stool were also done for each patient. Total count and differential counts were performed. Radiological examination was conducted in all cases to detect pneumoperitoneum. A plain X-ray of the abdomen in the erect posture was taken to detect the presence of gas under the dome of the diaphragm. Ulcer edge biopsy was taken from cases of peptic and non-specific ileal perforations and then

Table I. Depiction of previous history of cases. Most cases had a previous history of pain in the abdomen or fever or both. 30% of cases had a history of neither pain nor fever

Previous History	Peptic Ulcer Perforations	Non-Specific Ileal Perforations	Appendicular Perforations	Enteric ileal Perforations	Total	Percentage
Pain in Abdomen	19	0	2	0	21	42
Fever	1	5	2	6	14	28
No Pain/Fever	12	1	2	0	15	30
Total	32	6	6	6	50	100

subjected to histopathological examination. In operated cases, culture and sensitivity test was carried out with peritoneal exudate to identify the presence of various microbial organisms and detect their sensitivity to the antibiotics.

The pre-operative preparation essentially consisted of correction of dehydration, overcoming shock if it was present, gastric aspiration, parental broad-spectrum antibiotic coverage and tetanus prophylaxis. The treatment to be adopted in each case was decided based on the status, necessity and health condition of the patient. In 76% of cases, surgery was undertaken within 3 to 6 hours after their admission to the hospital. Depending upon the cases, right upper paramedian, upper midline or right lower paramedian incisions were made. For the cases of suspected small bowel perforations, right mid paramedian incisions were made and later they were extended either upwards or downwards depending upon the need. Postoperative fluid and electrolyte balance was maintained by input and output charts and adequacy of replacement was judged mainly on the basis of clinical features. In most cases, antibiotics started pre-operatively were continued and changed to suitable antibiotics after the sensitivity of the organisms was known. In the majority of cases, postoperative management included injection of I.V. fluids, oral fluids, blood transfusion and the removal of drains. The drainage tubes were removed on the 3rd and 4th postoperative day and gastric aspiration was discontinued as soon as the patient passed flatus. Postoperative complications were studied in the immediate follow-up period. Late follow-up of these patients was only considered fair, as the majority of them did not return for the check-up.

The data collected in this study were analyzed either using descriptive statistics or by chi-squared test/Student's t-test, whichever was appropriate.

Results

Among 50 surgically proven perforative peritonitis patients, 90% (45) of them were males and 10% (5) of them were females. Males were significantly ($p < 0.001$) affected with a male to female ratio of 9:1. The mean age of patients was 36 years with a range from 15 to 71 years. 64% (32 patients) of patients

had peptic ulcer perforations, 12% (6) had non-specific ileal perforations, 12% (6) had enteric ileal perforation and the remaining 12% (6) had appendicular perforations. The incidence of secondary peritonitis was statistically different across different age groups ($p < 0.001$). The highest incidence of secondary peritonitis (32%) was observed in the age group 21 to 30 years, followed by 31 to 40 years (26%) (Figure 1). Table I depicts the previous history of peritonitis patients. Of the 32 cases of perforated peptic ulcer, 19 had a previous history of pain in the abdomen lasting from 6 months to 15 years, 1 patient had a history of fever and 12 of them had no history of pain. In the case of appendicular perforations, 2 patients had a previous history of pain in the abdomen, 2 had a history of fever and 2 of them had no history. History of fever was present in all 6 cases of enteric ileal perforations. Previous history of fever was present in 5 cases of non-specific ileal perforations.

Figure 2 describes the analysis of symptoms and signs. Table II gives elaborate information on the patients' characteristics, in terms of specific symptoms and signs exhibited, among four commonly occurring perforations. All patients exhibited symptoms of pain, distension of abdomen, tenderness and rigidity ($p < 0.001$). The majority of subjects had diminished bowel sounds (80%) and vomiting (64%), and liver dullness was obliterated in 72% of subjects. Fever and shifting dullness were observed in half of the cases and diarrhoea (4%) was

