

# Prospective Evaluation of Outcome following Exploratory Laparotomy in Patients with Peritonitis due to Large Bowel Perforation

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## ABSTRACT

**Context:** Large bowel perforation is mostly seen in association with colo-rectal carcinoma. Diverticulitis is a common cause for large bowel perforation in the west while it is rarely seen in India. Recent studies advocate a primary procedure in the setting of large bowel perforations. **Aims:** The study was done to study the etiology, management and outcome of large bowel perforations. **Settings and Design:** This was a prospective observational study. **Materials and Methods:** The study was conducted over a period of three years including 24 patients with large bowel perforations who underwent exploratory laparotomy. Surgical procedure was planned on basis of Mannheim Peritonitis Index (MPI). Outcome in terms of mortality rate during index admission was evaluated. **Statistical analysis used:** The Chi square test and student's *t* test were used for qualitative and quantitative variables respectively. The factors found significant on Univariate analysis were assessed in a multivariate analysis. **Results:** Colo-rectal carcinoma was the most common aetiology present in 12 (50%) cases. Hartmann's procedure was done in 17 (70.9%) patients. Primary anastomosis was done in 4 patients and all of them fared well post-operatively. On multivariate analysis septic shock at presentation (OR=23.3, 95% CI=1.7-2.0, *p*<0.001) and MPI>35 (OR=17.8, 95% CI=1.5-1.9, *p*=0.006) were found to be the significant factors associated with mortality. All the bacterial isolates in peritoneal fluid culture samples were extended-spectrum beta-lactamase (ESBL) producing species. **Conclusion:** A primary procedure can be safely carried out in patients of large bowel perforation with a low MPI. MPI serves as useful guide to plan surgical procedure and predict the outcome.

**Key words:** Large bowel perforation, Diastatic perforation, Colorectal neoplasms, Mannheim peritonitis index, Sepsis, Septic shock.

**Key Messages:** Large bowel perforations are comparatively rare compared to small bowel perforations in India. Our study gives an idea on risk factors predicting mortality and focuses on the management of this condition and how Mannheim Peritonitis Index helps in decision-making in such patients.

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## INTRODUCTION

Perforation of the large bowel is an extremely serious condition with high rates of morbidity and mortality. This may partly be due to the fact that patients presenting with this condition are often elderly, with various pre-existing co-morbidities.<sup>[1,2]</sup> Large bowel perforation may occur due to a benign cause or as a complication of colo-rectal carcinoma. It is more common in the west largely due to an increased prevalence of diverticulitis. In eastern countries like India perforation of the large bowel is a less common cause of perforation peritonitis and when it does occur, colo-rectal carcinoma remains the commoner cause.<sup>[2-5]</sup> The reported incidence of large bowel perforations in the setting of colo-rectal carcinoma varies between 2.6 and 8.3 percent. Perforation usually occurs at the site of the tumor because of necrosis. Perforation occurring due to acute obstruction (diastatic perforation) is less common.<sup>[6,7]</sup> The overall

incidence of large bowel perforation is largely unknown. Studies conducted in the past have usually been disease specific.<sup>[7-9]</sup>

Mortality in cases with large bowel perforation ranges from 12.3% to as high as 66.7% and has remained unchanged over the last two decades.<sup>[8-13]</sup> The proper surgical treatment after diffuse peritonitis due to large bowel perforation is still controversial. Hartman's procedure is the preferred surgical intervention chosen over colostomy alone.<sup>[8,14]</sup> Recent studies advocate resection of diseased colonic segment with or without intraoperative colonic lavage and primary anastomosis as a management option in such cases.<sup>[9,15,16]</sup> An increase in rates of infection caused by antibiotic-resistant pathogens, including extended-spectrum beta-lactamase (ESBL) producing *Escherichia coli* and *Klebsiella* species has been noted. Empirical

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antibiotic therapy has to be started once perforation is suspected and knowledge of the resistance pattern of the bacteria helps guide appropriate antibiotic therapy.<sup>[17-18]</sup>

We conducted this prospective study to observe the etiology, management and outcome of patients with large bowel perforation who underwent exploratory laparotomy.

