

Review of 31 cases of neonatal gastrointestinal perforations

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Abstract:

Background: Despite the recently improved neonatal intensive management, gastrointestinal perforation during the neonatal period is still a major challenge for pediatric surgeons.

Objective: To review the effects of different clinical and operative parameters on the mortality of neonatal intestinal perforations.

Patients and Methods: A retrospective study was done to 31 cases of neonatal intestinal perforation at the neonatal intensive care unit of Basrah children speciality hospital during the past four and half years (July 2011 to December 2015). Information regarding the age, sex, gestational age, birth weight, clinical examination, x-rays value in diagnosis, causes and sites of perforations, types of operative procedures, and their effects on prognosis are all studied.

Results: Males were affected more than females (a ratio of 3.4: 1); birth weight has a significant association with the prognosis (P-value of 0.045). Hirschsprung's disease was the commonest cause for perforation (29%), followed by necrotizing enterocolitis and jejunoileal atresia (16.1%, each). Idiopathic perforations constituted only 12.9%. Ileum was the commonest site of perforation (58.1%), followed by cecum (16.1%). Stoma creation was the commonest operative procedure performed. Other procedures like, primary anastomosis, and primary peritoneal drainage followed by laparotomy were also used. This study revealed high mortality rate (45.2%). Complications like sepsis, anastomotic leaks, or burst abdomen carried a high risk of death.

Conclusions: High mortality rate is encountered, especially for necrotizing enterocolitis. In contrast to other study, Hirschsprung's disease is the commonest cause of perforation rather than necrotizing enterocolitis. Radiology has a relatively good accuracy in the diagnosis of intestinal perforations, although some cases were discovered intra-operatively. In this series, prompt accurate treatment with stoma creation harbored the best prognostic results; furthermore no benefits obtained from primary peritoneal drainage.

Keywords: neonates, perforations, intestine, mortality.

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Introduction:

Neonatal perforations of the gastrointestinal tract occur in the stomach, duodenum, small intestine or colon. Neonatal gastrointestinal perforation most commonly occurs as a complication of necrotizing enterocolitis accounting for 42% of cases. Spontaneous or idiopathic perforation, usually involving the terminal ileum, is the next most common presentation accounting for 22% of cases. (1) Neonatal gastric perforations most commonly occur in premature infants. About half of them are spontaneous, and the other half are iatrogenic from instrumentation. (2)

Gastrointestinal perforations occur more frequently in males, however there appears to be no sex predilection for those occurring in the stomach. (3) Approximately half of the patients with necrotizing enterocolitis will require surgical intervention because of evidence of intestinal perforation or persistent illness despite medical therapy. (4)

Meconium peritonitis is consequent upon a fetal intestinal perforation. The baby is born with a firm, distended, discolored abdomen and signs of obstruction. (5) A classic clinical presentation of complicated meconium ileus is intestinal perforation

with sterile meconium peritonitis and formation of a calcified pseudocyst. (6) If the intestinal perforation occurs early in the antenatal period, the x-ray appearance of a round rim of calcification underlines a meconium pseudocyst. (7)

Aims: To evaluate the association of demographic characteristics with the prognosis of neonatal intestinal perforations. To assess the influence of causes and sites on the prognosis of neonatal intestinal perforations.

To compare different operative procedures, commonly used for the treatment of neonatal intestinal perforations, and their effects on survival.

Patients and Methods

A retrospective study was done to all cases of neonatal intestinal perforations at the neonatal intensive care unit of Basrah children speciality hospital during the past four and half years (July 2011 to December 2015). The medical records of 36 cases of neonatal gastrointestinal perforations were reviewed. Four cases were excluded due to incomplete data and one neonate, died at arrival, was also excluded, so that a total of 31 cases were studied thoroughly.

Information regarding age, sex, gestational age, birth weight, clinical examination, x-rays value in diagnosis, causes and sites of perforations, types of

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operative procedures, and their effects on prognosis are all studied.

Statistical significance is determined by using the Statistical Package for Social Sciences (SPSS) version 20. χ^2 tests. A *P*-value of < 0.05 was assumed to be significant.

Results:

The mean age for neonates presented with intestinal perforations was 4.8 days (min= 7hours, max. =25 days) with SD of 5.57. Male-to-female ratio was 3.4:1. From 23 full-term neonates, 13(56.5%) survived,

while only 4 (50%) preterm neonates survived from a total of 8. The best survival found in neonates weighing more than 2.5 kg (11 of 15, 73.3%). Mortality rate, in low birth weight neonates (1.5-2.5kg), was high (6 of 14, 42.9%); furthermore the two very low birth weight neonates (1-1.5kg) died. There was no neonate with extreme low birth weight faced in this study. In addition, neonates weighing less than 2.5 kg carried higher mortality (62.5%) than those weighing more than 2.5 kg (26.7%) with *P*-value of 0.045.