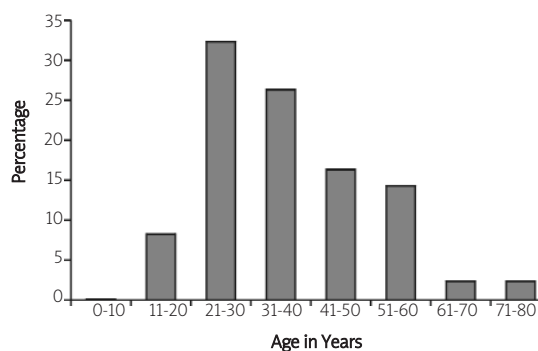


Figure 1. Incidence of secondary peritonitis among different age classes. The highest incidence of secondary peritonitis (32%) was observed in the age group 21 to 30 years, followed by 31 to 40 years (26%)

Table II. Characteristics (symptoms and signs) of secondary peritonitis cases. The total number of cases exhibiting a specific symptom and their percentages are indicated in the four commonly occurring perforations among the study population

Patients' characteristics (Symptoms & Signs)	Peptic ulcer perforations (32 cases)		Non-specific ileal perforations (6 cases)		Appendicular perforations (6 cases)		Enteric ileal perforations (6 cases)		Total (50 cases)	
	No. of cases	%	No. of cases	%	No. of cases	%	No. of cases	%	No. of cases	%
Pain	32	100	6	100	6	100	6	100	50	100
Vomiting	21	65.5	4	66.6	6	100	1	16.6	32	64
Constipation	16	50.0	4	66.6	3	50	0	0	23	46
Diarrhoea	1	3.12	1	16.6	0	0	0	0	2	4
Distension	32	100	6	100	6	100	6	100	50	100
Fever	5	15.6	5	83.3	5	83.3	6	100	21	42
Tenderness	32	100	6	100	6	100	6	100	50	100
Rigidity	32	100	6	100	6	100	6	100	50	100
Obliteration of liver dullness	26	81.3	5	83.3	1	16.6	4	66.6	36	72
Absent/ /diminished bowel sounds	27	84.3	4	66.6	4	66.6	5	83.3	40	80
Shifting dullness	23	71.8	4	66.6	0	0	2	33.3	29	58

rarely recorded. A plain X-ray of the abdomen in the erect posture indicated that 72% of cases had gas under the diaphragm. 81% of the cases who were diagnosed with peptic ulcer perforations had gas under the diaphragm, while only 16% of the cases who were diagnosed with appendicular perforations had gas under the diaphragm.

Operative findings

The culture test with peritoneal exudate produced no bacterial growth in nearly 38% of the samples. The overwhelming portion was represented by mixed cultures ($p < 0.001$). In 30% of bacterially positive cases, one bacterial species could be identified, whereas in 70% from two to six species were cultivated. The predominant microorganism was *Escherichia coli*. Only *Escherichia coli* was found in most appendicular perforation cases. In addition to *E. coli* other combinations of microbes such as *Klebsiella pneumoniae*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *paracolon*

and *staphylococci* were detected in non-specific ileal and peptic ulcer perforations cases. The mixed group of organisms consisting of *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus spp*, *staphylococci* and *paracolon* in various combinations was sensitive to gentamycin, chlormycetin, ciprofloxacin, ampicillin and norfloxacin. Sensitivity test to the latest genera of antibiotics such as cefataxime and augmentine could not be carried out for logistic reasons.

Surgical management

Figure 3 shows the variety of operative procedures adopted in this series of patients. All cases of peptic ulcer perforations were closed with an omental graft, either free or pedicled. Simple closure of the perforation was done in 4 cases of non-specific and 6 cases of specific ileal perforations. Resection and end-to-end anastomosis was done in 2 cases of ileal perforations. Vagotomy and Heineke Mikulicz procedure of pyloroplasty was carried out in one peptic ulcer

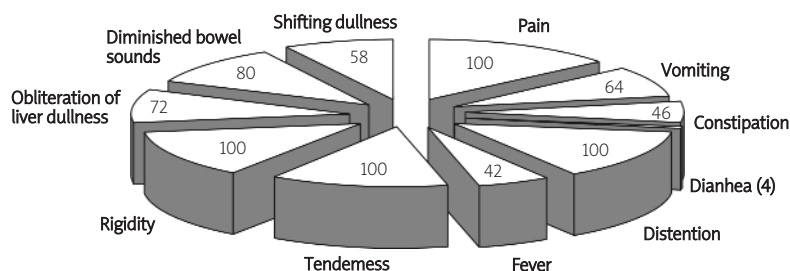


Figure 2. Occurrence of symptoms and signs among secondary peritonitis cases. The numbers indicate percentage of cases exhibiting a specific symptom. All patients exhibited symptoms of pain, distension of the abdomen, tenderness and rigidity. The majority of subjects had diminished bowel sounds and vomiting, and liver dullness was obliterated in 72% of subjects