## SUBJECTS AND METHODS

We conducted a prospective study in the Department of General Surgery, Pt. B. D. Sharma Post Graduate Institute of Medical Sciences, Rohtak over a period of three years from July 2014 to July 2017. Twenty-four adult patients who presented to the emergency with perforation peritonitis and had large bowel perforation on exploratory laparotomy were included in the study. Patients with perforation of other parts of the gastro-intestinal tract were excluded. On presentation to the emergency department, hemodynamic status of the patients was assessed, intravenous fluid resuscitation was started and empiric intravenous antibiotics (a third generation cephalosporin along with anaerobic coverage) were given. Routine blood and radiological investigations were done. Source control was done by exploratory laparotomy at the earliest. Mannheim Peritonitis Index (MPI) was used to grade the severity of peritonitis and the surgical procedure chosen accordingly (Table 1).<sup>[19]</sup>

A definitive procedure in form of resection and primary anastomosis with a protecting ileostomy was done in patients with MPI<20. We did intra-operative antegrade colonic lavage in all patients undergoing primary anastomosis. In rest of the patients, either Hartmann's procedure or colostomy alone was done depending upon the resectability and patient's hemodynamic status. The peritoneal fluid was collected in a sterile culture tube and sent to the Microbiology department for culture at the time of laparotomy. Each sample was subjected to gram staining and aerobic bacterial culture and sensitivity. Antimicrobial susceptibility was determined using Kirby Bauer Disk Diffusion method and the treatment was changed accordingly. The isolates were labelled as Extended Spectrum Beta Lactamase (ESBL) producing if they were resistant to all third generation cephalosporins. The factors contributing to the final outcome of the patients were assessed. Mortality was observed only during index admission.

At the end of the study, the data was collected and analyzed with help of SPSS software (version 21). The qualitative data was analyzed using chi-square test and quantitative data by Student *t*-test. A value of *p* <0.05 was considered significant. The significant variables were combined in a logistic regression model to analyze the factors associated with mortality.

## RESULTS

During the study period 283 patients presented to the surgical emergency with perforation peritonitis, of them 24 (8.5%) had large bowel perforation as the source of intra-abdominal sepsis. These patients were included in the study and comprised of 15 females and 9 males, with a mean age of 39.9 ± 12.8 years and 48.1 ± 12.2 years respectively. On presentation to the surgical emergency, 7 (29.1%) patients had septic shock and 10 (41.7%) had some or the other organ dysfunction in form of raised urea, raised PCO<sub>2</sub> or prior mechanical obstruction for >24 h.

Perforation was more common in the distal large bowel, with 50% of them occurring in the sigmoid colon (Table 2 and 3).

Resection of the diseased gut with proximal end colostomy (Hartmann procedure) was done in 17 (70.9%) patients. A primary anastomosis was done in 4 (16.6%) patients (Table 4).

Mean hospital stay in survivors was 9.29 ± 3.1 days. Survivors with malignancy had a mean hospital stay of 8.85 ± 1.06 days compared to 9.6 ± 4.03 days for cases with a benign cause and the difference was not

**Table 1: Mannheim Peritonitis Index scoring.**

Risk factor	Weighting if present
Age >50 years	5
Female sex	5
Organ failure <sup>a</sup>	7
Malignancy	4
Preoperative duration of peritonitis >24 h	4
Origin of sepsis not colonic	4
Diffuse generalized peritonitis	6
Exudate	
Clear	0
Cloudy, purulent	6
Fecal	12
<sup>a</sup> Definitions of organ failure	
Kidney	Creatinine level >177 umol/L Urea level >167 mmol/L Oliguria <20 ml/h
Lung	PO <sub>2</sub> <50 mmHg PCO <sub>2</sub> >50 mmHg
Shock	Hypodynamic or Hyperdynamic
Intestinal obstruction	Paralysis >24h or complete mechanical obstruction

statistically significant (*p*>0.05). Patients who underwent a primary procedure had a mean stay of 8.5 ± 1.7 days compared to 7.3 ± 4.3 days for patients undergoing staged procedures and again the difference was not statistically significant (*p*>0.05).

