Necrotizing Enterocolitis: A Comparison Between Full-Term and Pre-Term Neonates

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Abstract

A retrospective study comparing 16 full-term and 18 pre-term neonates with NEC operated on at Siriraj Hospital between 1987 and 1999 is presented. Major risk factors leading to NEC in full-term neonates included sepsis, SGA, birth asphyxia, severe jaundice requiring exchange transfusion and chorioamnionitis. Although full-term neonates developed NEC earlier than pre-term neonates (8.56 days vs 12.78 days), the average ages of operation in both groups were the same. There was no difference in CBC and bacteriological culture's results between term and pre-term patients. The decision to conduct operative treatments for full-term neonates with NEC was mostly based on only clinical signs of peritonitis (56.25%) before the pneumo-peritoneum developed (31.25%). Ileo-caecal region was the most common site of bowel necrosis in both premature and full-term infants. Although term infants had a better 3-month survival rate than pre-term neonates (75% and 61% respectively), both groups had the same surgical complication rates.

Key word : Necrotizing Enterocolitis, Neonate, Full-term Infant, Risk Factors, Pneumatosis Intestinalis, Indications for Operation, Operative Complications, Survival Rate

Necrotizing enterocolitis (NEC) is a worldwide problem that has emerged in the past 25 years as the most common gastrointestinal emergency in neonatal intensive care units. It has been associated with prematurity, being more common among infants weighing < 1,500 g at birth. Never-theless, it is estimated that 7-13 per cent of NEC occurred in full-term infants[1,2]. Because little is known about the NEC in larger newborns, we performed an exploratory analysis of retrospective information obtained from all NEC cases who required operations during the last 12 years. NEC

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in full-term neonates were compared with pre-terms to identify different risk factors, clinical manifestations, results of investigation, indications of operation, surgical findings and outcomes.

MATERIAL AND METHOD

The medical records of all infants with a diagnosis of NEC, who required operative treatments and were admitted to Siriraj Hospital between March 1987 and July 1999, were collected and reviewed. All collected data included all clinical backgrounds (i.e, sex, gestational ages, birth weights, routes of delivery, Apgar scores, presence of recognized risk factors), onsets of NEC and all clinical manifestation details, radiological findings, laboratory parameters before operations, bacteriological cultures, operative findings as well as operative treatments and results. In order to demonstrate the different clinical manifestations and results of NEC which occurred in full-term neonates clearly, we compared all information of these full-term infants with those of neonates who were born prematurely and operated on at the same period of time.

All comparable quantitative data were analyzed by the Student's t-test for unpaired groups and the qualitative data were compared by the Fisher's Exact test. The statistical significance was defined as p value < 0.05.

RESULTS

Of 34 NEC patients treated surgically in Siriraj Hospital between March 1987 and July 1999, 16 were full-term neonates with gestational ages greater than or equal to 37 weeks. Sex, gestational ages, birth weights, routes of delivery are revealed in Table 1. Small for gestational age which was defined by a birth weight of less than the tenth percentile of gestational age, was identified in 31.25 per cent of full-term infants, compared to 17.65 per cent of pre-term neonates. Most infants were born by the normal vaginal route and the percentages of abnormal delivery compared to full-term and pre-term groups were the same. Two premature neonates developed NEC following abdominal operations, i.e., a primary fascial closure for gastroschisis and an ileal resection with double ileostomy for ileal atresia. Two full-term neonates developed NEC following intestinal operations. A full-term neonate had duodenoduodenostomy done for duodenal atresia and the other one had colostomy performed for an anorectal malformation.

Risk factors contributing to NEC are demonstrated in Table 2. Although full-term neonates had a lower incidence of birth asphyxia compared to premature neonates (26.67% vs 56.25% respectively), asphyxia was the major risk factor of NEC in full-term neonates compared to the normal full-term neonatal population. Other risk factors

Table 1.   Sex, gestational ages, birth weights, routes of delivery of all necrotizing enterocolitis.

