

# Neonatal Gastrointestinal Perforation

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Twenty four neonates with gastrointestinal perforations (GIP) were studied prospectively over a period of two years. The purpose of study was to determine the causes, locations and mortality of these perforations in this part of the world. Out of 24 neonates, there were 16 males and 8 females. All were operated and each had a solitary perforation. Fifteen (62.5%) had idiopathic or spontaneous perforations, 4(16.6%) developed perforation secondary to distal obstruction, 3(12.5%) perforations were due to Necrotizing Enterocolitis (NEC) whereas 2(8.4%) were iatrogenic in nature. Three(12.5%)perforations were located in stomach, 11(45.8%) involved small bowel whereas 10(41.7%) were in large bowel. Hirschsprung's disease, Colonic atresia and Imperforate anus of high variety were the obstructive causes of perforations. The size of perforation ranged from pinhole to about 1cm. Simple closure of perforation was performed in 12(50%)cases, resection and anastomosis was done in 3(12.8%), whereas exteriorization of perforation was carried out in 8(33.3%) cases. Bishop koop operation was performed in 2(8.3%) cases. Overall mortality rate was 37.5% with highest (66.6%)mortality associated with gastric perforations whereas mortality rate of small and large bowel perforations were 27% and 40% respectively. Delay in reporting to the hospital resulting in septic shock and imbalance of fluid and electrolytes was responsible for high mortality associated with neonatal gastrointestinal perforation.

**Key Words:** Neonatal, Gastrointestinal Perforations, Acute Abdomen, Idiopathic.

Neonatal gastrointestinal perforation (NGIP) is not an uncommon paediatric surgical problem. It is associated with substantial morbidity and mortality. Necrotizing enterocolitis (NEC) is the predominant cause of NGIP<sup>1</sup> whereas others may be idiopathic or spontaneous, due to distal obstruction or iatrogenic in nature. Drugs like indomethacin therapy in very low birth weight infants may also cause NGIP<sup>2</sup>. Perforation due to distal obstruction is becoming rare nowadays due to early detection of the underlying pathology. However perforation due to NEC is increasing in number as a result of improvement in the survival of premature infants<sup>3</sup>.

Abdominal distention, vomiting, constipation and respiratory distress are common features of NGIP. Roentgenography of the abdomen in upright posture shows gas under right hemidiaphragm. Neonates differ from older children or adults in having immature immune mechanism, poor localization of perforations, different fluid and electrolyte requirement and poorly developed thermoregulatory system. The management of NGIP is therefore quite different from its older counterpart. It has improved tremendously in recent past due to advancement in perinatal care, better understanding of neonatal pathophysiology, refinement in parenteral nutrition and improvement in paediatric anaesthetic cum ventilatory support<sup>3</sup>. The author has tried to study different aspects of this neonatal surgical problem and compared them with those reported from other parts of the world.

## Patients And Methods

A prospective study on all neonates presenting with GIP over a period of 2 years(from June 1989 to May 1991) was conducted at Mayo Hospital Lahore. Out of 24 neonates

there were 16 males and 8 females. Birth weight ranged from 1.5 kg to 3.5 kg. Seven (29.1%) neonates weighed between 1.5 and 2 kg, 9(37.5%) were between 2 and 2.5 kg whereas 8(33.4%) had weight more than 2.5kg. Age at the time of perforation has been shown in table I.

Table no 1: Age at the time of perforation in relation to etiology

Etiology	1 <sup>st</sup> Week	2 <sup>nd</sup> Week	3 <sup>rd</sup> Week	4 <sup>th</sup> Week	n=
NEC	2	1			3
Idiopathic	12	3			115
Obstructive	4				4
Iatrogenic			1	1	2
Total	18	4	1	1	24

Only 3(12.5%) neonates were premature having gestational age ranging between 30 to 32 weeks. History of perinatal stress was found in 60% of idiopathic type of NGIP. Obstetric complications like prepartum haemorrhage, premature rupture of membranes etc were found in 29% of mothers. Laboratory investigations included blood examination for Hb% , TLC and DLC. Serum electrolytes and arterial blood gas analysis were also done. Roentgenography of abdomen showed gas under diaphragm in 86.8% cases whereas 12.5% had evidence of pneumatosis intestinalis. All babies were resuscitated before surgery. Triple regimen of antibiotics comprising of Ampicillin, Aminoglycoside and Metronidazole was started preoperatively. Laparotomy was carried out through transverse abdominal incision. The edge of perforation was sent for histopathological examination. In case of perforation of large bowel tissue was also examined for presence of ganglion cells at the site of perforation as well as from the muscularis of rectum near the peritoneal reflection. Different surgical procedures carried out are shown in table III.