Mean MPI for the whole group was 30.9 ± 8.5. It was significantly higher (*p*>0.05) in patients with colo-rectal carcinoma (35.16 ± 6.46) compared to the patients with a benign etiology (26.67 ± 8.28). The mean MPI for survivors was 28 ± 8.4 whereas in cases with mortality the mean MPI was 37.33 ± 1.63 and the difference was highly significant (*p*<0.001).

Culture and sensitivity of the peritoneal fluid obtained during laparotomy showed *Escherichia coli* in 21(87.5%) samples and *Klebsiella* in 3 (12.5%) with all the species isolated being ESBL producing bacteria sensitive to carbapenems.

The entire study population had a mortality rate of 25%. Mortality in patients with malignancy was 33.3%, while in patients with benign causes it was 16.7% but this difference was not statistically significant (*p*>0.05). Septic shock at presentation and MPI > 35 were the significant factors associated with mortality in univariate as well as multivariate analysis (Table 5).

## DISCUSSION

An emergency surgeon encounters patients with perforation peritonitis on a day-to-day basis in Indian hospitals. Cases with gastro-duodenal and small bowel perforations are encountered frequently but those with large bowel perforation are comparatively rare.<sup>[3-5]</sup> The two most common causes of large bowel perforations given in literature are diverticulitis and colo-rectal carcinoma.<sup>[2,7-10,20]</sup> Diverticulitis is seldom seen in India and none of the past studies conducted in the Indian sub-continent have reported diverticulitis as a cause of perforation peritonitis, whereas large bowel perforation due to colo-rectal carcinoma and sigmoid volvulus are more common in our region.<sup>[3-5]</sup> In our study colo-rectal carcinoma was the most common etiology with only a single case of perforation

**Table 2: Sites of colonic perforation.**

Site of perforation	Number of patients (%)
Caecum	3 (12.5)
Ascending colon	3 (12.5)
Transverse colon	1 (4.2)
Sigmoid colon	12 (50)
Recto-sigmoid junction	5 (20.8)

**Table 3: Etiology of perforation.**

Etiology	Number of patients (%)
Colo-rectal carcinoma	12 (50)
Volvulus	3 (12.5)
Diverticulitis	1 (4.2)
Traumatic	2 (8.3)
Iatrogenic	1 (4.2)
Ischemic colitis	1 (4.2)
Others	4 (16.6)

**Table 4: Surgical treatment done.**

Surgical treatment	Number of patients (%)
Resection and colostomy (Hartmann's procedure)	17 (70.9)
Primary anastomosis	4 (16.6)
Only colostomy and drainage without resection	3 (12.5)

**Table 5: Univariate and multivariate analysis of factors associated with mortality.**

Factor	Univariate analysis		Multivariate analysis	
	OR (95% CI) <sup>a</sup>	p value	OR (95% CI) <sup>a</sup>	p value
Age > 45 years	1.25 (0.19-7.96)	0.813		
Female sex	4.0 (0.39-41.50)	0.224		
Malignancy	2.5 (0.36-17.31)	0.346		
Only drainage procedure without resection	0.118 (0.09-1.64)	0.075		
Diastatic perforation	5.0 (0.48-51.7)	0.151		
Septic shock at presentation	40.0 (2.96-539.6)	<0.001	23.3 (1.7-2.0)	<0.001
MPI > 35	17.5 (1.56-196.3)	<0.001	17.8 (1.5-1.9)	0.006

<sup>a</sup> OR- Odds Ratio, CI- Confidence Interval

due to diverticulitis. Diastatic perforation occurs due to formation of a closed loop with a competent ileo-coecal junction on the proximal end and obstructed distal bowel at the other end. This causes severe peritonitis due to increased amount of fecal spillage. Diastatic perforations have been associated with mortality rates reaching up to 50%.<sup>[10,19]</sup> Of the 14 patients who had diastatic perforations in our study, 5 (35.7%) expired. This was not a significant factor for mortality for the entire group ( $p>0.05$ ). In cases with colo-rectal carcinoma 4 (33.3%) patients

having diastatic perforation had mortality, this again was not statistically significant ( $p>0.05$ ).