Sex	Preterm (n = 18) Male 12, Female 6	Term (n = 16) Male 9, Female 7	Total (n = 34) Male 21, Female 13
Average GA +,- SD (weeks)	30.83 +,- 2.6	38.06 +,- 1.18*	34.24 +,- 4.19
Range of GA (weeks)	27-34	37-42	27-42
Average birth weight +,- SD (gm)	1443.89 +,- 391.88	2627.50 +,- 485.85*	2000.88 +,- 738.92
Range of birth weight (gm)	810-2200	1910-3570	810-3570
Small for gestational age	17.65% (3/17)	31.25% (5/16)**	24.24% (8/33)
Available data of delivery	n= 16	n= 16	n= 32
Normal vaginal delivery	62.5% (10)	68.75% (11)**	65.63% (21)
Abnormal vaginal delivery	25.0% (4)[a]	0%	12.50% (4)
Vacuum delivery	0%	18.75% (3)[b]	9.38% (3)
Caesarian section	12.5% (2)[c]	12.5% (2)[d]	12.5% (4)

 * p < 0.001 compared to preterm group;
 ** p > 0.05 compared to preterm group.
 a. Included 3 twin deliveries and 1 criminal abortion.
 b. Included 2 maternal exhaustion and 1 maternal heart disease.
 c. Included 1 pre-eclampsia, 1 unknown cause; d. 1 breech presentation,1 chorioamnionitis.

Table 2.   Risk factors contributing to NEC.

Asphyxia (Apgar <8)	Preterm	Term	Total
Apgar 1 < 8	56.25% (9/16)	26.67% (4/15)	41.94% (13/31)
Apgar 5 < 8	25.00% (4/16)	6.67% (1/15)	16.13% (5/31)
Other risk factors	Preterm (n = 18)	Term (n = 16)	Total (n = 34)
Sepsis	50.00% (9)	37.50% (6)	44.12% (15)
Jaundice	50.00% (9)	25.00% (4)	38.24% (13)
RDS	55.56% (10)	0%*	29.41% (10)
Indomethacin Rx for PDA	44.44% (8)	0%*	23.53% (8)
Apnea	33.33% (6)	0%	17.65% (6)
Exchange transfusion	11.11% (2)	18.75% (3)	14.71% (5)
Chorioamniitis	16.67% (3)	6.25% (1)	11.76% (4)
Miscellaneous causes	11.11% (2)**	12.50% (2)***	11.76% (4)

    * $p < 0.05$ compared to the premature group.
   ** Included 2 hypothermia (temperature < 35 C).
*** Included 1 cardiopulmonary resuscitation and 1 thick meconium stain.

leading to NEC in full-term neonates included sepsis (37.5%), severe jaundice requiring exchange transfusion (18.75%), chorioamnionitis, cardiac arrest and thick meconium stain. Risk factors related with prematurity, such as respiratory distress syndrome (RDS), severe patent ductus arteriosus (PDA) requiring indomethacin therapy and frequent apnea, have never aggravated full-term neonates to NEC.

The average onset of NEC +,- SD, average duration of NEC before operations +,- SD and average age at operation +,- SD of pre-term neonates (n = 18) were 12.78 +,- 13.82, 1.78 +,- 2.46 and 14.67 +,- 15.20 days respectively, whereas, the average onset of NEC +,- SD, average duration of NEC before operations +,- SD and average age at operation +,- SD of term neonates (n = 16) were 8.56 +,- 10.84, 6.25 +,- 11.11, and 14.81 +,- 19.97 days respectively. Although full-term neonates developed NEC earlier than pre-term neonates (8.56 days vs 12.78 days), this difference was not statistically significant because of too small sample sizes. The average duration of NEC before operations in the full- term group was longer than the pre-terms but the average ages at operation in both full-term and pre-term neonates were the same (14.81 days vs 14.67 days, p > 0.05).