Tab.1 Demographic factors of neonatal intestinal perforations

Demographic features	Died		Survive		Total	P-value
	No.	%	No.	%		
Age	< 72 hours	7	47.7%	8	53.3%	0.87
	> 72 hours	7	43.75%	9	56.25%	
Sex	Male	9	37.5%	15	62.5%	0.112
	Female	5	71.4%	2	28.6%	
Maturity	Term	10	43.5%	13	56.5%	0.750
	Preterm	4	50%	4	50%	
Birth weight	< 2500 g	10	62.5%	6	37.5%	0.045
	> 2500 g	4	26.7%	11	73.35%	

Clinical diagnosis was suggestive in only 18 cases (58%), while 25 cases (80.6%) were diagnosed by plain abdominal x-rays erect films and the remaining cases were discovered during laparotomy.

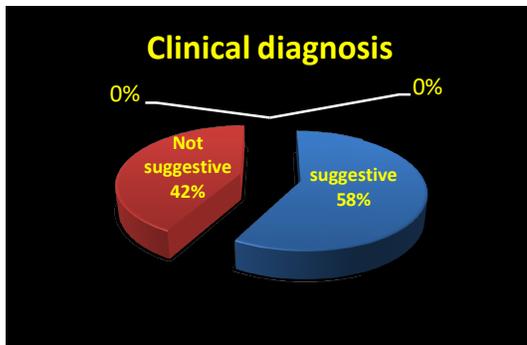


Figure 1 Value of clinical examination in diagnosis

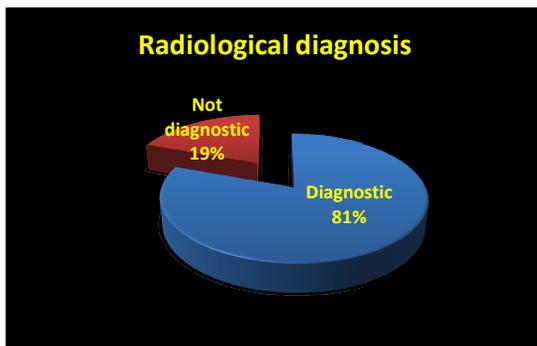


Figure 2 Value of plain x-rays in diagnosis

In this study, Hirschsprung's disease is the commonest cause of neonatal intestinal perforation (29%), followed by necrotizing enterocolitis (16.1%), Jejunioleal atresia (16.1%), idiopathic perforation (12.9%), meconium ileus (9.7%), intestinal volvulus (6.5%), meconium peritonitis (6.5%), rectal injury (3.2%). Rectal injury seems to be as a complication to rectal stimulation in neonate complained of delayed passage of meconium.

The overall mortality rate was relatively high (45.2%). Causes related to mortality were as follows: rectal injury (100%), necrotizing enterocolitis (80%), jejunioleal atresia (60%), idiopathic (50%), intestinal volvulus (50%), meconium ileus (33.3%), Hirschsprung's disease (22.2%), meconium peritonitis (0%). One case of meconium peritonitis then diagnosed as Hirschsprung's disease; furthermore, another case of focal necrotizing colitis diagnosed later on, by rectal biopsy as Hirschsprung's disease.

Tab.2 Cause related prognosis of intestinal perforations

CAUSE	SURVIVAL					
	Died		Survive		Total	
	No.	%	No.	%	No.	%
Hirschsprung' disease	2	6.5%	7	22.6%	9	29%
Necrotizing enterocolitis	4	80%	1	20%	5	16.1%
Jejunioileal atresia	3	60%	2	40%	5	16.1%
Idiopathic perforation	2	50%	2	50%	4	12.9%
Meconium ileus	1	33.3%	2	66.7%	3	9.7%
Meconium peritonitis	0	0%	2	100%	2	6.5%
Intestinal volvulus	1	50%	1	50%	2	6.5%
Rectal injury	1	100%	0	0%	1	3.2%
Total	14	45.2%	17	54.8%	31	100%

The commonest site of perforation was the ileum (58.1%), followed by cecum (16.1%), colon (12.9%), stomach (6.5%), jejunum (3.2%), and rectum (3.2%). Site-related survival was as follows: cecum (80%), colon (75%), and ileum (55.6%), with no survival found in patients with gastric, jejunal, or rectal perforations.