Hartmann's procedure has been established as the procedure of choice in patients with large bowel perforation, but some studies show that a resection and primary anastomosis with or without intra-operative colonic lavage can be done even when peritoneal contamination is present.<sup>[9,13,14]</sup> Salem *et al.* did a meta-analysis of studies comparing primary anastomosis (PA) with Hartmann's procedure (HP) in cases of diverticular peritonitis. They found that reports of PA compared favorably to reports of HP for patients with diverticular perforation or peritonitis. Rates of mortality, wound infection and other complications were lower in patients undergoing PA than in patients undergoing HP for similar disease.<sup>[15]</sup>

Resection of left sided disease is considered more demanding than right-sided resections but the mortality and complications of both have been shown to be similar in recent literature.<sup>[10,14]</sup> In the management of patients with generalized peritonitis, stratifying patients into various risk groups is beneficial, as the treatment can be optimized and the choice of surgical procedure be tailored to be most beneficial. MPI provides a reliable means to assess risk evaluation in cases with perforation peritonitis.<sup>[11,21]</sup> In our study we used MPI to assess severity of peritonitis and proceeded with a primary procedure only in those patients that had a MPI of less than 20. Following this criterion, 4 patients (all with a left sided perforation) were eligible for a primary procedure. Post-operatively they did well with no mortality in this group.

In the western literature mortality in patients with large bowel perforations has been reported to be between 12.3% and 21.7%, which is slightly lower than our rate of 25%. One other study from India by Malik *et al.* reported a very high mortality rate of 66.7% in patients with large bowel perforations. In their study as well, a high MPI was a significant factor associated with mortality.<sup>[11]</sup> The higher mortality in patients from our region may be attributed to delay in seeking proper medical care by the patients and thus higher incidence of presentation with diastatic perforations and septic shock.

A very important fact is the rise of resistant bacteria in cases with intra-abdominal sepsis. Data from SMART (Study for Monitoring Antimicrobial Resistance Trends), a study done to observe the antibiotic resistance profile in bacteria causing intra-abdominal sepsis stated *Escherichia coli*, *Klebsiella pneumoniae* and *Enterobacter cloacae*, to be the most frequently isolated organisms. Among them 18% of *E. coli* and 26.2% of *K. pneumoniae* were positive for ESBL. Overall, resistance among ESBL-producing isolates increased during the study period. Carbapenems were the only agents that maintained consistent activity against ESBL-producing isolates.<sup>[18]</sup> One interesting observation in our study was that all the bacteria isolated were ESBL producing resistant bacteria.

## CONCLUSION

Colo-rectal carcinoma remains the most common cause of large bowel perforation in our setup. Hartmann's procedure is the mainstay of surgical management, although a primary procedure may be feasible in cases with minimal contamination and low MPI. MPI may serve as a guide for deciding surgical procedure and prognosis. As there continues to be a rise in resistant bacteria, carbapenems should be started empirically in cases of suspected large bowel perforation.

## ACKNOWLEDGEMENT

None.

## CONFLICT OF INTEREST

None.

## ABBREVIATIONS USED

**ESBL:** Extended Spectrum Beta Lactamase; **MPI:** Mannheim Peritonitis Index.

## SUMMARY

Large bowel perforation has high mortality rates. The etiology of large bowel perforations is different in the Indian sub-continent when compared to the western world. While diastatic perforations due to colorectal carcinoma are common in former, diverticulitis is commoner in latter. In our study we demonstrate the utility of Mannheim Peritonitis Index in treatment decisions for patients with large bowel perforation. A patient with low Mannheim Peritonitis Index may be a suitable candidate for a definitive primary procedure. Along with this in our study we found that all enterobacteriaceae isolates in peritoneal fluid culture were extended spectrum beta-lactamase producing and most of them were sensitive to carbapenems. Presentation with septic shock and a high Mannheim Peritonitis Index were significant risk factors associated with mortality in these patients on both univariate and multivariate analysis.