Pre-operative complete blood counts (CBC) were recorded in 16 pre-term and 12 full-term newborns. The average WBC count +,- SD of pre-term neonates (12189 +,- 8955 cell/mm^3) were not different (p > 0.05) from those of term neo-

nates (12157 +,- 8679 cell/mm^3). There was no difference in average neutrophil percentages +, - SD between pre-term and term neonates (55.81 +, - 23.1% and 47.92 +,- 32.6% respectively, p > 0.05). The incidences of platelet counts less than 100,000/ mm^3 in pre-term and term neonates were 30.77 per cent (4/13) and 33.33 per cent (3/9) respectively and there was no statistical significance.

Haemoculture results of premature neonates were 2 Klebsiella pneumoniae, 1 Coagulase Negative Staphylococcus, 1 Salmonella group C, 1 Staphylococcus aureus and 8 no-growth cultures, whereas, blood culture results of full-term neonates were 1 Klebsiella pneumoniae, 1 Echerichia coli, 1 Non-Fermentative-Gram-Negative-Rod and 5 no-growth specimens. Peritoneal fluid of pre-term newborns was cultured and the results were 4 Klebsiella pneumoniae, 2 Pseudomonas aeroginosa, 2 Echerichia coli, 2 Candida spp, 1 Entero-cocci, 1 Citrobactor freundi and 3 no- growth cultures. Peritoneal fluid culture results of term infants were 2 Pseudomonas aeroginosa, 2 Entero-cocci, 1 Klebsiella pneumoniae and 2 no-growth specimens.

The results of pre-operative abdominal radiological findings, indications of operations and operative findings are demonstrated in Tables 3, 4 and 5 respectively. Although pneumoperitoneum was the most common indication of operation in premature neonates (55.56%), it was not the major indication of operation in full-term neonates

Table 3.   Plain abdominal radiological findings.

X-ray findings	Preterm (n = 18)	Term (n = 16)	Total (n = 34)
Free air	55.56% (10)	31.25% (5)	44.12% (15)
Pneumatosis intestinalis	16.67% (3)	37.50% (6)	26.47% (9)
Generalized bowel dilatation	16.67% (3)	31.25% (5)	23.53% (8)
Portal vein gas	5.56% (1)	18.75% (3)	11.76% (4)
Fixed loop of bowel dilatation	11.11% (2)	0%	5.88% (2)

Table 4.   Indications of operations.

Indications of operation	Preterm (n = 18)	Term (n = 16)	Total (n = 34)
Peritonitis signs	38.89% (7)	56.25% (9)	47.06% (16)
Free intraperitoneal air	55.56% (10)	31.25% (5)	44.12% (15)
Failure to medical treatment*	0%	6.25% (1)	2.94% (1)
Gut obstruction	0%	6.25% (1)	2.94% (1)
Necrosis of ostomy	5.56% (1)**	0%	2.94% (1)

    * There was no sign of clinical peritonitis.
   ** A case of ileal atresia (post ileal resection and double ostomy).

Table 5.   Operative findings.

Operative findings at operation	Preterm (n = 18)	Term (n = 16)	Total (n = 34)
1. Necrosis and perforation	72.22% (13)	56.25% (9)	64.71% (22)
1.1. Ileo-caecal region	55.56% (10)*	31.25% (5)	44.12% (15)
1.2. Colonic necrosis and perforation	16.67% (3)	18.75% (3)	17.65% (6)
1.2.1. Rt. half of colon	0%	12.50% (2)**	5.88% (2)
1.2.2. Isolated transverse colon	5.56% (1)	6.25% (1)	5.88% (2)
1.2.3. Isolated sigmoid colon	11.11% (2)	0%	5.88% (2)
1.3. Isolated jejunum	0%	6.25% (1)	2.94% (1)
2. Ileal necrosis, no perforation	11.11% (2)	25.00% (4)	17.65% (6)
3. No necrosis, no perforation	16.67% (3)	18.75% (3)	17.65% (6)

    * Included a case of isolated caecal perforation, a case of two-segmental ileal necrosis, and a case combined
      with an omphalomesenteric perforation.
   ** Composed of a case with Rt. transverse perforation and a case which had three perforation sites at caecum,
      Rt. and Lt. transverse colon.

