

**EFFECT OF MATERNAL AND FETAL FACTORS  
ON EARLY NEONATAL MORBIDITY &  
MORTALITY OF TERM SMALL FOR DATE INFANTS**

by

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*Introduction*

Term small for date (SFD) infants are low birth weight infants with a gestational age of 37-42 completed weeks. Those infants whose birth weights are less than 10th percentile for the gestational age are called SFD infants (Battaglia and Lubchenco, 1967). Khatua *et al* (1979) in their study of 2792 term infants born to apparently healthy mothers showed that the 10th percentile weight varied from 1.75 kg. at 37 weeks to 2.25 kg. at 41 and 42 weeks, indicating 2.25 kg as the upper limit of low LBW criteria.

Though the neonatal morbidity and mortality study has been done by several workers (Gupta *et al*, 1972; Bhakoo, 1975; Shila Karan *et al*, 1972; Shah and Udani, 1969) in our country, there is no report on early neonatal (1st week) morbidity and mortality of term SFD infants.

This study was undertaken to find out the early neonatal morbidity and mortality pattern of term SFD infants and the maternal and fetal factors influencing them, so that appropriate measures can be

taken to reduce their morbidity and mortality.

*Materials and Methods*

Two thousand, six hundred and seventy consecutive liveborn infants were studied in the Eden Nursery of Calcutta Medical College from November 1979 to February 1980 with particular stress on term infants with a gestational age of 37-42 completed weeks.

These infants were examined in detail with particular emphasis on birth weight and gestational age corroborated by Dubowitz's (1971) morphological and neurological criteria. Only those infants whose birth weights were less than 10th percentile for the gestational age were considered as SFD infants. Term AFD infants were considered as normal infants. A detailed history of the mother was taken regarding the age, parity, height, weight, socio-economic status, antenatal care, period of gestation and any maternal disease general or obstetrical, onset and duration of labour, duration of premature rupture of membrane if any, colour of the amniotic fluid, fetal movement and fetal heart sound and the type of delivery.

All infants were kept under constant supervision till discharge or death to re-

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Accepted for publication on 3-2-81.

cord any abnormality. Diagnostic studies like examination of blood, stool, urine C.S.F., umbilical and conjunctival swab, teleradiogram of chest and heart and E.C.G. were done in appropriate cases. Postmortem examination was done in 26 cases. Three hourly feeds with 10% glucose were started from 3rd hour to all SFD infants for the first 2-3 feeds and from 6th hour to all AFD infants to pre-

vent hypoglycemia. Treatment was carried out on specific indication. Various maternal and fetal factors influencing the morbidity and mortality of term SFD and normal infants were analysed, statistically scrutinised and compared.

#### Observations

Two thousand six hundred and seventy consecutive liveborn infants were studi-

TABLE I  
Early Neonatal Morbidity and Mortality of Term SFD and Normal Infants

	No. of infants	Morbidity		Mortality	
		No.	%	No.	%
Pre-term infants	130	51	39.2	35	27
Term SFD infants	652	213	32.6	43	6.6
Normal infants	1862	289	15.5	22	1.18
Post-term infants	26	7	26.9	2	7.7
Total	2670	560	21	102	3.82

TABLE II  
Early Neonatal Morbidity and Mortality Pattern of Term SFD and Normal Infants

Nature of Morbidity	SFD (652)				Normal (1862)			
	Morbidity		Mortality		Morbidity		Mortality	
	No.	%	No.	%	No.	%	No.	%
Asphyxia	62	9.5	8	1.2	103	5.5	10	.53
Diarrhoea	16	2.4	2	.3	21	1.12	1	.05
Septicemia	23	3.5	16	2.45	13	.69	2	.16
Intrac. stress	7	1.07	—	—	25	1.34	—	—
H.D.N.	19	2.9	1	.15	6	.32	—	—
Aspiration syndrome	15	2.3	5	.76	5	.26	2	.107
Trans. tachypnoea	5	.76	—	—	10	.53	—	—
Convulsion	5	.76	—	—	10	.53	—	—
Cong. malformation	10	1.51	3	.46	4	.21	—	—
Pneumonia	2	.3	2	.3	4	.21	—	—
R.D.S.	3	.46	3	.46	2	.107	—	—
Meningitis	1	.15	1	.15	3	.16	1	.05
Massive pulm. haemo	2	.3	2	.3	1	.05	1	.05
Hemor. disease of newborn	3	.46	—	—	—	—	—	—
D.I.C.	—	—	—	—	2	.1	2	.1
Superficial infection	40	6.1	—	—	80	4.3	—	—
Total	213	32.6	43	6.6	289	15.5	22	1.18



