CLINICAL RESEARCH

Bre ist feeding, nutritional state, and child survival in rural Bar gladesh

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Abstra :

The efi :ct of breast feeding on nutritional state, morbidity, and child survival was examined prospectively in a community in rural Bangladesh. Every month for six months health workers inquired about breast feeding and illness and measured arm circumference in an average of 4612 children aged 12-36 months. Data from children who died within one month of a visit were compared with those from children who survived. Roughly one third of he deaths in the age range 18-36 months were attributable to absence of breast feeding. Within this age range protection conferred by breast feeding was independent of age but was evident only in severely malnourished children.

In communities with a high prevalence of malnutrition breast feeding may substantially enhance child survival up to 3 years of age.

Introduction

Breast feeding enhances survival during infancy[1-4] and ranks among the first four strategies promoted by Unicef for improving infant and child survival.[5] Nevertheless, its impact in older children is still unknown.[6 7] In a community study in Senegal, Cantrelle and Leridon found an excess of deaths in 12-24 month old children when the mother stopped breast feeding at the beginning of a new pregnancy.[8] This association, however, was not significant and there was no measurable effect on overall child mortality. In patients admitted to hospital for diarrhoea, measles, and respiratory infections in Rwanda Lepage et al also found a lower mortality in breast fed children up to 2 years of age,[9] but interruption of breast feeding due to serious illness may have biased these results.[7 10] Later

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Aaby et al produced data from a measles epidemic in Guinea-Bissau showing no relation between survival and breast feeding in the same age range.[11] Re-examination of the impact of breast feeding on child survival is therefore timely.

Present study

Since 1966 the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B; formerly the Cholera Research Lat oratory) has maintained a demographic surveillance system in Matlab subdistrict in rural Bangladesh.[12] At the time of this study the system covered 147 villages with a total population of about 190 000. In 1978 a maternal and child health and family planning programme was introduced in half the villages.

This study was conducted in the "comparison area" which did not receive health intervention by the ICDDR,B, other than the provision of oral rehydration salts. Every month, in addition to their routine demographic work, 30 women community health workers measured the mid-upper arm circumference[13] of children aged between 6 and 36 months and asked the mother or guardian whether the child was still breast fed, had diarrhoea (at least three liquid stools within the past 24 hours), and whether there were symptoms of acute respiratory infections, defined as the simultaneous presence of fever, cough, and tachypnoea. Diarrhoea was classified as watery or bloody and termed chronic if it had lasted for more than seven days before the interview.

One aim of the study was to identify simple characteristics of children with a high risk of death.[14] Ethical approval was granted on condition that the study would last the minimum time required. Thus the study was conducted for only six months, which precluded examination of seasonal variations in nutritional state in relation to breast feeding and mortality. The study period (October 1985 to March 1986) included part of the preharvest lean season.[15]

Below 1 year less than 2% of children were not breast fed and this analysis was limited to children over that age. Among these, almost all breast fed children (98·8%) received some food in addition to breast milk. Thus in this report "weaning" refers to finishing with breast feeding completely and not to the introduction of other foods in the diet. Data from exclusively breast fed and partially breast fed children were combined for analysis. Other studies in the same community have shown that the first weaning food is rice gruel and that adult type foods are rarely given before the age of 18 months.[16 17]

Arm circumference was selected as the indicator of nutritional state, being easy to measure in the community and comparing favourably with other anthropometric indices for assessing the short term risk of death.[18 19] Circumference was measured to the nearest 2 mm with locally manufactured insertion tapes.[20]

Child months were pooled for analysis; a child was considered as a survivor if alive one month after interview and was entered as a new child month for the next round. Classical statistical and epidemiological techniques were used.[21-23] Means were compared with the t test and proportions by the χ^2 or Fisher's exact test; relative risks were estimated from incidence density ratios and their confidence limits by Miettinen's test based interval.[22] Pooled risk ratios were approximated by an analogue of a Mantel-Haenszel estimate.[23] Heterogeneity of relative risks was evaluated by testing differences in the logarithm of the odds ratio in different groups of children.[23] Attributable risk was calculated as described by Walter.[24]

Results

Altogether 27 675 child months (average 4612 per round) were available for analysis. The median age of children at weaning was 30·5 months, which was similar to an earlier report.[25] The proportion of weaned children was the same for boys and girls (38%) and was uniformly low under 18 months (figure).