(31.25%). The decision to conduct operative treatments for NEC in full-term neonates was mostly based on only clinical signs of peritonitis (56.25%) before the pneumoperitoneum developed (31.25%). In most of these full-term infants (56.25%) evidence of bowel necrosis on the basis of clinical manifestations could be detected before the necroses bowels perforated and free air was delivered. Seventy-two per cent of pre-term infants had bowels perforated from progressive necrosis, whereas, only 56 per cent of term neonates had these perforations. This difference originated from the fact that bowel necrosis without a perforation was found in 25 per cent of term infants compared to only 11 per cent of premature neonates. The premature group tended to be diagnosed later because clinical peritonitis signs were not obvious enough (only 38.89% of cases) until the gangrene bowels perforated (72.22%) and free air was released and identified (55.56%). Pneumatosis intestinalis was a

Table 6. Operative treatments.

Operative treatments	Preterm (n = 18)	Term (n = 16)	Total (n = 34)
1. Necrosis and perforation	72.22% (13)	56.25% (9)	64.71% (22)
1.1. Resection and double ostomy	n = 7	n = 5	n = 12
Ileal resection	6*	2	8
Rt. half colectomy	0	3**	3
Sigmoid colon resection	1	0	1
1.2. Exteriorization as ostomy	n = 5	n = 1	n = 6
Loop ileostomy	2	0	2
Transverse colostomy	1	1	2
Caecostomy	1	0	1
Sigmoid colostomy	1	0	1
1.3. Suture the perforation site and proximal ostomy	n = 1***	n = 1	n = 2
1.4. Resection and anastomosis	n = 0	n = 1	n = 1
1.5. Suture the perforation site	n = 0	n = 1	n = 1
2. Ileal necrosis, no perforation	11.11% (2)	25.00% (4)	17.65% (6)
2.1. Exteriorization as ileostomy	1	2	3
2.2. Resection and double ostomy	0	2	2
2.3. Ileal resection and anastomosis	1	0	1
3. No necrosis, no perforation	16.67% (3)	18.75% (3)	17.65% (6)
3.1. Loop ileostomy	1	1	2
3.2. Loop jejunostomy	0	1	1
3.3. Tube ileostomy	0	1	1
3.4. Transverse colostomy	1	0	1
3.5. Manual bowel decompression	1	0	1
Drainage	64.71% (11/17)	43.75% (7/16)	54.55% (18/33)

* Included a case with omphalomesenteric duct resection and a case requiring two-segmental ileal resection.
** Included a case requiring a suture at Lt. transverse colon.
*** Had an ostomy from the previous operation for ileal atresia.

more common radiological finding in full-term neonates (37.50%) than pre-term neonates (16.67%) and so was portal vein gas (18.75% *vs* 5.56%, respectively).

The operative findings are described in Table 5. The ileo-caecal region was the most common site of bowel necrosis (61.77%) in both premature and full-term infants (66.67% and 56.25% respectively). The percentages of colonic necrosis from advanced NEC compared to pre-term and term patients were the same (16.67% and 18.75% respectively, p > 0.05).

The operative treatments for all necrotizing enterocolitis are elucidated in Table 6. For scenarios where the affected bowels were gangrenous, with or without perforations, resection of these parts of the intestine and creation of double ostomy from the adjacent viable bowels, was the most common procedure for either pre-term or full-term patients. Exteriorization of the necrotic bowel as the ostomy was the second most common operation offered to these patients. In the highly selected cases when the necrotic bowels were not so long and the rest of the bowels were obviously viable, intestinal resection and primary end-to-end anastomosis was performed safely. This procedure was applied in our two cases and the results of this procedure were excellent. When the operative finding revealed an extensive necrotizing enterocolitis without a necrotic bowel, some types of bowel decompressing procedure were employed.

The results of operative treatments are described in Table 7. Sepsis was the most common cause of death in both groups. Although term infants had a better 3-month survival rate than the pre-term neonates (75% and 61% respectively), this difference was not statistically significant due to too small sample sizes. Despite the different survival rate, both groups had the same surgical complication rates (25.00% and 27.78% respectively, p > 0.05). No pre-term NEC survived if they had a surgical complication, in contrast to term patients who although having a surgical complication, could survive. All term infants who died, had no surgical

Table 7.   Mortality and morbidity of operations for necrotizing enterocolitis.