Table III: Relationship between site of perforation, Type of Surgical Procedure &amp; Mortality of NGIP

Type of surgical procedure	Site of perforation					n=	Mortality
	Stomach	Jejunum	Ileum	Caecum	Colon		
Direct suturing	3(2)	3(1)	3(1)	2	1	12	33.3%
Resection & anastomosis			3(1)			3	33.3%
Exteriorisation				4(2)	3(2)	7	57.1%
Bishop Koop			2			2	
Total	3(2)	3(1)	8(2)	6(2)	4(2)	24	37.5%
Mortality	66.6%	33.3%	25%	33.3%	50%		37.5%
		27.3%		40%			

Idiopathic perforations of large bowel with minimal soiling of peritoneal cavity were closed primarily. However perforations of large bowel with marked soiling and those caused by distal obstruction were exteriorized for the definitive procedure to be carried out later. Iatrogenic perforations of large bowel were also exteriorized.

### Results

Out of 24 cases of NGIP 15(62.5%) were of idiopathic or spontaneous variety. Histological examination of their edges failed to reveal an etiology. Three (12.5%) were caused by NEC and distal ileum was the site of perforation in these cases. Four (16.6%) perforations occurred due to distal obstruction, of these three involved caecum whereas in one case sigmoid colon was the site of perforation. Classical HD at rectosigmoid junction, long segment HD upto splenic flexure and atresia of descending colon were the obstructive causes of caecal perforations, whereas sigmoid colon perforated due to imperforate anus. Out of 2 iatrogenic perforations 1 of caecum was due to an incision over an obstructed inguinal hernia which was misdiagnosed as an abscess by a general practitioner and the other was caused by an enema tube in a baby undergoing diagnostic barium study for HD. Relative number of different types of perforations and their sites is shown in table II.

Table II: Relationship between the site &amp; etiology of gastrointestinal Perforation.

Site	Idiopathi c	Etiology			n	%ag e
		NEC	Obstructiv e	Iatrogeni c		
Stomach	3				3	12.5
Jejunum	3				3	12.5
Ileum	5	3			8	33.3
Caecum	2		3	1	6	25
Ascendin g Colon	1				1	4.2
Transver se Colon	1				1	4.2
Sigmoid Colon			1	1	2	8.3
Total	15	3	4	2	22	44

Results of different surgical procedures in these neonates are shown in table III. Sixty six percent neonates with gastric perforations died during early post operative

period. They died of septicemia. Out of 8 neonates with idiopathic type of small intestinal perforations, 6 had direct closure of which 2 (33.3%) died whereas remaining 2 had Bishop Koop operation done and they survived. Two neonates with idiopathic perforations of caecum and one of ascending colon, with minimal soiling of peritoneal cavity also survived with primary closure of perforations. One infant with idiopathic perforation of transverse colon which was exteriorized died due to advanced septicemia. Out of 3 neonates with perforations due to NEC treated by resection and end to end anastomosis, 1 died. This was a premature child with birth weight of 1.5 kg. Three out of 4 neonates with perforations due to distal obstruction which were exteriorized died where as overall mortality of exteriorization was 57%.

### Discussion

Neonates with GIP present with clinical features simulating intestinal obstruction. Apart from abdominal distension, vomiting and constipation they may have erythema of abdominal wall or a palpable mass. They may exhibit respiratory distress as an early feature of perforation<sup>3</sup>. Majority of the perforations specially of idiopathic variety and those caused by NEC occur during the first week of life<sup>5</sup>. Roentgenography of the abdomen in upright posture showing pneumoperitoneum clinches the diagnosis. If the baby is too ill to be held upright, a roentgenogram taken in lateral decubitus position will also demonstrate free air<sup>6</sup>. However free air may not be present in a small percentage of patients where loops of intestine wall off the free air<sup>6</sup>. Pneumoperitoneum in a ventilated neonate may result from pulmonary leak rather than gut perforation<sup>1</sup>.

Common causes of NGIP in order of frequency are NEC, Spontaneous or idiopathic, obstructive and iatrogenic<sup>6</sup>. Necrotizing enterocolitis is an entity that was hardly mentioned about 30 years ago<sup>7,8</sup> but now has become the leading cause of perforation in neonates. Patients of NEC may present with minimal signs having benign course to extensive bowel necrosis and perforation<sup>9</sup>. Terminal ileum and ascending colon are the favoured sites of involvement. It usually occurs in premature babies of weights ranging from 750gm to 1500gm, taking formula feed. Mucosal injury, presence of bacteria and metabolic substrate like formula feed are essential for the development of NEC<sup>10</sup>. Ischemia of