ed. The observations are shown in Table I—Table VIII. The important causes of morbidity among term SFD infants were asphyxia (29.1%), infection (19.2%), aspiration syndrome (7%) and congenital malformation (4.7%) in that order. The common sites of major malformations were—C.N.S. 23%, musculo-skeletal 22%, gastro-intestinal system 20%, cardiovascular 7% and others 28%. In normal infants asphyxia, infection and intracranial stress were most common. The overall incidence of deep infection like septicemia, diarrhoea, pneumonia and meningitis in term infants were 3.3% and their mortality rate was 1.03%.

Superficial infection included 7 cases of pyoderma, 51 cases of oral thrush, 52 cases of conjunctivitis and 10 cases of umbilical infection and these were about one and half times more common in SFD than in AFD infants. The cause of convulsion in 15 infants could not be ascertained except in 3 SFD infants who had hypoglycemia.

The morbidity and mortality of SFD infants of mothers with a height of 150 cm or less were 38.4% and 9.5% respectively as opposed to 27% and 3% respectively at a maternal height of 160 cm. or more. In AFD infants the corresponding rates

were 21% and 1.5% in the former (< 150 cm.) and 11.7% and .91% in the later (> 160 cm.) group.

The morbidity and mortality of SFD infants of mothers having a body weight of 40 kg. or less were 37% and 9.8% respectively as compared to 27% and 3.8% with maternal weight of 50 kg or more. In AFD group, the corresponding figures were 19.2% and 1.6% respectively with maternal weight of 40 kg. or less and 9.9% and .45% with maternal weight of more than 50 kg.

Again the morbidity and mortality of SFD infants of mothers having occasional or no antenatal check up was 41.4% and 7.6% respectively as opposed to 21% and 4.2% in those whose mothers had 3 or more check-up. In normal infant group the corresponding rates were 20% and 1.3% when the mothers had no check up and 10% and .9% with 3 or more antenatal check up.

40% death occurred within 24 hours and all of them had asphyxia at birth and 62% within 48 hours.

The proportion of morbidity and mortality of SFD and normal infants when statistically compared differed greatly which were significant even at 1% level of significance. When the difference was

TABLE III  
Morbidity and Mortality in Relation to Birth Weight

Wt. in kg.	Term LBW infants				Normal infants					
	No. of inf.	Morbidity No.	Morbidity %	Mortality No.	Mortality %	No. of inf.	Morbidity No.	Morbidity %	Mortality No.	Mortality %
1 or less	2	2	100	2	100					
1.1-1.5	15	12	80	8	53.5					
1.6-2	240	97	40.4	17	7.1					
2.1-2.25	395	102	25.8	16	4					
2.26-2.5						969	164	17	12	1.2
2.6-3						558	84	15	6	1.07
>3						335	41	12.2	4	1.16
Total	652	213	32.6	43	6.6	1862	289	15.5	22	1.18

further analysed, taking into consideration of second variable namely maternal age, parity, height, weight, antenatal, check up and maternal diseases separately the above observation about the morbidity and mortality in the two groups was

also found to be significant. Similar difference in the morbidity and mortality among different groups of SFD infants were also observed, but not in different groups of normal infants.

TABLE IV  
*Morbidity and Mortality in Relation to Gestational Age*

Gest. age in wks.	SFD infants					Normal infants				
	No. of inf.	Morbidity		Mortality		No. of Inf.	Morbidity		Mortality	
		No.	%	No.	%		No.	%	No.	%
37	37	15	40.05	3	9.4	144	24	16.6	3	2
38	130	47	36.1	8	6.15	352	60	17	5	1.4
39	144	40	27.7	10	6.9	446	70	15.7	6	1.1
40	248	75	26.3	15	5.28	550	80	14.5	4	.72
41	60	24	40	4	6.1	230	31	13.4	2	.6
42	33	12	36	3	9	140	24	17.1	2	1.43
Total	652	213	32.6	43	6.6	1862	289	15.5	22	1.18

