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Exploratory laparotomy for acute intestinal conditions in children: A review of 10 years of experience with 334 cases

Rajendra K. Ghritlaharey, K. S. Budhwani, Dhirendra K. Shrivastava

ABSTRACT

Aim: The aim of this study was to review 10 years of experience in the management of children with acute intestinal conditions requiring exploratory laparotomy. **Patients and Methods:** This retrospective study included 334 children (244 boys and 90 girls) who underwent laparotomy for acute intestinal conditions between Jan 1, 2000 to Dec 31, 2009. Patients were grouped into two categories: group A (n = 44) included patients who needed laparotomy with terminal ileostomy and group B (n = 290) included patients who needed laparotomy without terminal ileostomy. We excluded neonates and patients with jejunoileal and colonic atresias, anorectal malformations, congenital pouch colon, neonatal necrotising enterocolitis, Hirschsprung's disease, appendicitis, abdominal trauma and gastrointestinal tumours. **Results:** During the last 10 years, 334 laparotomies were performed in children under 12 years: 59.88% for intestinal obstruction and 40.11% for perforation peritonitis. Causes in order of frequency were: ileal perforations 34.13%; intussusceptions 26.34%; Meckel's obstruction 10.17%; congenital bands and malrotation 6.88%; postoperative adhesions 5.98%; miscellaneous peritonitis 5.68%; miscellaneous intestinal obstructions 4.79%; abdominal tuberculosis 4.19% and roundworm intestinal obstruction 1.79%. Ileostomy closures (n = 39) was tolerated well by all except one. The mortalities were 28 (8.38%) in group B and 6 (1.79%) in group A. **Conclusions:** The need for re-exploration not only increases the morbidity but also increases mortality as well. Diverting temporary ileostomy adds little cumulative morbidity to the primary operation and is a safe option for diversion in selected cases. The best way to further reduce the mortality is to create ileostomy at first operation.

Department of Paediatric Surgery, Gandhi Medical College & Associated Kamla Nehru & Hamidia Hospitals Bhopal, Madhya Pradesh - 462 001, India

Address for correspondence:
Dr. Rajendra K Ghritlaharey,
Department of Paediatric Surgery,
Gandhi Medical College & Associated Kamla Nehru & Hamidia Hospitals,
Bhopal, Madhya Pradesh - 462 001, India
E-mail: drrajendrak1@rediffmail.com

Key words: Exploratory laparotomy, ileostomy, ileal perforations, intestinal obstruction, intussusception

INTRODUCTION

Acute abdomen can be defined as "syndrome induced by wide variety of pathological conditions that require emergent medical or more often surgical management". Nothing can replace the clinical acumen of the physicians in the management of acute abdomen in children.[1] Acute abdomen is caused due to gastrointestinal diseases such as acute appendicitis, intestinal obstructions and perforation peritonitis.[2] The causes of obstruction in children are anorectal malformations, intussusception, Meckel's diverticulum, abdominal Koch's, congenital band obstructions, Hirschsprung's disease, ascariasis, etc.[2-4] Intussusception remains a common cause of bowel obstruction in young children and results in significant morbidity and mortality, if not promptly treated.[2,3,5] Typhoid ileal perforation is still prevalent in many developing countries and associated with very high morbidity and mortality in children.[6,7] We are reporting our experience of 334 cases of exploratory laparotomies done for intestinal obstruction and perforation peritonitis in children in our department.

PATIENTS AND METHODS

This is a single institution retrospective study in children aged below 12 years, who underwent exploratory laparotomy for acute intestinal obstruction and intestinal perforation peritonitis. It was conducted in the department of paediatric surgery over a period of 10 years (Jan 2000 to Dec 2009). Patients were grouped into two categories: group A (n = 44) included patients who needed exploratory laparotomy with terminal ileostomy and group B (n = 290) included patients needing exploratory laparotomy without terminal ileostomy. We excluded neonates, patients of jejunoileal and colonic atresias and stenosis, anorectal

malformations (ARM), congenital pouch colon, neonatal necrotising enterocolitis (NEC), Hirschsprung's disease/ total colonic aganglionosis, appendicitis, abdominal/ intestinal trauma and gastrointestinal tumours. Diagnostic work up of patients included clinical history and examination supported with plain skiagram and ultrasonography (USG) of the abdomen and pelvis. Surgeons who participated in this study are well-experienced consultant paediatric surgeons (professor, associate professor and assistant professor of paediatric surgery) with clinical experience of 27, 17, and 9 years, respectively, in the field of paediatric surgery.

