Brief Report s

Neonatal Necroti zing Enter ocolitis

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Necrotizing enterocol itis (NEC) is one of the mo st widespr ead gastro intestinal (GI) disorders respo nsible for significant morb idity and mo rtality, particularly in low birth weight babies. The pathogenesis of NEC is still an enigma and it has been postulated that the dise ase results from hy poxem ia and mu cosal injur y, aggrav ated by feeding and bac terial prol iferation(l). There are a few reports on NEC from vari ous centers in India(2 -5). In this communi cation, we descri be a group of patients with NEC adm itted to the Neona tal In tens ive Care Unit (NICU) of the Kasturba Hospital, Manipal, and attempt to define risk fac tors for the disease in the popul at ion by means of a case co ntrol approach.

Subj ects and M ethods

Thir ty four infan ts with NEC, durin g the period January 1990 to August 1994, were taken for the epidemiolog ical study. Criteria for diagnosis included presence of abdominal distension, guaiac p ositive

stools and radiographic findings (fixed dis tended loop s, mucos al thick ening, pneumatosis intestina ls, portal venou s gas or free air). All cases were classified as per the modified Bell staging(6). Only inborn babies were included in the *cas e control study* to iden tify risk factors for NEC. Twenty three babi es were inborn and 46 weight matched controls (+/- 50 g), admitted to the NICU within th e same thr ee month period, were chosen from the unit computer log which is maintained for all babies. All cont rols had been in th e hospital for at last thr ee we eks to avoid havin g missed NEC af ter dischar ge. Data was en tered into the Dbase III program and analy sis was done using the EPI5 statistical pack - age. Chi squar e, Stud ent's 't-test and Mann-Whitney U-test were used to assess significance w herever relevant.

Results

A Descriptive Epidemi ology

Thirt y four cases of NEC were di ag nos ed be tween Januar y 1990 to Au gust 1994 which constituted 1.38% (34/2448) of all admissions to the NICU during that pe riod. Twenty three of these (67.64%) were inbo rn and they compr ised 0.47% (23/ 5303) of all inborn babies during the same period. The me an birth we ight and gesta tional age of all NEC babies was 1584.56+/ -490.31 g and 33.53 +/- 3.03 weeks, re spectively. Twenty eight (82.35%) were pr eterms and 33/34 (97.05%) wer e low birth weight (<2500 g). Twelve (35.29%) were small for gestational age. The median age at presentation was two days (range 0- 8) and the median age of first enteral feeds was two days (range 0-7). The frequency of symp toms and signs are summar ized in *Table I.*

TABLE I–*Frequency of Symptoms and Signs in NEC cases (n=34).*

Clinical feature	Number	Per cent
A. Symptoms		
Abdominal distension	16	47.5
Poor feeding	11	32.4
Lethargy	10	29.4
Grunting	10	29.4
Vomiting	8	23.5
Jaundice	6	17.6
Others	4	11.8
B. Signs		
Abdominal distension	27	79.4
Hyperbilirubinemia	23	67.6
Hypoglycemia	20	58.8
Umbilical erythema	19	55.9
Increased gastric return	16	47.1
Apnea	14	41.1
Gastric bleed	12	35.3
Lethargy	8	23.5
Absent bowel sounds	8	23.5
Bradycardia	7	20.6
Abdominal wall edema	6	17.6
Hypothermia	4	11.8
Cyanosis	4	11.8
Tachypnea	4	11.8
Others	16	47.1

B. Case Control Study

Twenty three inborn cases were compared with 46 weight matched controls. Cases and controls did not differ significantly in terms of mean maternal age, parity, type of delivery, presentation, presence of meconium stained liquor, sex of the baby, mean birth weight and gestation. Pregnancy induced hypertension (PIH), lower mean one and five minute APGAR scores and polycythemia emerged significant. Cases had a higher frequency of hypothermia and septicemia although the

difference was not statistically significant. The organisms isolated were coagulase positive *Staph.aurens* (4 cases, 6 controls), *Citrobacter diversus* (3 cases, 2 controls), *Klebsiella* (2 each), others (1 case, 2 controls). Distribution of preterms and small for gestation were equal in both groups. The frequency of postnatal problems were no different in both groups *(Table II).* The data on feeding schedules is summarized in *Table III.*

Discussion

Epidemiology

NEC is generally described as a disease of ill preterm neonates. The overall incidence varies from 3-5% of all live-births(l,7,8) with a higher incidence in very low birthweight babies(l). Our incidence is much lower and agrees with other Indian authors(2). The mean birthweight and gestational age of NEC babies are higher in this and other(2) series. It is interesting to note that authors (1,7,8) from developed countries have reported the disease in babies of much lower birth weight and gestation. It is possible that early mortality of extremely low birth weight (EL BW) babies in nurseries of developing countries, due to other illnesses, precludes death from NEC later on; our extremely low birth weight (ELBW) population was only 2/34 (5.88%) of all cases. We practice extreme caution in initiating and grading up feeds in babies at risk for NEC and this may explain, in part, the low incidence seen.