bowel caused by perinatal stress or any other low flow state to bowel result in mucosal damage, bacterial invasion and necrosis of bowel wall. Transmural necrosis of gut gives rise to frank perforation. Immature ileum is also said to absorb intact bacterial toxins and macro molecules which damage the gut wall<sup>11</sup>. Gram negative and anaerobic bacteria are usually the organisms responsible for development of NEC<sup>12</sup>. Second most common type of NGIP after NEC is spontaneous or idiopathic type. The exact etiology of this type of perforation still remains to be detected. However selective or local ischemia of the viscus due to localized vascular accident in the wall of affected bowel or shunting of blood away from the gut to the vital organs has been accounted for its occurrence. The term "Ischemic bowel syndrome" has been assigned to it<sup>15</sup>. Neonates born with low birth weights having history of resuscitation are especially at high risk of developing GIP. In the series presented by Tan et al<sup>4</sup> NEC is the predominant (54%) cause of NGIP, whereas in the present study NEC shared only 12.5% of total number of cases. This wide discrepancy is due to the fact that most of premature babies who develop NEC commonly die before they report to hospital in this part of the world. Those who are admitted usually die of complications like sepsis etc before frank perforation occurs. In the West perforation due to NEC is high because more premature infants survive due to refined perinatal care and improved ventilatory support of these tiny babies<sup>3,6</sup>. Idiopathic variety of NGIP is the major contributor (62.5%) in present series. Small bowel is the commonest (53.3%) site for idiopathic perforations followed by large bowel (26.6%) and stomach (20%). In a study presented by Weinberg et al (14), small gut was involved in 57% of cases followed by large bowel (43%), where as Zamir et al's series showed small intestinal involvement in 55% of cases where as large bowel and stomach were responsible for 30% and 15% cases NGIP respectively. In Bell's series<sup>3</sup> 14% perforations in neonates were secondary to distal obstruction whereas in series presented by Tan et al distal obstruction was responsible for 21.4 % cases of NGIP. In the present series this figures around 16%.

Early detection of perforations and preoperative resuscitation contribute to successful outcome. This has specially been stressed in infants of very low birth weights<sup>16,17</sup>. Surgery should be carried out as soon as resuscitation is complete. The type of procedure to be undertaken depends upon the condition of intestine and peritoneal soiling. Direct suturing is feasible in most gastric perforations and in perforations of small intestine which are small in size and have minimal soiling of peritoneal cavity. Exteriorization of perforation is advised in all cases of small and large bowel perforations where condition of the child is critical or where extensive soiling of peritoneal cavity is present. In neonates of very low birth weight avoiding excessive bowel manipulation with prompt exteriorization of affected segment can remarkably change the outcome<sup>18</sup>. Perforations due to distal

obstruction should also be exteriorized. Resection and anastomosis is recommended in cases of perforations of large size or where an intestinal segment of doubtful viability is present alongwith perforation as seen in cases of NGIP due to NEC<sup>19</sup>. Bishop koop anastomosis (end to side Roux-en-y with distal limb stoma) is safer than end to end anastomosis. In the present series direct suturing and end to end anastomosis had 33.3% mortality rate whereas it was 57 % in cases of exteriorization. In series of 56 patients presented by Tan et al the mortality rate in the group with direct suturing of perforation was 57% whereas those undergoing end to end anastomosis and exteriorization had a mortality rate of 11% and 34% respectively. Mortality rate of gastric perforation in the present series is 66.6% whereas small and large intestinal perforations have 27.5% and 40% mortality rate respectively. In series presented by Tan et al gastric, small intestinal and large intestinal perforations had mortality rate of 60%, 34.6% and 17.4% respectively. The overall mortality rate of 37.5% of the present series is comparable with the series presented by Tan et al of 30% and of 33% presented by Bell<sup>3</sup>.

High mortality associated with NGIP in the present series is due to delay in presenting these babies to the hospital. Lack of transport facilities especially in villages, poverty and ignorance contribute to delay in reporting these babies to hospitals. Most of the babies who died had time interval of 2-3 days between the onset of signs of perforation and reaching the hospital. Majority of these babies are usually taken to the doctors who do not have much experience in dealing with neonates. When ultimately they report to the specialized units, sepsis already developed in these babies, makes them unfit for surgery. Transportation of these neonates by ignorant parents also adds to morbidity and mortality because most of them either aspirate or become hypothermic on their way to hospital. In villages most of the deliveries take place at home, with no facilities for perinatal care further adds to the number of neonates having the potential of developing NGIP. Improvement in the prognosis of NGIP can therefore be anticipated by early recognition of the condition and rapid transport of the child to a specialized paediatric surgical unit providing better peri and post operative care of these tiny patients of NGIP and better peri cum post operative care to these tiny patients.

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