## REFERENCES

- Bohnen J, Boulanger M, Meakins JL Progress in generalized peritonitis. Relation to cause and risk factors. *Arch Surg.* 1983;118(3):285-90
- Sartelli M, Catena F, Ansaloni L *et al.* Complicated intra-abdominal infections in Europe: a comprehensive review of the CIAO study. *World J Emerg Surg.* doi: 2012; 7(1):36.
- Bali RS, Verma S, Agarwal PN *et al.* Perforation Peritonitis and the Developing World. *ISRN Surgery.* Do. 2014; 2.
- Jhobta RS, Attri AK, Kaushik R *et al.* Spectrum of perforation peritonitis in India-review of 504 consecutive cases. *World J Emerg Surg.* doi: 2006; (1):26.
- Afridi SP, Malik F, Ur-Rahman S *et al.* (2008) Spectrum of perforation peritonitis in Pakistan: 300 cases Eastern experience. *World J Emerg Surg.* Doi. 2008; 3(1):31.
- Phillips RK, Hittinger R, Fry JS *et al.* Malignant large bowel obstruction. *Br J Surg.* 1994; 81(9):1270-6.
- Carraro PG, Segala M, Orlotti C *et al.* Outcome of large-bowel perforation in patients with colorectal cancer. *Dis Colon Rectum.* 1988;41(11):1421-6.
- Krivanek S, Armbruster C, Dittrich K, Beckerhinn P Perforated colorectal cancer. *Dis Colon Rectum.* 1996;39:1409-14.
- Zeitoun G, Laurent A, Rouffet F *et al.* and the French Associations for Surgical Research Multicentre, randomized clinical trial of primary versus secondary sigmoid resection in generalized peritonitis complicating sigmoid diverticulitis. *Br J Surg.* 2000;87(10):1366-74.
- Bielecki K, Kaminski P, Klukowski M Large bowel perforation: morbidity and mortality. *Tech Coloproctol.* 2002;6(3):177-82.
- Malik AA, Wani KA, Dar LA, Wani MA, Wani RA, Parray FQ Mannheim Peritonitis Index and APACHE II—prediction of outcome in patients with peritonitis. *Ulus Travma Acil Cerrahi Derg.* 2010;16:27-32
- Morris CR, Harvey IM, Stebbings WS, Speakman CT, Kennedy HJ, Hart AR Epidemiology of perforated colonic diverticular disease. *Postgrad Med J.* 2002;78(925):654-58.
- Imperiali G, Meucci G, Alvisi C *et al.* Segmental colitis associated with diverticula: a prospective study. *Am J Gastroenterol.* 2000;95(4):1014-16.
- Biondo S, Jaurrieta E, Rague JM *et al.* Role of resection and primary anastomosis of the left colon in the presence of peritonitis. *Br J Surg.* 2000;87(6):1580-84.
- Salem L, Flum DR Primary anastomosis or Hartmann's procedure for patients with diverticular peritonitis? A systematic review. *Dis Colon Rectum.* 2004;47(11):1953-64.
- Chandra V, Nelson H, Larson DR, Harrington JR Impact of primary resection on the outcome of patients with perforated diverticulitis. *Arch Surg.* 2004;139(11):1221-24.
- Sartelli M, Catena F, Ansaloni L *et al.* Complicated intra-abdominal infections worldwide: the definitive data of the CIAOW Study. *World J Emerg Surg.* 2014;9(1):37.
- Hawser SP, Bouchillon SK, Hoban DJ, Badal RE In vitro susceptibilities of aerobic and facultative anaerobic Gram-negative bacilli from patients with intra-abdominal infections worldwide from 2005-2007: Results from the SMART study. *Int J Antimicrob Agents.* 2009;34(6):585-8.
- Billing A, Fröhlich D, Schildberg FW. And the Peritonitis Study Group Prediction of outcome using Mannheim peritonitis index in 2003 patients. *Br J Surg.* 1994;81(2):209-13.
- Hsu CW, King TM, Wang JH, Wang HT Colorectal Perforation: Spectrum of the Disease and Its Mortality. *J Soc Colon Rectal Surg.* 2007;18(3):81-88.
- Renoux B, Herbault GF, Jean E Diastatic perforations of the colon of neoplastic origin. Apropos of 15 cases *J Chir (Paris).* 1986;123(11):644-50.

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