RESULTS

Three hundred and thirty-four exploratory laparotomies were performed at the author's department of paediatric surgery for ileal perforation peritonitis and intestinal obstructions in children below 12 years of age in the last 10 years from Jan 2000 to Dec 2009, and these children were included in this study. They were 244 (73.05%) boys and 90 (26.94%) girls with a male to female ratio of 2.71:1. Ninety-eight (29.34%) exploratory laparotomies were performed in infants, 90 (26.94%) were operated in the age group of 1–5 years and 146 (43.71%) were between 5 and 12 years of age. Two hundred (59.88%) laparotomies were done for acute intestinal obstructions and 134 (40.11%) done for intestinal perforation peritonitis [Table 1]. Causes of acute intestinal conditions that required surgery in the order of frequency are shown in Table 2. Re-exploration was needed in 9.28% (n = 31) patients: 3 from group A and 28 from group B for anastomotic leak, burst abdomen, faecal fistula, etc. We observed 34 (10.17%) deaths; of these, 28 (8.38%) were from group B and 6 (1.79%) from group A. Nine of the 34 deaths were that of infants. Summary of patients who died from groups A and B are given in Tables 3 and 4, respectively. During the study period, 39 ileostomy closures were also done and were well tolerated by all except one patient who died of medical problem in post operative period.

DISCUSSION

This study was not an age-, sex-, or disease-matched study. The objective was to review our 10 years of experience with exploratory laparotomies done in the department of paediatric surgery. We also try to analyse the importance of temporary terminal ileostomy during acute abdominal surgery in children and data of these patients were analysed retrospectively. Exclusion criteria are already mentioned in the Section "Patients and Methods". This study comprised 244 (73.05%) boys and 90 (26.94%) girls with a male to female ratio of 2.71:1. Ninety-eight (29.34%) patients were infants, 90 (26.94%) were aged 1–5 years and 146 (43.71%) were between 5 and 12 years of age. Other studies also showed male predominance but reported more to occur in infants as well.[2,8,9] This difference is because of the exclusion of ARM, atresias and NEC in our study.

The most common surgical cause of acute abdomen in children is appendicitis.[2,10] We have excluded appendicitis from our study. Intussusception remains a commonest cause of bowel obstruction in infants and young children and has been reported by many authors.[2,3,5,10] Other causes of intestinal obstruction in children are Meckel's diverticulum, congenital bands, adhesions, ascariasis, etc.[2,11,12] The commonest cause of intestinal obstruction in our study was also intussusception 26.34% (n = 88), followed by Meckel's obstruction/patent vitello-intestinal duct (PVID)10.17% (n = 34), congenital bands and malrotation of gut 6.88% (n = 23), and post operative adhesions 5.98% (n = 20). Ileal perforation peritonitis, mostly due to typhoid perforation in children, is the leading cause of peritonitis and still prevalent in many developing countries.[6,7,13] The causes of perforation peritonitis in our study include isolated ileal perforation 34.13% (n = 114) and miscellaneous causes of perforation peritonitis (perforations of ileum and jejunum, and colon) 5.68% (n = 19).

Nothing can replace the clinical acumen of the physicians in the management of acute abdomen in children. Plain radiographs of abdomen in erect position are most useful when intestinal obstruction or perforation of viscus is the concern. In majority of the cases of acute abdomen in children, USG of abdomen and pelvis can provide specific diagnosis.[1,10,14] In the modern era of technologies, computed tomography (CT) scan, magnetic resonance imaging (MRI), and other scanning and laparoscopy are also advocated for the diagnosis of acute abdomen in children.[10,14,15] In our study, diagnostic work up of patients included detailed clinical history and examination, and supported with plain skiagram and USG of the abdomen and pelvis.