Table III. Local postoperative complications that occurred in this series of cases. Stitch abscess was the most common complication, occurring in 38% of cases

No.	Symptoms & Signs	Peptic ulcer perforations (32 cases)		Non-specific ileal perforations (6 cases)		Appendicular perforations (6 cases)		Enteric ileal perforations (6 cases)		Total (50 cases)	
		No. of cases	%	No. of cases	%	No. of cases	%	No. of cases	%	No. of cases	%
1.	Stitch abscess (wound infection)	7	21.8	6	100	2	33.3	4	66.6	19	38
2.	Subphrenic abscess and pelvic abscess	4	12.5	0	0	1	16.6	0	0	5	10
3.	Faucal fistula	0	0	1	16.6	0	0	2	0	3	6
4.	Paralytic ileus (>72 hrs)	1	3.12	0	0	0	0	0	0	1	2

perforation case. Appendicectomy was undertaken in all 6 cases of appendicular perforations.

Post-operative complications

Table III portrays the local post-operative complications that occurred in our study, and they were statistically significant ($p < 0.003$). Stitch abscess was the most common complication, occurring in 38% of cases. All cases of non-specific ileal perforations had developed wound infection. They were treated with appropriate antibiotics. There were about 4 patients who developed right sub-hepatic abscess postoperatively, confirmed by ultra sonogram study, and it was then drained under ultrasound guidance simultaneously. One patient had developed a pelvic abscess, which was treated by drainage through the anterior rectal wall as the abscess was pointing anteriorly. Two patients of enteric ileal perforation and one patient of non-specific ileal perforation had developed faecal fistula, which were treated conservatively. The patient who developed paralytic ileus even after 72 hrs was treated conservatively by continuing gastric aspiration and I.V. fluids.

Mortality

The mortality rate due to secondary peritonitis from four different perforations was significantly different (Figure IV, $p < 0.002$). Seven patients developed general complications such as toxæmia and septicaemia shock. They were treated with I.V. fluids blood transfusion, inj. cefataxine, inj. dopamine, inj. adrenaline, cardiopulmonary resuscitation and oxygen inhalation. However, all seven patients (14%) died in spite of attempts at resuscitation. The highest mortality rate, 33%, was recorded with enteric ileal perforation patients.

Discussion

Secondary peritonitis caused by intraabdominal lesions, such as perforation of a hollow viscous, is still a severe disease with high mortality and mandates

surgical intervention. In our study, the most frequent cause of peritonitis was peptic ulcer perforations (64%), followed by small bowel perforation (24%) and appendicular perforations (12%). Our results are in

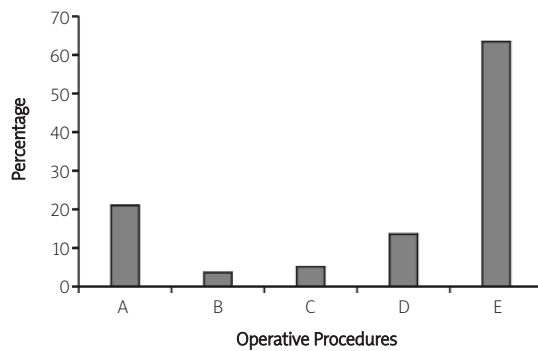


Figure 3. A variety of operative procedures adopted in this series of secondary peritonitis patients. The commonest surgery performed was omental patching, in 62% of patients