Results	Preterm (n = 18)	Term (n = 16)	Total (n = 34)
Died within 90 days	38.89% (7)	25.00% (4)	32.35% (11)
Died within 1 year	44.44% (8)	25.00% (4)	35.29% (12)
Average age at death (days)	49.00*	29.25	41.82*
Major causes of death			
Sepsis	87.50% (7)	100.00% (4)	91.67% (11)
Pneumonia	12.50% (1)	0%	8.33% (1)
Associated causes of death			
Congestive heart failure	2	1	3
Recurrent pneumonia	1	0	1
Liver failure	1	0	1
CNS infection	1	0	1
Surgical complications of the first operation	27.78% (5/18)	25.00% (4/16)	26.47% (9/34)
Surgical complications of the dead group	62.50% (5/8)**	0%	41.67% (5/12)
Surgical complications of survival group	0%	33.33% (4/12)***	18.18% (4/22)

*   Excluded the case which expired at the age of 240 days.
** Included 2 necrosis of ostomy, 2 progressive gangrene of bowel, 1 perforation of the bowel distally,1 adhesion band obstruction, 1 wound disruption and 1 intraabdominal collection.
*** Included 2 necrosis of ostomy, 2 perforations of bowel distally, 1 adhesion band obstruction, 1 wound disruption, 1 intraabdominal collection and a case with strictures at both ostomy and distal bowel.

complication and they died from sepsis at a younger age than the pre-term group (29.25 days and 49.00 days respectively). Surgical complications of both groups were nearly the same and also revealed in Table 7.

DISCUSSION

Necrotizing enterocolitis (NEC) is the most common surgical emergency in the newborn. Up to half of babies with NEC develop advanced disease requiring surgical interventions. Although necrotizing enterocolitis has emerged as a major cause of mortality and morbidity in premature infants, the occurrence of NEC in full-term infants is not frequently reported. It was estimated that the frequency of the disorder among all term infants was 0.17 per 1,000 live births, compared to the incidence of NEC occurring in premature infants which was 16.9 per 1,000 live births[2].

Although many published reports describing factors related to NEC failed to show a consistent risk factor other than prematurity, the majority of patients in these reported series were premature infants. Only a few studies have focussed specifically on larger newborns with NEC[1-3]. These studies, which examined only full-term neonates, reported a number of factors that have placed full-term infants at risks of NEC. These reported risk factors included small for gestational age[1,2,4,5], perinatal asphyxia[1-3], hypoglycemia[1-3], exchange transfusions[1,2], polycytemia[2,3], prolonged rupture of membranes[1], chorioamnionitis[1], congenital heart disease[1], and maternal pregnancy-induced hypertension[2]. In our series, risk factors leading to NEC in our full-term neonates included small for gestational age (SGA) (31.25%), birth asphyxia (26.67%), exchange transfusion (18.75%), chorioamnionitis, cardiac arrest and thick meconium stain. These risk factors have their own theological backgrounds. SGA from intrauterine growth retardation is associated with the diastolic steal phenomenon derived from a patent ductus artioriosus[4] which is rarely seen in AGA mature infants. Asphyxia diminishes the gut blood supply and therefore contributes to the pathogenesis of necrotizing enterocolitis. Exchange transfusion requiring the use of umbilical artery catheters causes a decrease in mesenteric blood flow increasing the risk of NEC[6].

However, in our series, the recognized risk factors were absent in 31.25 per cent[5] of our term neonates. Although physiologically stressed term infants are at risk for the development of NEC, it would also appear that apparently normal

term infants can develop NEC. This may suggest different causes resulting in the same end-organ manifestation of injury[7].