The surgical objectives at laparotomy for ileal perforation peritonitis are cleaning of contamination into the peritoneal cavity with either one of the following: primary repair of the perforation, wedge resection and simple closure, segmental resection of diseased bowel and anastomosis, creation of stoma/ ileostomy, etc. depending upon the condition of the involved bowel segment and patient himself /

Table 1: Demographics of exploratory laparotomy (n = 334) done and deaths (n = 34) for acute intestinal conditions in children (Jan 01, 2000 to Dec 31, 2009)

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total (%)	Deaths (%) (A + B)
Age group	Infants	13	09	07	10	06	13	13	12	08	07	98 (29.34)	09 (2.69) (1 + 8)
	1–5 years	08	11	10	02	12	06	14	10	09	08	90 (26.94)	11 (3.29) (2 + 9)
	5–12 years	11	18	19	13	11	16	15	12	15	16	146 (43.71)	14 (4.19) (3 + 11)
Sex	Boys	21	27	27	19	24	27	29	25	22	23	244 (73.05)	24 (7.18) (5 + 19)
	Girls	11	11	09	06	05	08	13	09	10	08	090 (26.94)	10 (2.99) (1 + 9)
Diagnosis (exp lap done for)	Intestinal obstruction	21	21	22	16	19	23	27	21	18	12	200 (59.88)	15 (4.49) (2 + 13)
	Perforation peritonitis	11	17	14	09	10	12	15	13	14	19	134 (40.11)	19 (5.68) (4 + 15)
Exp lap done	Group A	01	01	04	03	02	03	08	07	10	05	44 (13.17)	06 (1.79)
	Re-expl	00	00	00	01	01	00	00	00	00	01	03	00
	Group B	31	37	32	22	27	32	34	27	22	26	290 (86.82)	28 (8.38)
	Re-expl	01	02	03	01	04	05	06	00	01	05	28	09
Total		32	38	36	25	29	35	42	34	32	31	334	34 (10.17) (6 + 28)
Ileostomy closure done		01	03	01	03	01	03	03	08	12	04	39	01 (2.56)
Mortality (n = 34)	Group A	00	00	01	00	01	00	01	01	01	01	06 (1.79)	—
	Group B	01	04	01	02	05	04	06	02	02	01	28 (8.38)	—
	Infants (A + B)	0 + 0	0 + 0	0 + 0	0 + 1	0 + 2	0 + 2	0 + 1	1 + 2	0 + 0	0 + 0	(1 + 8) 09 (2.69)	—

Exp lap, exploratory laparotomy; re-expl, re-exploration

Table 2: Causes of acute intestinal conditions in children (n = 334) and deaths (n = 34) (Jan 01, 2000 to Dec 31, 2009)

Causes ↓↓ (in order of frequency)	Number of cases (%) (exp lap done)	Deaths (% of total exp lap) (A + B)
Ileal perforation peritonitis	114 (34.13)	14 (4.19) (4 + 10)
Intussusceptions	88 (26.34)	13 (3.89) (2 + 11)
Meckel's, PVID obstruction, etc.	34 (10.17)	03 (0.89) (0 + 3)
Congenital bands, mal-rotations, etc.	23 (6.88)	—
Post operative obstructions	20 (5.98)	—
Miscellaneous peritonitis	19 (5.68)	01 (0.29) (0 + 1)
Miscellaneous obstructions	16 (4.79)	—
Abdominal TB obstruction	14 (4.19)	02 (0.59) (0 + 2)
Worm obstruction (ascariasis)	06 (1.79)	01 (0.29) (0 + 1)
Total	334 (100)	34 (10.17) (6 + 28)

Exp lap = exploratory laparotomy

herself.[6,7,13,16] We have operated upon 114 (34.13%) cases of ileal perforation peritonitis in children: 70.17% (n = 80) were males and 29.82% (n = 34) were females. Seventy-two patients (63.15%) were of 5–12 years, 27 (23.68%) were of 1–5 years and only 15 (13.15%) patients were infants. More than three fourths (n = 88) of the patients had single perforation in ileum and about one fourth (n = 26) had more than one perforation. The surgical treatments done were simple primary closure of perforation after freshening of the margins (n = 62; 54.38%), segmental resection and anastomosis (n = 20; 17.54%), ileostomy (n = 19; 16.66%), wedge resection and simple closure (n = 8; 7.01%), abdominal drainage and other procedures (n = 5; 4.38%).