With the exclusion of three deaths from drowning, 49 children died within one month of a visit. Children who were not breast fed at the time of interview had twice the risk of death during the following month compared with breast fed children (table I). This difference was present only after 18 months of age and persisted up to 3 years (table II). In the age group 18-36 months children who were not breast fed had a threefold risk of death, and
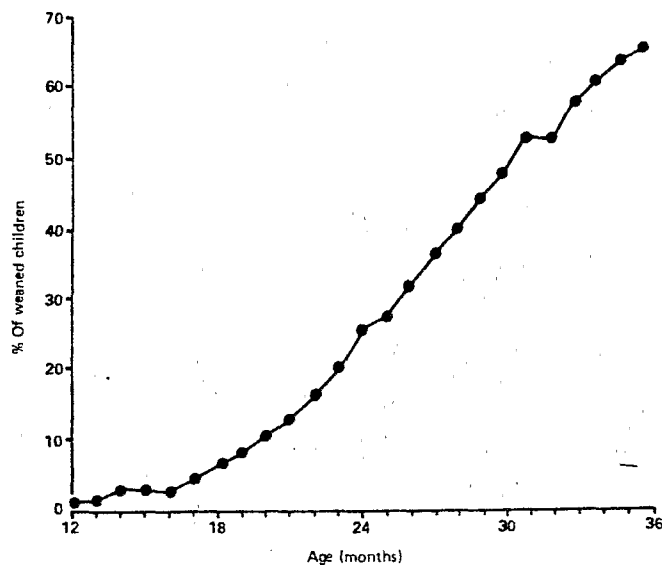
Percentage of weaned children at different ages.

TABLE I—*Deaths within one month of interview in breast fed and weaned children*

	Weaned	Breast fed	Total
Child months	7643	20 032	27 675
Deaths	22	27	49

$\chi^2 = 7·33$; p<0·01. Relative risk for weaned children 2·14. 95% Confidence limits 1·23 and 3·70.

TABLE II—*Deaths within one month of interview in breast fed and weaned children in different age groups*

Age group (months)		Weaned	Breast fed	Relative risk*
12-17	Child months	176	6622	—
	Deaths	0	11	
18-23	Child months	753	5108	3·39
	Deaths	3	6	
24-29	Child months	2611	5267	3·45
	Deaths	12	7	
30-36	Child months	4103	3035	1·73
	Deaths	7	3	

*Relative risks of death in last three cells not significantly different (χ^2 for heterogeneity= 0·75; df=2). Relative risk of death for last three cells combined 2·83 (95% confidence limits 1·49 and 5·38).

the proportion of deaths associated with the absence of breast feeding (the attributable risk) was 34·4% (95% confidence limits 10·0% and 58·8%).

The mean arm circumference of weaned children was similar to that in breast fed children (129 (SD 10) mm and 128 (SD 12) mm), but weaned children were on average older than breast fed children (mean ages 29 and 22 months respectively). Using the modified Jelliffe standard to correct for age,[26] we found that breast fed children had a significantly greater mean arm circumference for age—79·5% (SD 6·4%) v 79·0% (SD 7·4%) (t=5·65; p<0·001). Moreover, a significantly higher proportion of weaned children had an arm circumference below 111 mm (7·7% v 4·9%; χ^2=82·7, p<0·001).

Risk of death was significantly increased in the absence of breast feeding only in children with an arm circumference below 111 mm (table III). As a whole, children with an arm circumference below 111 mm had a relative risk of dying of 22·1 (95% confidence limits 14·9 and 32·6) compared with other children. Breast feeding was associated with a higher mortality in children with an arm circumference above 110 mm but this was not significant (table III).

TABLE III—*Deaths within one month of interview in breast fed and weaned children in different arm circumference categories*

Arm circumference (mm)		Weaned	Breast fed	Relative risk*
≤110	Child months	592	984	4·16
	Deaths	20	8	
111-125	Child months	2098	6511	0·24
	Deaths	1	13	
>125	Child months	4953	12 537	0·42
	Deaths	1	6	

*Relative risks of death highly significantly different among the three cells (χ^2 for heterogeneity= 9·38; d=2; p<0·01). Relative risk significantly different from 1 only in first cell (χ^2=13·93; p<0·001; 95% confidence limits for relative risks 1·97 and 8·78).