The rapid onset of NEC in the term neonate distinguishes it from the same disease occurring in the premature infant. This phenomenon has been recognized and reported in many series[1,2,7,8]. NEC in the premature infant generally occurs between the 7th and 14th day of life and occasionally as late as the 3rd week of life[2,8,9], whereas, in the term neonates, approximately half of NEC start within the first 48 hours of life and the majority fully develop in the first 4 days of life [1,2,7,8]. In our experience, NEC in the term neonate developed at the average of 8.56 days which was much earlier than those of pre-term neonates (12.78 days). The reason for the earlier onset of NEC in this group of patients might be the fact that full-term neonates tended to be fed earlier than pre-term neonates[1]. Enteral alimentation is thought to be a main contributor in the pathogenesis of NEC. Formula milk may produce a nutritionally induced inflammation through several hypothetical mechanisms: undigested casein, malabsorbed carbohydrate and long chain fatty acids [10]. In our series, although full-term neonates developed NEC earlier than the premature group, the average age of operation in the full-term group was the same as the pre-term group (14.81 days vs 14.67 days).

In our series, there was no difference in average WBC counts and neutrophil percentages between pre-term and term neonates. The majority of both pre-term and term patients had normal platelet counts, despite advanced NEC requiring laparotomy. This finding contradicted the results of O' Neill et al[11], which previously reported that 95 per cent of the overall patients requiring operations for NEC had platelet counts less than 150,000/ mm^3. The incidences of platelet counts less than 100,000/ mm^3 of pre-term and term neonates were the same (30.77% and 33.33% respectively).

Klebsiella pneumoniae was the most common pathogen identified in both haemocultures and peritoneal fluid cultures in either pre-term or term infants. Escherichia coli and Pseudomonas aeroginosa were frequently cultured organisms in both groups. These results were similar to previously reported studies[1,12]. The results of haemocultures and peritoneal fluid cultures were not so different between pre-term and full-term neonates, therefore,

we were unable to identify specific pathogens that could implicate this particular situation[2].

Operation for necrotizing enterocolitis is reserved for infants with intestinal gangrene or perforation. It should not be undertaken until gangrene is present, but ideally should be performed before intestinal perforation occurs. The best indications are pneumoperitoneum, positive paracentesis and portal venous gas[13]. Good indications are fixed intestinal loop noted on X-ray, erythema of the abdominal wall and a palpable abdominal mass[13]. From our data, in most full-term infants (56.25%) the evidence of bowel necrosis on the basis of clinical signs of peritonitis could be detected before the necroses bowel perforated and free air was delivered (31.25%). This implied that we could decide to conduct operations (based on clinical backgrounds) earlier than those of the premature group which had progressive bowel necrosis and perforations in 72.22 per cent of cases. Our data indicated that erythema of the abdominal wall was still a reliable indicator for bowel necrosis, in contrast to the results of Andrews DA's series (7) which revealed that the unexpected finding of pneumoperitoneum was the most common indication of operation.

Although a previous study[7] reported that all term neonates with NEC requiring operations had severe colonic disease without small bowel involvement, in our series, both pre-term and term patients had the same percentages of colonic necrosis (16.67% and 18.75% respectively). Ileocaecal region was the most common site of bowel necrosis in both premature and full-term infants (66.67% and 56.25% respectively).

In our series, term infants had better 3-month survival rates than pre-term neonates (75% and 61% respectively). This finding was compatible with many reported series[2,7-9,14]. The absence of associated problems related with prematurity probably contributes to the improved survival of the term neonate with NEC[7]. Although term infants had better survival rates than pre-term neonates, they had the same surgical complication rates (25.00% and 27.78% respectively). Complication rates were not affected by either the gestational age or birth weight or the age at the time of operation[14]. The types of surgical complications of both groups were nearly the same. From the data in Table 7, if pre-term neonates with NEC had a

surgical complication, they could not survive. We can explain this finding from the fact that a premature infant has an increased susceptibility to infection from significant reductions of neutrophil migration and phagocytosis[15] in addition to immunoglobulin deficiencies[16]. This immunological immaturity caused the deaths of all premature infants who had surgical complications, whereas, term infants could tolerate these surgical complica-

tions. However, sepsis was the most common cause of death for these term infants[14] in spite of no surgical complication.