Intussusception remains the most common cause of bowel obstruction in infants and young children and results in significant morbidity and mortality. Treatment options for the intussusception are hydrostatic/barium enema reduction, exploratory laparotomy (manual reduction, segmental bowel resection for gangrene and anastomosis, hemicolectomy, creation of stoma, etc.) and laparoscopic procedures.[2,3,5,17-19] Intussusception comprised about one fourth (26.34%; n = 88) cases of our study group with 68 (77.27%) boys and 20 (22.72%) girls. Three fourths (76.13%; n = 67) of the patients were infants, n = 13 (14.77%) were aged 1–5 years and only n = 8 (9.09%) patients were of 5–12 years

Table 3: Summary of patients (n = 6) who died from group A (Jan 01, 2000 to Dec 31, 2009)

Name	Age	Sex	G C	Diagnosis	Operative findings	Operation done	Complications	Re-expl	Hospital stay (days)	Year
A	3 years	M	Fair	Intestinal obstruction	Intussusception with gangrene	Resection of gangrenous ileum with ileostomy	Septicaemia	—	18	March 2002
Sh	5 years	M	Fair	Perforation peritonitis	Multiple ileal perforations	Ileal perforations repair with ileostomy	Septicaemia	—	12	April 2004
S	12 years	M	Poor	Perforation peritonitis	Multiple ileal perforations	Ileal perforations repair with ileostomy	Leak, peritonitis, burst abdomen, septicaemia	—	16	July 2006
Ru	8 months	M	Fair	Intestinal obstruction	Intussusception with gangrene	Resection of gangrenous ileum with ileostomy	Septicaemia, DIC	—	08	January 2007
Ar	10 years	F	Poor	Perforation peritonitis	Multiple ileal perforations	Ileal perforations repair with ileostomy	Septicaemia	—	02	May 2008
Vi	8 years	M	Poor	Perforation peritonitis	Multiple ileal perforations	Ileal perforations repair with ileostomy	Leak, peritonitis, burst abdomen, septicaemia, DIC	—	32	March 2009

GC - General condition on admission; leak - anastomotic leak - re-expl, re-exploration, DIC - disseminated intravascular coagulation

Table 4: Summary of patients (*n*=28) who died from group B (Jan 01, 2000 to Dec 31, 2009)

Name	Age	Sex	G C	Diagnosis	Operative findings	Operation done	Complications	Re-expl	Hospital stay (days)	Year
J	11 years	F	Poor	Perforation peritonitis	(Abd TB) ileal strictures and perforations	Repair of ileal perforations and stricturoplasty	Cardiac and respiratory failure	—	1	May 2000
Ve	10 years	M	Fair	Perforation peritonitis	Ileal perforation	Repair of ileal perforation	Pelvic abscess	Re-expl + drainage	37	May 2001
B	10 years	M	Poor	Perforation peritonitis	Ileal perforation	Repair of ileal perforation	Septicaemia	—	4	June 2001
Vi	4 years	F	Poor	Perforation peritonitis	Multiple jejuno-ileal perforations	R/A of jejunum and ileum	Leak	—	07	Sept 2001
Su	6 years	M	Fair	Intestinal obstruction	Meckel's obstruction	Meckel's diverticulectomy	Leak	R/A of ileum	18	Oct 2001
Mo	2.6 years	M	Poor	Intestinal obstruction	Intussusception with gangrene	R/A of ileum	Septicaemia	—	9	Aug 2002
Sa	10 years	F	Fair	Perforation peritonitis	Ileal perforation	Repair of ileal perforation	Faecal fistula, septicaemia	—	50	Aug 2003
So	5 months	F	Poor	Perforation peritonitis	Intussusception with gangrene	R/A of ileum	Respiratory failure	—	1	Aug 2003
La	10 years	M	Poor	Perforation peritonitis	Ileal perforation	Repair of ileal perforation	Septicaemia	—	6	April 2004
Ma	6 years	M	Poor	Perforation peritonitis	Ileal perforation	Repair of ileal perforation	Septicaemia	—	16	July 2004
Sau	11 months	M	Poor	Intestinal obstruction	Intussusception	Reduction of intussusception and repair of tear	Septicaemia	—	11	Aug 2004
Di	1.3 years	M	Poor	Perforation peritonitis	Intussusception with gangrene	R/A of ileum	Leak, faecal fistula	R/A of ileum	35	Sept 2004
H	3 months	M	Fair	Intestinal obstruction	Prolapsed ileum with gangrene through PVID	Resection of part of ileum + PVID and anastomosis	Leak, peritonitis, septicaemia	Ileostomy done	24	Oct 2004
R	4.6 years	M	Poor	Intestinal obstruction	Intussusception with gangrene	Resection of gangrenous ileum and anastomosis	Leak, peritonitis, septicaemia	Ileostomy done	7	Mar 2005
P	2 months	F	Fair	Intestinal obstruction	Intussusception with gangrene	Resection of gangrenous ileum and anastomosis	Leak, peritonitis	Ileostomy done	20	May 2005