TABLE V  
*Morbidity and Mortality in Relation to the Age of the Mother*

Age in Yr.	SFD infants					Normal infants				
	No.	Morbidity		Mortality		No.	Morbidity		Mortality	
		No.	%	No.	%		No.	%	No.	%
>20	234	90	38.4	19	8.1	324	59	18.2	5	1.5
20-24	268	79	26	13	4.85	835	122	14.6	8	.95
25-29	110	30	27.3	7	6.36	506	75	14.8	5	.98
30-34	34	11	32.3	3	9	139	22	15.9	2	1.4
>35	6	3	50	1	16.6	58	11	19	2	3.44
Total	652	213	32.6	43	6.6	1862	289	15.5	22	1.18

TABLE VI  
*Morbidity and Mortality in Relation to the Parity of the Mother*

Parity	SFD infants					Normal infants				
	No.	Morbidity		Mortality		No.	Morbidity		Mortality	
		No.	%	No.	%		No.	%	No.	%
1	200	71	35.5	16	8	712	114	16	9	1.26
2	238	67	28	11	4.6	574	82	14.2	5	1.87
3	110	35	31.8	7	6.3	356	52	14.6	4	1.1
4 or >	104	40	34.8	9	8.6	220	41	18.6	4	1.8
Total	652	213	32.6	43	6.6	1862	289	15.5	22	1.18



TABLE VII  
Early Neonatal Morbidity and Mortality of SFD and Normal Infants of Diseased Mother

Disease and No. of cases	SFD infants				Normal infants					
	No. of cases	Morbidity No.	Morbidity %	Mortality No.	Mortality %	No. cases	Morbidity No.	Morbidity %	Mortality No.	Mortality %
Anaemia—95										
Hb < 7 gm	50	38	76	12	24	25	12	48	2	8
Toxaemia—65	40	30	75	6	15	10	6	60	1	10
A.P.H.—52	19	10	52.6	5	26.3	12	4	33.3	1	8.33
Hypertension—23	10	7	70	3	30	5	2	40	—	—
Rh. Ht. disease—6	4	4	100	—	—	—	—	—	—	—
Jaundice—10	5	4	80	2	40	—	—	—	—	—

TABLE VIII  
Morbidity and Mortality in Relation to the Mode of Delivery

Mode of delivery	No. of infants	Morbidity		Mortality	
		No.	%	No.	%
<i>SFD infants</i>					
Normal	499	129	25.8	32	6.4
Abnormal	153	84	55	11	7.1
<i>Normal infants</i>					
Normal	1576	198	12.5	15	.95
Abnormal	286	91	31.5	7	2.44

#### Discussion

Early neonatal mortality varies from 27 to 33.4/1000 live births and constitute 66% to 87% of the total neonatal death (Gupta *et al*, 1972; Bhakoo, 1975; Shah and Udani, 1969; Lubchenco *et al*, 1972; Athavale *et al*, 1969). This death rate is much higher in our country than in Western countries (Battaglia, 1967; Forfer, 1973) and is much more in preterm than term infants (Gupta *et al*, 1972; Shila Karan *et al*, 1972; Shah and Udani, 1969; Beargie *et al*, 1970). In the present series

the overall early neonatal morbidity and mortality were 210 and 38.2 per 1000 live birth respectively. While in normal infants the morbidity and mortality rates were 155 and 11.8 per 1000 live births respectively, in term SFD infants the corresponding figures were 326 and 66. In preterm infants the corresponding figures were 392 and 270 indicating that term SFD infants are usually liable to have higher morbidity and mortality and need special nursery care. In term SFD infants the major causes of morbidity and mortality were asphyxia, infection, aspiration syndrome and major congenital malformations. In normal infants asphyxia, infection and intracranial stress were mainly responsible for the morbidity. Asphyxia was 2 times more common, septicemia 5 times, aspiration syndrome 7 times and congenital malformation 7 times more common in SFD infants. The mortality was also much higher in SFD infants compared to normal infants. It was 15 times higher in septicemia, 7 times higher in aspiration and 2 times higher in asphyxia. Higher incidence of morbidity and mortality in SFD infants were also observed by other workers. (Beargie *et al*, 1970; Bhargava *et al*, 1974; Bhalla



*et al*, 1979). Lower incidence of hypoglycemia observed in SFD group was due to routine early feeding of 10% glucose in these infants.