Tab.3 Sites related prognosis of intestinal perforations

SITES	PROGNOSIS					
	Died		Survive		Total	
	No.	%	No.	%	No.	%
Stomach	2	100%	0	0%	2	6.5%
Jejunum	1	100%	0	0%	1	3.2%
Ileum	8	44.4%	10	55.6%	18	58.1%
Cecum	1	20%	4	80%	5	16.1%
Colon	1	25%	3	75%	4	12.9%
Rectum	1	100%	0	0%	1	3.2%
Total	14	45.2%	17	54.8%	31	100%

Fig.3 shows the association between multiple perforations with the survival of neonatal intestinal perforations. There is a significant association with P= value of 0.007.

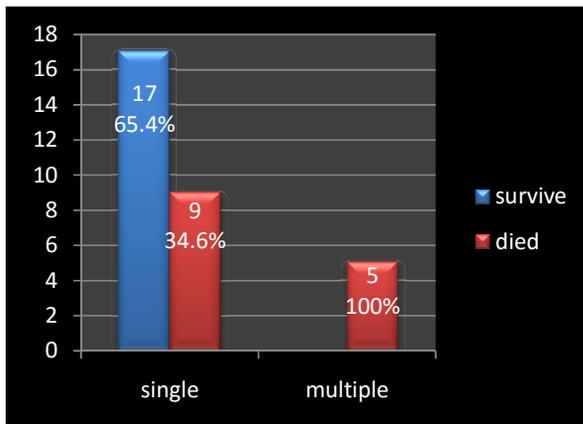


Figure 3 Multiple perforations and prognosis

Different operative procedures for the treatment of neonatal intestinal perforations were performed. All the neonates treated with primary peritoneal drainage followed by laparotomy and those neonates treated with jejunostomy died. Ileostomy was the commonest procedure done which harbors relatively better prognosis (64.7%) apart from cecostomy which was the best (100%). Primary anastomosis carried only 33.3% survival hope.

Tab.4 Operation related prognosis of intestinal perforations

PROCEDURE	PROGNOSIS					
	Died		Survive		Total	
	No.	%	No.	%	No.	%
Jejunostomy	1	100%	0	0%	1	
Ileostomy	6	35.3%	11	64.7%	17	
Cecostomy	0	0%	2	100%	2	
Colostomy	2	40%	3	60%	5	
Primary anastomosis	2	66.7%	1	33.3%	3	
Peritoneal drainage	3	100%	0	0%	3	
Total	14	45.2%	17	54.8%	31	

Complications were associated with high death rate. Sepsis (confirmed by blood culture) found in 14 cases; of which 11 neonates died. Wound infections occurred in 8 patients, of them 4 did not survive. Burst abdomen occurred in 2 patients, both died. Anastomotic leak occurred in one patient who died.

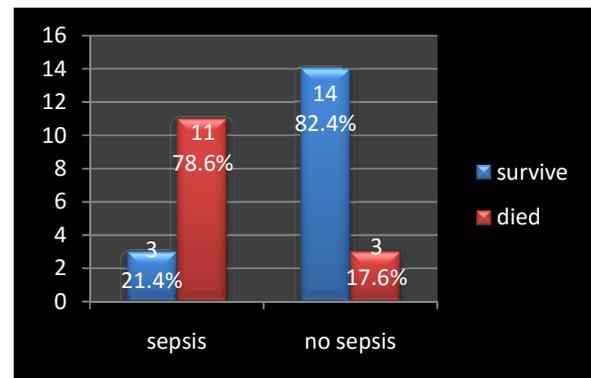


Figure 4 Sepsis related prognosis

Statistical associations: Neonatal intestinal perforations occur more frequently in male, although the association with mortality is not significant (P-value = 0.112). Again, age at presentation and gestational age have insignificant association with death (P-value = 0.87, 0.750, respectively). Birth weight of less than 2.5 kg has a significant association with mortality (P-value= 0.045). Sepsis has significant association (p-value= 0.001), as do multiple perforations (p-value= 0.007). Primary peritoneal drainage has a significant association with mortality (P-value= 0.045).

Discussion:

Despite the recently improved neonatal intensive management, such as ventilator management, availability of antibiotics and other medicines, and operative and anesthetic techniques, gastrointestinal perforation during the neonatal period is still a major problem for pediatric surgeons. (8, 9) The mean age for neonatal intestinal perforation is 4.8 days (differ from other study, which mentioned later presentation (11.4 days). (10) Male is affected more than female with a ratio of 3.4: 1 (similar to other studies, although higher male predilection found in this review). (10, 11, 12) The best survival encounters in neonates weighing more than 2.5 kg (73.3%), while for those with low birth weight (1.5-2.5kg) is 42.9%, very low birth weight (1-1.5kg) is 0%. There were no neonates with extreme low birth weight (less than 1kg) studied. There is a significant association between birth weight (around 2.5 kg) and survival with P-value of 0.045. This is similar to other study. (11) Prematurity is associated with higher death but the association is not significant (P-value=0.750). Plain abdominal x-rays erect film is a valuable and diagnostic tool in 80.6%; this is similar to what found by a study done by Almoutaz A. Eltayeb. (13) Hirschsprung's disease is the commonest cause for neonatal intestinal perforation (29%), followed by necrotizing enterocolitis (16.1%), Jejunioleal atresia (16.1%), idiopathic perforation (12.9%), meconium ileus (9.7%), intestinal volvulus (6.5%), meconium peritonitis (6.5%) rectal injury (3.2%). There is a big difference between this finding and other studies. Necrotizing enterocolitis is the commonest cause of neonatal intestinal obstruction in most other series. (10, 12, 13) Since enterocolitis is common in very low birth weight preterm neonates who recently salvaged in an increasing rate in most developed society so that the risk of developing enterocolitis become high and higher and so predominates the causes of neonatal intestinal perforations. This may also reflect the still high mortality of intestinal perforations in neonates in these societies owing to the high mortality of necrotizing enterocolitis. As the survivals of premature and critical ill neonates increase, the incidence of necrotizing enterocolitis is expectedly rising. Up to 90% of necrotizing enterocolitis occurs in preterm. (12) The persistent high mortality despite advancements in anaesthesia and neonatal intensive care has been attributed to increasing survival of extreme premature babies. (14) The overall mortality rate is relatively high (45.2%). In comparison with other studies, there is a wide variation in mortality rate. Mortality from neonatal intestinal perforation is still high; ranging from 40-70%. (15, 16) Some recent studies have; however, reported lower rates of death between 30-36%. (17) In this study, the mortality due to necrotizing enterocolitis was 80% which is similar to another study 83.3%. (11) One neonate with rectal injury died (mortality 100%) which may not reflect the actual risk, so that a large sample required for confirmation. In this study, although the mortality

among female (71.4%) is higher than male (37.5%) which is similar to other series (11), but the association is not statistically significant. The commonest site of neonatal intestinal perforation is the ileum (58.1%) which is similar to other studies. (11, 12) Regarding the site of perforation, it is clear that perforations affecting the upper gastrointestinal tract have worse prognosis than those affecting the lower gastrointestinal tract (no survival in neonates with gastric and jejunal perforations); similar to a study done by Gursev Sandlas. (10) This high mortality may be due to the fact that perforations in upper gastrointestinal tract usually require primary repair and prolonged postoperative fasting, while in case of ileal or colonic perforations, stoma creation is possible and optimum. This exteriorization reduces the time of surgery, time of exposure to anaesthesia, and early postoperative feeding especially when total parental nutrition is not available. Different operative procedures were used in the treatment of neonatal intestinal perforations. All neonates treated with primary peritoneal drainage followed by laparotomy and those treated with jejunostomy died. Ileostomy is the commonest procedure done which harbors relatively better prognosis (64.7%) apart from cecostomy which is the best (100%). Primary anastomosis or repair carried only 33.3% survival hope. Because of the low number of cases treated with primary peritoneal drainage, we could not assess the efficacy of this procedure in the treatment of neonatal intestinal perforation, although all 3 neonates treated with peritoneal drainage died. In similar study, there is a controversy regarding the benefit of primary peritoneal drainage. Some encourage its use with relatively good results and may even obviate laparotomy. (11) Other textbooks mention that there was no evidence from the trial to support the benefit of primary peritoneal drainage in extremely low birth weight (LBW) infants with intestinal perforation (2). Prospective trials are required to better define the role of peritoneal drainage in necrotizing enterocolitis. (18)

Conclusions:

Neonatal intestinal perforation is associated with high mortality rate, particularly with certain risk factors like low birth weight, gastroduodenal and rectal perforations, upper stomas, primary peritoneal drainage, or necrotizing enterocolitis. Radiological diagnosis has a relatively good accuracy in the diagnosis of neonatal intestinal perforation. Pre- and post-operative Complications increase the risk of death. In this study, Hirschsprung's disease is the most common cause of neonatal intestinal perforations, then necrotizing enterocolitis, which may be due to low survival rate of extremely low birth weight preterm neonate in our society. The most common site of perforation is the ileum, followed by cecum.

Recommendations: Prompt treatment with stoma creation carries the best results during the

management of neonatal intestinal perforation study. Prospective trials are required to better define the role of peritoneal drainage in the management of neonatal intestinal perforation.

Caution should be paid during rectal irrigations as rectal perforation may be of iatrogenic aetiology due to vigorous rectal stimulation during the management of neonates with delayed passage of meconium.

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