Table 4: Contd...

Ba	5 months	M	Poor	Intestinal obstruction	Intussusception with gangrene	Resection Meckel's gangrenous ileum + congenital band and anastomosis	Leak, peritonitis	Repair of leak	20	Sept 2005
K	2 years	M	Poor	Intestinal obstruction	Intussusception with gangrene	Resection of gangrenous ileum and anastomosis	Septicaemia	—	7	Oct 2005
Pri	12 years	F	Poor	Perforation peritonitis + TB of lungs	Ileal perforation	Repair of ileal perforation	Leak, respiratory failure	—	17	Feb 2006
Vai	2 years	F	Poor	Intestinal obstruction	Round worms with gangrene	Resection of gangrenous ileum and anastomosis	Leak, septicaemia	—	27	March 2006
A	10 years	M	Poor	Perforation peritonitis	Ileal perforation	Repair of ileal perforation	Septicemia	—	1	April 2006
D	1.6 years	M	Poor	Intestinal obstruction	Intussusception, Meckel's with gangrene	Resection Meckel's + gangrenous ileum and anastomosis	Septicaemia	—	17	May 2006
Sa	4 years	M	Fair	Perforation peritonitis	Intussusception with gangrene with perforation	Resection of gangrenous ileum and anastomosis	Leak, peritonitis	Ileostomy done	15	Sept 2006
H	2 months	M	Poor	Perforation peritonitis	Ileal perforation	Repair of ileal perforation	Septicaemia	—	4	Nov 2006
Tu	2 months	M	Poor	Intestinal obstruction	Meckel's obstruction	Resection Meckel's with part of ileum and anastomosis	Leak, septicaemia	—	7	March 2007
S	11 months	F	Poor	Intestinal obstruction	Intussusception with gangrene	Resection of gangrenous ileum and anastomosis	Septicaemia, cardiac failure	—	2	Nov 2007
M	4 years	F	Poor	Perforation peritonitis	Dense adhesion, pyo-peritoneum	Adhesiolysis, lavage and drainage	Septicaemia	—	3	Feb 2008
R	6 years	M	Poor	Intestinal obstruction	Abdominal tuberculosis	Adhesiolysis and biopsy	Septicaemia	—	7	Aug 2008
Ma	8 years	M	Poor	Perforation peritonitis	Ileal perforation	Repair of ileal perforation	Leak, faecal fistula, DIC	Ileostomy done	8	June 2009

GC - general condition on admission; Abd TB - abdominal tuberculosis; leak - anastomotic leak; re-expl, re-exploration; R/A - resection and anastomosis; DIC - disseminated intravascular coagulation

of age. Fifty-four (61.36%) patients presented with intestinal obstruction and 34 (38.63%) had features of gangrenous bowel. This study included only those patients who needed exploration for the management of intussusception. Operative manual reduction of intussusception was possible in $n = 30$ (34.09%) patients (14 had serosal tears/minor bowel tears which needed repair only) and 65.90% ($n = 58$) required bowel resection. Resection of gangrenous ileum and ileo-ileal anastomosis were done in $n = 24$ patients, segmental resection of gangrenous bowel (ileum and colon) with ileo-colic (ascending colon) anastomosis in $n = 13$ patients, ileo-transverse anastomosis/hemicolectomy in $n = 8$ patients and resection of diseased gangrenous segment with terminal ileostomy was done in $n = 13$ (14.77%) patients. We found that only six patients had Meckel's diverticulum as the lead point for intussusception.