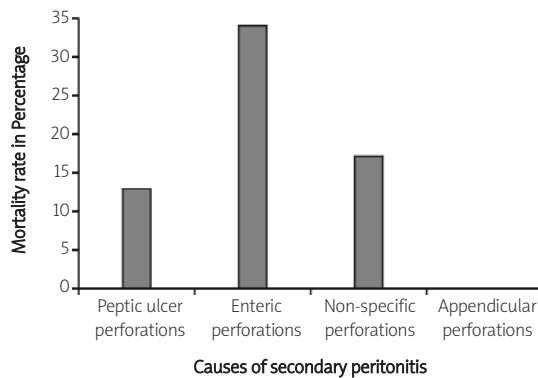


Figure 4. Mortality rate among four different causes of secondary peritonitis. The highest mortality rate (33%) was recorded with enteric ileal perforations cases

agreement with a number of other studies previously done indicating that peptic ulcer perforations are the commonest, followed by small bowel and appendicular perforation, in this region of the world [25, 33, 34]. We recorded 12.5% mortality among peptic ulcer perforation patients. A number of other studies indicated mortality in peptic ulcer up to 12% with a higher mortality seen in patients over 50 years and those who presented late to the hospital [16, 17]. As expected, the next most commonly encountered perforations arose from small bowel perforation. Peritonitis due to perforation of the small bowel is seen more commonly in developing countries, where it is usually secondary to perforation of typhoid ulcers that are seen in enteric fever. The above average prevalence of appendicular perforations (12%) probably reflects the younger age of patients in our study, where appendicitis and consequently complications are known to be much higher [35].

The highest incidence of secondary peritonitis (32%) was observed in the age group of 21 to 30 years, followed by 31 to 40 years (26%). The peak incidence justifies the fact that both peptic ulcer and typhoid are significantly prevalent among this age group in developing countries [33, 36]. Males were predominantly affected, with a male to female ratio of 9:1, which is a little higher than what has been reported in the literature; 3:1 or 4:1 or 5:1 male to female ratio has been reported in various studies [37, 38]. The much higher incidence of perforative peritonitis in males compared to females may be attributed to the fact that highest incidence of peptic ulcer and small bowel complications are reported among males in the eastern part of the world [25].

All subjects (100%) showed symptoms of pain, distension of the abdomen, tenderness and rigidity irrespective of type of abdominal infections. The majority of subjects had diminished bowel sounds (80%) and vomiting (64%), and liver dullness was obliterated in 72% of subjects. Fever and distension of the abdomen are simple and accurate predictors of complications in surgically treated patients of perforated peptic ulcer and other perforations. For the purpose of our study, we defined abdominal distension as any visible abdominal bloating. Presence of concomitant medical illness has previously been identified as a significant predictor of the risk of postoperative morbidity and mortality by several authors [39, 40] and at least one paper found that abdominal distension also strongly predicts the risk and number of postoperative complications [41]. The diagnosis of perforation was made on clinical history, examination and presence of gas under the diaphragm but was confirmed only on exploration. The presence of gas beneath the diaphragm points to a perforation of the gastrointestinal tract. A plain X-ray of the abdomen in the erect posture indicated that 72% of cases had gas under the diaphragm.

It is important to note that most patients came to the hospital after considerable delay. Only 6% of patients showed up at the hospital within six hours after appearance of the first symptom. 24% of patients appeared at the hospital after between 12 and 24 hours. However, the majority of patients (54%) arrived 24 hours after the appearance of the first symptom. The delay in seeking medical treatment could be attributed to various factors such as ignorance and lack of conveyance from their places to the major hospital. This may be linked to the socio-economic status of the patients. The bulk of the patients in our study came from the low socio-economic strata. There were hardly any patients from the middle or upper income groups. But this cannot be taken to indicate that perforative peritonitis is rare in the higher income strata. The preponderance of patients from the low socio-economic strata in this study is because most of the patients who attend this general hospital in India are from those strata. Middle and upper class patients normally obtain their medical care from private hospitals. In 76% of cases, surgery was undertaken within 3 to 6 hours after their admission to the hospital. Most patients, who came to the hospital after much delay, were in a condition of shock, so valuable time was lost in trying to improve their general condition to make them fit for surgery. The highest mortality occurred in those patients who were admitted to the hospital after more than 24 hours from the time of appearance of the first symptom.