The morbidity and mortality are also influenced by the birth weight and gestational age of the infants. (Gupta *et al*, 1972; Bhakoo, 1975; Beargie *et al*, 1970. Bhargava, 1974; Bhalla *et al*, 1979). None with a body weight of 1 kg. or less survived in this series. The morbidity and mortality rates were 80% and 53.5% respectively in infants weighing 1.1-1.5 kg. The mortality rate came down to 4% in 2.1-2.25 kg. group. While those having a birth weight of more than 2.25 kg. the morbidity and mortality rates were 15.5% and 1.18% respectively.

Both the morbidity and mortality rates in SFD Group were found to be highest at 37 weeks of gestation with a lowest rate of 26.3% and 5.28% respectively at 40 weeks after which again there was a rise upto 36% and 9% respectively at 42 weeks. Though the morbidity and mortality rates in term SFD infants have not been analysed according to the different gestational age by other workers (Gupta *et al* 1972; Bhakoo, 1975; Shah and Udani, 1969; Bhargava *et al*, 1974) they have observed significantly higher rate in preterm infants.

The age and parity of the mother exert an appreciable influence on the neonate. The morbidity and mortality was highest (38.4% and 8.1%) in infants of mothers aged less than 20 years and also more than 35 years due to the high incidence of their SFD infants as well as of primiparous and grand multiparous mothers. The young mothers who are still growing have a greater metabolic need than the elders and their infants have to face a greater competition for nutrients during the intrauterine life. (Khatua *et al* 1979). Maternal height was inversely

proportional to the morbidity and mortality of the newborn and this relation was much more obvious in SFD group. Low height of the mother is usually associated with small pelvis, prolonged labour difficult delivery with higher incidence of asphyxia, intracranial injury and aspiration, Maternal malnutrition has also been found to affect the fetal growth adversely and their prognosis. (Khatua *et al*, 1979; Indani *et al* 1979; Drillien, 1970). Maternal weight of 40 kg. or less was found to be associated with higher incidence of morbidity and mortality of their infants. The morbidity and mortality came down from 37% and 9.8% respectively in this group to 21% and 3.8% respectively in those whose mothers had a body weight of 50 kg or more. The morbidity was double in both the SFD and normal group of infants whose mothers had no antenatal check up. Various maternal diseases like anaemia, toxemia of pregnancy, A.P.H., hypertension, jaundice and chronic heart disease were also found to be associated with higher incidence of morbidity and mortality in their infants. While toxemia of pregnancy and hypertension by producing microvascular changes in the placenta interfere with diffusion of gases and nutrients; anaemia, chronic heart disease and A.P.H. produce deprivation of oxygen to the developing fetus and interferes with its growth. The morbidity and mortality rates were 2-3 times more in abnormal than in normal deliveries. Similar finding were also found by other worker (Gupta *et al*, 1972; Bhakoo, 1975; Indani *et al*, 1979). High death rate (40%) within 24 hours of her birth points to the need for efficient obstetrical management. Thus it was found that term SFD infants have statistically much higher incidence of morbidity and mortality than their normal counterpart and these can be minimised by improving the



nutrition of the mother, regular antenatal check up, prompt diagnosis and management of maternal diseases and efficient obstetrical and neonatal management.

#### Summary

A study of 2670 consecutive liveborn infants showed an overall early neonatal morbidity and mortality of 21% and 3.82% respectively. The early neonatal morbidity and mortality of term SFD infants were 32.6% and 6.6% respectively as opposed to 15.5% and 1.18% respectively in term AFD infants. The important causes of morbidity in term SFD infants were asphyxia (29.1%), infection (19.2%), aspiration syndrome (7%) and congenital malformation (4.7%) in that order. In normal infants asphyxia, infection, intracranial stress were most common. Various fetal and maternal factors like low birth weight of 2.25 kg. or less, lower gestational age, maternal age below 20 years, primiparity, grand multiparity, short stature, undernutrition, poor antenatal care, diseases of the mother like anaemia, severe toxemia, A.P.H. hypertension etc. had statistically significant adverse effect on the early neonatal morbidity and mortality of both the term SFD and AFD infants, more so on the former.

#### Acknowledgement

Our thanks are due to Dr. J. B. Mukherjee, Principal, Medical College,

Calcutta, for his kind permission to publish this paper.

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