Meckel's diverticulum may present as diverticulitis, intestinal obstruction, perforation peritonitis and intestinal bleeding. Treatment options for the same are resection of the diverticulum/diverticulectomy, wedge resection and anastomosis, segmental resection with Meckel's and anastomosis, etc. and can be done by open surgery or laparoscopically.[11,20,21] Thirty-four children (29 boys and 5 girls) were treated at the author's department for Meckel's diverticulum and PVID. Majority ($n = 28$) presented with intestinal obstruction, three had bleeding (diverticulitis) and diagnosed on Technetium scan and three were incidental findings at laparotomy for others. The findings were Meckel's diverticulum with bands ($n = 9$), PVID in $n = 9$ ($n = 3$ presented with prolapsed intestine), and Meckel's diverticulum with gangrene was observed in 16 patients. Twenty patients needed segmental resection of ileum with Meckel's and anastomosis, 13 needed diverticulectomy/wedge resection and 1 patient needed ileostomy after resection of gangrenous intestine.

Early diagnostic laparoscopy and treatment can be safely performed in children for acute abdomen. This technique not only results in the accurate, prompt and efficient management of acute abdomen with minimum number of complications but also at the same time reduces the rate of unnecessary laparotomy.[19-22] At present we are not doing any laparoscopic procedure in our department as we do not have the facilities of doing laparoscopy for these cases.

Abdominal tuberculosis is treated conservatively with anti-tuberculous drugs alone but patients with acute intestinal obstructions and perforation peritonitis may need laparotomy for diagnosis and relief of bowel obstruction and perforation.[2,23] We included 14 (4.19%) (10 boys and 4 girls) cases of abdominal tuberculosis in our study with 7 each presenting as peritonitis and acute intestinal obstruction. The operative procedures done were adhesiolysis and biopsy only (n = 4), adhesiolysis and stricturoplasty (n = 3), resection of ileum and anastomosis (n = 2), ileo-transverse anastomosis/bypassing the stricture (n = 2) and n = 3 patients needed ileostomy. Ascariasis is the infestation by the largest intestinal (mostly small intestine) nematode of man, a problem in the tropics attributed to poor hygienic and low socioeconomic conditions. Most cases of intestinal obstruction due to *Ascaris lumbricoides* (round worms) can be managed conservatively. However, emergency surgery (enterotomy, milking of the worm to colon and segmental resection and anastomosis) is needed in patients with features of gangrene and perforation.[4,12] We had six cases of ascariasis, three presented with intestinal obstruction and the other three with peritonitis. Patients of ascariasis treated conservatively in our department were not included in this study. Three patients needed resection of ileum for gangrene (n = 2 primary anastomosis and n = 1 ileostomy), two needed enterotomy for removal of bunch of worms and another one needed milking of the worms to the colon distally.

Some children required temporary ileostomy in the course of management for typhoid ileal perforation/intestinal perforations, intestinal obstructions, etc. for various reasons.[16,24,25] In this study of 334 cases, 52 required temporary terminal ileostomy; 44 (13.17%) required during first operation (group A) and 8 (2.39%) cases required ileostomy during second surgery/re-exploration for anastomotic leak and faecal fistula (group B). There were 43 male and 9 female children and this included 16 (30.76%) infants, 13 (25%) between 1 and 5 years of age and 23 (44.23%) were of 5–12 years. Indications for ileostomy were ileal perforation peritonitis (n = 19; 36.53%), intussusception (n = 13; 25%), anastomotic leaks/faecal fistula (n = 8; 15.38%), post-operative intestinal obstruction (n = 6; 11.53%), intestinal tuberculosis (n=3; 5.76%), Meckel's with bowel gangrene (n = 1; 1.92%), ascariasis with bowel gangrene (n = 1; 1.92%), and n = 1 (1.92%) for other obstruction.

Complications are known to occur with exploratory laparotomy done in children for perforation peritonitis and intestinal obstructions and major complications are anastomotic leak, faecal fistula, burst abdomen, septicaemia, post operative intestinal obstructions and multiple organ failure.[6-8,13,25] In our study, we only registered the major complications (anastomotic leaks, faecal fistula, burst abdomen and peritoneal abscess) and other minor complications were excluded. We observed major complications in about 12% (n = 41) patients and are anastomotic leaks (n = 20), faecal fistula (n = 7), post operative intestinal obstructions (n = 7), burst abdomen (n = 5), peritoneal collections/peritoneal abscesses (n = 2).