In the bacteriological study of peritoneal fluid, bacterial growth was absent in 38%, infection was monomicrobial in 22%, and in 40% of patients peritonitis was polymicrobial. A high percentage of no bacterial growth is consistent with previous studies suggesting that swabs taken from different parts of the peritoneal cavity for culture could affect bacterial growth and cultures taken during operations performed after 24 hours often could also show negative growth [42]. The fact that we could only identify 6 bacterial species (four of them were gram-negative and two were gram-positive) further supports the suggestion that only a few pathogens are truly involved in infectious peritonitis, despite the enormous microbial diversity of the gastrointestinal tract [1, 4]. It is interesting to note that most pathogens were sensitive only to newer antibiotics such as ciprofloxacin and norfloxacin, even though resistance to these drugs was observed in a couple of cases. In most cases, ciprofloxacin and metrogyl were used. Ciprofloxacin was substituted by ampicillin and gentamycin in a few appropriate cases. In some cases, where the patient's condition was very bad, drugs such as cefotaxime were used.

We used a variety of operative procedures, keeping three fundamental principles in mind, for the efficient surgical management of secondary peritonitis. Principle 1 eliminates the source of infection: we eliminated the

source of infection by closure, exclusion or resection of the infection focus or by appendectomy or omental graft. Overall, the commonest surgery performed was omental patching, in 62% of patients. Omental patching has been shown to be a very effective method for closure of even large and giant perforations [43]. Principle 2 purges the infected abdominal cavity: to achieve the second goal of surgical management, intraoperative peritoneal lavage with saline was regularly performed to reduce the degree of bacterial contamination and to remove the blood, faecal material and necrotic tissue. In some cases, the antibiotic metrogyl was added to the lavage solution. It did work in this series of cases, although there are some reports indicating that the addition of antibiotics to the lavage solution produced no clear benefits [44, 45]. To achieve the third goal of surgical management, intra-abdominal drains were used to prevent persistent or recurrent infection. In the majority of cases corrugated rubber drains in the right flank were used to drain the peritoneal cavity and bilateral drains were used in a few cases.

A variety of general and local postoperative complications were recorded in this series of patients. Two patients developed pulmonary oedema. Seven patients had developed toxemia and septicemia shock. They were treated with I.V. fluids, blood transfusion, inj. cefataxine, inj. dopamine, inj. adrenaline, cardiopulmonary resuscitation and oxygen inhalation. However, all seven patients died despite our attempts at resuscitation. Wound infection was the most common complication, occurring in 38% of cases, followed by subphrenic abscess and pelvic abscess (10%). A majority of studies in fact show wound infection as the number one postoperative complication. We recorded 14% mortality in our series of patients; the mortality rate has been shown to vary across different regions of the world depending on access to medical facilities, preoperative shock, size of perforations, antibiotic use and abuse, delay in presentation of patients to the emergency unit and delay in operation [46, 47]. The mortality in this series of patients could have been significantly reduced if patients had presented earlier. 54% of patients arrived at the emergency unit only 24 hours after the first appearance of symptoms. A majority of the patients who were diagnosed with enteric ileal perforations arrived 24 hours after appearance of the first symptom. As a result, the highest mortality rate (33%) was recorded among these patients. The main cause of mortality can therefore be attributed to considerable delay in presentation of patients.

Conclusions

1. The most frequent cause of secondary peritonitis encountered in this study was peptic ulcer perforations, which was observed in 64% of cases.
2. The highest incidence of secondary peritonitis (32%) was observed in the age group 21 to 30 years, followed by 31 to 40 years (26%).
3. Males were predominantly affected, with a male to female ratio of 9:1.
4. This study showed results that were comparable to previous studies, confirming that our population of patients was representative.
5. The fact that we could only identify 6 bacterial species in the peritoneal exudates further supports the suggestion that only a few pathogens are truly involved in infectious peritonitis, despite the enormous microbial diversity of the gastrointestinal tract.
6. Presentation of patients immediately after the first symptom and timely surgical intervention are the keys to successful battle against secondary peritonitis.
7. The most important factor clearly deciding the fate of the patient is eliminating the source of infection. The omental patch procedure was a simple and very effective method for closure of any size of perforations.
8. The incidence of secondary peritonitis can be tackled efficiently by better use of guidelines, by patients, appropriate use of prophylactic antibiotics and timely interventions of surgeons.

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