We conclude that a substantial proportion of neonates with NEC will be of term gestation. The presentations, clinical courses and results of operative treatments for these full-term neonates with NEC differ from those encountered in premature infants with NEC.

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โรคลำไส้อักเสบเน่าตายในทารก: การศึกษาเปรียบเทียบระหว่างทารกที่คลอดครบกำหนดกับทารกที่คลอดก่อนกำหนด

รวิศ เรืองตระกูล, พ.บ.*, มงคล เลาหเพ็ญแสง, พ.บ.*,
ชนา สาทรกิจ, พ.บ.*, พลภัทร ตาละลักษมณ์, พ.บ.*

ผู้นิพนธ์ได้ทำการศึกษาย้อนหลังในผู้ป่วยเด็กที่ได้รับการผ่าตัดรักษาโรคลำไส้อักเสบเน่าตายในโรงพยาบาลศิริราช ระหว่างปี พ.ศ. 2530 ถึงปี พ.ศ. 2542 โดยได้ทำการศึกษาเปรียบเทียบระหว่างทารกที่คลอดครบกำหนดซึ่งมีทั้งสิ้น 16 รายกับทารกที่คลอดก่อนกำหนดซึ่งมีทั้งสิ้น 18 ราย ปัจจัยเสี่ยงที่ทำให้เกิดโรคลำไส้อักเสบเน่าตายในทารกที่คลอดครบ กำหนดได้แก่ การติดเชื้อในกระแสโลหิต ภาวะน้ำหนักตัวน้อยกว่าปกติ ภาวะขาดออกซิเจน ภาวะตัวเหลืองอย่างรุนแรงซึ่ง จำเป็นจะต้องได้รับการถ่ายเลือด และการติดเชื้อในเยื่อบุน้ำคร่ำ แม้ว่าอายุของทารกที่คลอดครบกำหนดที่เกิดโรคลำไส้- อักเสบเน่าตายจะมีอายุน้อยกว่าอายุของทารกที่คลอดก่อนกำหนดก็ตาม (กล่าวคือ 8.56 วันและ 12.78 วันตามลำดับ) อายุที่ทารกจำเป็นจะต้องได้รับการผ่าตัดไม่ได้แตกต่างกันระหว่างกลุ่มทารกทั้งสองกลุ่ม นอกจากนั้นผลการตรวจทางโลหิต- วิทยาและทางจุลชีววิทยาก็ไม่ได้มีความแตกต่างกันระหว่างทารกทั้งสองกลุ่ม สำหรับทารกที่คลอดครบกำหนดนั้นลักษณะ อาการทางคลินิกเมื่อเกิดภาวะอักเสบภายในช่องท้องก็เป็นข้อบ่งชี้ที่เพียงพอในการตัดสินใจผ่าตัดรักษา (56.25%) ก่อนที่ ลำไส้จะเน่าตายและเกิดภาวะลมรั่วภายในช่องท้อง (31.25%) บริเวณที่มีการอักเสบเน่าตายมากที่สุดทั้งในทารกที่คลอด ครบกำหนดและก่อนกำหนดก็คือบริเวณลำไส้เล็กส่วนปลายต่อกับลำไส้ใหญ่ส่วนต้น แม้ว่าทารกที่คลอดครบกำหนดจะมี อัตรารอดชีวิตที่ 3 เดือนมากกว่าทารกที่คลอดก่อนกำหนดก็ตาม (75% และ 61% ตามลำดับ) ทารกทั้งสองกลุ่มก็มีผล แทรกซ้อนทางศัลยกรรมในอัตราส่วนที่เท่ากัน

คำสำคัญ : โรคลำไส้อักเสบเน่าตาย, ลำไส้เน่าตาย, ลำไส้อักเสบ, ทารก, ครบกำหนดคลอด, คลอดครบกำหนด, เด็ก, ปัจจัยเสี่ยง, ลมในผนังลำไส้, ข้อบ่งชี้ในการผ่าตัด, ผลแทรกซ้อน, อัตราการตาย, อัตราการรอดชีวิต

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