Re-exploration was done in 9.28% (n = 31) patients: 28 (8.38%) from group B and 3 (0.89%) from group A. Surgical procedures done (n = 31) during re-exploration were the following. Thirteen were treated with re-repair/re-anastomosis of anastomotic leaks, 8 needed ileostomy, 5 were treated with adhesiolysis and 4 cases of burst abdomen were also repaired and 1 peritoneal and pelvis abscess was drained during re-exploration.

Creation of ileostomy is also prone for the complications and most common of these are peristomal skin excoriation, redness, bleeding, infections, stoma prolapse, retraction, strictures, intestinal obstruction, fluid and electrolyte imbalances, etc. In this study, three cases with ileostomy developed major complications in the form of stoma prolapse, para-stomal hernia and prolonged frequent loose stool that necessitated early closure. Peristomal skin excoriation was treated with proper stoma care and local hygiene. Ileostomy closure can be achieved using one of the three techniques: enterotomy suture, resection with either hand sewn or stapled anastomosis.[26-28] Laparoscopic assisted stoma closure in children has also been reported in literature.[29] We preferred to close the ileostomy (n = 39) at about 10 weeks or after that, following primary operation. No special investigations were needed except in a few cases wherein distal ileostograms were done. We used manual double layer closure of ileostomy; inner full thickness with vicryl (interrupted or continuous) and outer seromuscular with silk or vicryl

depending upon the surgeon's choice. We observed minor anastomotic leak in two, wound infection in four, postoperative intestinal obstruction in one patient and all were treated conservatively.

Mortality is reported with exploratory laparotomy done for ileal perforation peritonitis and intestinal obstruction in infants and children. More number of deaths was reported in patients operated for perforation peritonitis than that operated for intestinal obstruction. Many factors influencing the deaths in children are younger age, delayed presentation, longer interval between presentation and operation, sepsis, peritonitis, multi organ failure, etc.[2,5-8,13,16,18] We registered a total of 34 (10.17%) deaths of 334 patients: 28 from group B and 6 from group A and included 24 (7.18%) male and 10 (2.99%) female children. Nine deaths (2.69%) were that of infants, 11 (3.29%) were of children between 1 and 5 years and 14 (4.19%) deaths were of children aged 5–12 years. Summary of patients who died from groups A and B are given in Tables 3 and 4, respectively. Although we observed more deaths in patients operated for perforation peritonitis (5.68%) than for intestinal obstructions (4.49%), the difference is statistically not significant. We also noticed significantly more deaths in group B patients than in group A ($P < 0.01$). There were only 6 (1.79%) deaths of patients who were assigned ileostomy at first laparotomy (group A) while there were 28 (8.38%) deaths in group B patients ($P < 0.01$). Re-exploration also increases the number of deaths significantly. We observed 9 (29.03%) deaths of 31 re-exploration ($P < 0.05$) cases. Infants account for about 30% ($n = 98$) of total operation in this study and we noticed nine deaths. Eight of the nine infantile deaths were from group B and three infants required re-exploration for anastomotic leaks. There was also one (2.56%) death among 39 ileostomy closures. She earlier had exploratory laparotomy with ileostomy for worm intestinal obstruction, followed by ileostomy closure. Although she had minor anastomotic leak after stoma closure, she died suddenly of convulsions at seventh post operative day.

CONCLUSIONS

Diverting temporary ileostomy adds little cumulative morbidity to the primary operation and is a safe option for diversion in selected cases in patients with severe abdominal contamination and whenever a bowel condition is in doubt or is unhealthy. The need of re-exploration significantly increases the mortality. So, best possible and safest surgical procedure must be exercised at first laparotomy. Best way to further reduce the mortality is to create terminal ileostomy at the first operation. Surgical options must be individualised and the patients must be treated on case to case basis. Poor general condition, delayed presentation, anastomotic leaks, septicaemia, etc. were also responsible for more morbidity and mortality.

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