The age at diagnosis is much earlier than that seen by some (1,7,8) but compares well with others(2). It has been reported that the more immature the baby at birth, later is the age at presentation(7) and since our babies are more mature they have probably presented early. Symptoms and signs were similar to earlier reports(8). Hyperbilirubinemia is perhaps more com -

TABLE II–*Risk factor for NEC.*

Risk factors		Cases (n=23)	Controls (n=46)	p value
A. Maternal History				
Mean age		26.17	25.98	ns
(SD)		(5.15)	(3.99)	
Gravida	1	12	23	
	2-3	9	19	ns
	>3	2	4	
Pregnancy indu-ced hypertension		10	8	0.02
Prolonged rupture-of membranes		14	29	ns
Meconium		3	7	ns
Type of delivery				
Normal		13	31	
Cesarean		10	15	ns
Presentation				
Vertex		20	39	
Breech		3	7	ns
B. Birth History				
Mean 1 min APGAR		6.043	7.533	0.01
(SD)		(2.72)	(2.20)	
Mean 5 min APGAR		8.22	9.41	0.001
(SD)		(2.19)	(1.35)	
Type of birth				
Singleton		20	33	
Twin 1		1	5	ns
Twin 2		2	8	
C. Postnatal Problems				
Mean gestation(wks)		33.91	33.65	ns
(SD)		(2.69)	(2.55)	
D. Gestation & growth				
Preterm AGA		14	25	
Preterm SGA		5	12	ns
Term SGA		3	5	
Term AGA		1	4	
Polycythemia		12	12	0.033
Hypothermia		6	4	ns
Septicemia		10	10	ns

ns – not significant.

TABLE III–*Feeding Patterns.*

Risk factors	Cases (n=23)	Controls (n=46)	p value
Mean age at first feed (days)			
(SD)	3.43	2.54	0.048
	(1.92)	(1.79)	
Type of initial feed			
Breasmilt	18	34	
Formula	3	3	ns
Dextrose	2	9	
Mean quantity per feed(ml)			
(SD)	4.39	5.23	ns
	(4.58)	(7.43)	
Frequency of feeds			
1h	17	42	ns
2h	6	4	
Grading			
Slow	20	40	ns
Fast	3	6	
Additives			
Nil	17	28	
MCT	6	13	
Vitamin E	0	20	0.007
Drugs	0	4	

ns – not significant.

mon in our pattern of NEC as the age at diagnosis is earlier and some of it could be attributed to exaggeration of physiological jaundice due to delay in feeding. The incidence of umbilical erythema is high in this series and may be related to cord care procedures. Until very recently, sterile disposable cord clamps were not available in this hospital.

Case Control Study

The mean gestational age of cases and controls did not differ significantly but 19 patients (82.6%) of NEC were seen in preterms. Presence of lower mean APGAR scores have been causally implicated by

many workers (1,2,8,9) and an association was also seen in this study. This gives credence to the theory of a diving reflex producing gut ischemia and making the baby vulnerable to NEC(10,11).

Pregnancy induced hypertension (PIH) has been reported as a risk factor(8) and also emerged significant in the present report. These mothers tend to have small for gestational age babies who are at risk for birth asphyxia and polycythemia. Many workers(l,2,8) have found polychythemia to be a risk factor and in our series, 12/23 (52.1%) cases had the condition. Hyperviscosity causes ischemia of the bowel due to sludging in the arteries.

Hypothermia at admission or during the NICU stay before onset of NEC was seen in a significant number of cases. A similar observation has been reported by others(l). With inadequate facilities in most Indian units for monitoring and maintaining optimum temperature, this may well be significant factor.

The type of feeds and feeding schedules were no different in cases and controls. The association of NEC with the volume and schedule of formula feeding has been documented by many workers(8). The mean age of first feed was delayed in the cases probably due to a cautious approach in at risk infants. For the same reason, additives were given infrequently in cases as compared to controls.

In conclusion, NEC, in this region, seems to affect relatively more mature and higher birth weight infants and has an earlier onset as compared to that reported from developed countries. Considering the fact that PIH, birth asphyxia, polycythemia and hypothermia emerged as important risk factors, it is tempting to attribute poor gut blood flow as an important etiological factor in our babies. Good antenatal and perinatal care can decrease some of the above mentioned risk factors. Cautious commencement of enteral feeds coupled with liberal use of breastmilk may help in reducing the incidence of this type of NEC. Since resources to treat cases of full blown NEC are scarce, prevention, early recognition and aggressive treatment of mild cases will be rewarding.

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