Children were more likely to be weaned within one month of an attack of bloody diarrhoea than were healthy children (table IV), suggesting that an intercurrent illness might produce a spurious association between the absence of breast feeding and risk of death. To examine this possibility the prevalence of selected illnesses and risk of death were examined in relation to the duration of weaning. Children weaned before the study were on average 2·9 months older than children weaned during the study and it can reasonably be assumed that most of them had been weaned for longer. The morbidity data from these children (pooled with those from children who

TABLE IV—*Relative risk of stopping breast feeding within one month of interview among children presenting with different symptoms compared with children without particular group of symptoms*

Symptoms	Total child months with symptoms	No of child months with symptoms followed by weaning within one month	Relative risk of stopping breast feeding	95% Confidence limits	p Value
Acute respiratory infection	360	15	0·99	0·60, 1·64	NS
Acute non-bloody diarrhoea	1656	53	0·75	0·57, 0·98	<0·05
Chronic non-bloody diarrhoea	679	28	0·98	0·68, 1·42	NS
Bloody diarrhoea	166	17	2·47	1·57, 3·89	<0·001
Any of above	2861	111	0·91	0·75, 1·11	NS

Total number of children weaned during study 840. Total number of child months after which breast feeding was continued 19 192.

had been weaned for more than three months) were compared with those from children known to have been within three months of weaning and with those from breast fed children (tables V and VI). The prevalence of bloody and chronic diarrhoea significantly increased with the duration of weaning but there was no excess of these diseases in recently weaned children. Mortality showed the same trend. The prevalence of acute non-bloody diarrhoea and of acute respiratory infection was unrelated to weaning.

The case fatality rate for bloody diarrhoea was higher in weaned than in breast fed children (four deaths among 153 cases (2·6%) compared with two deaths among 166 cases (1·2%); p>0·2 by Fisher's exact test) and the same was true for chronic diarrhoea (10 deaths among 421 cases (2·4%) compared with three among 679 cases (0·4%)). This last difference was significant (χ^2= 8·32; p<0·01).

Discussion

These results show a strong association between breast feeding and survival in children of 18-36 months of age and suggest that about one third of deaths in this age range may be attributed to the absence of breast feeding. Nevertheless, the association cannot be assumed to be causal until possible sources of bias and consistency with other studies have carefully been considered.[27]

TABLE V—*Prevalence of different types of illnesses related to stopping breast feeding. Results expressed as numbers (percentages) of child months with symptoms*

Symptoms	Still breast fed (total child months= 20032)	Weaned for three months or less (total child months= 1647)	Weaned at beginning of study or for more than three months (total child months= 5996)	χ^2[a]	p Value
Acute respiratory infection	360 (1·8)	30 (1·8)	96 (1·6)	0·92	NS
Acute non-bloody diarrhoea	1656 (8·3)	126 (7·7)	546 (9·1)	3·14	NS
Chronic non-bloody diarrhoea	679 (3·4)	73 (4·4)	348 (5·8)	68·5	<0·001
Bloody diarrhoea	166 (0·8)	16 (1·0)	137 (2·3)	80·9	<0·001

[a]χ^2 for trend in proportions: $d=1$.

TABLE VI—*Deaths in relation to stopping breast feeding*

	Still breast fed	Weaned for three months or less	Weaned at beginning of study or for more than three months
Child months	20032	1647	5996
Deaths	27	4	18
Mortality/10 000	13	24	30

χ^2 for trend=7·51; $d=1$; $p<0·01$.

There was no difference in breast feeding patterns between boys and girls, so making sex related biases unlikely. In this community breast feeding is continued for longer in the poorer families, who also experience higher child mortality.[25] Not adjusting for socioeconomic state might therefore lead to an underestimate of the risk of death associated with the absence of breast feeding.[4] Weaning in critically ill children was not a source of bias, as there was no peak of disease or death in children who had just been weaned. The apparent protection conferred by breast feeding up to three months after weaning might also result in an underestimate of the effect of breast feeding on child survival.

Our results are consistent with other studies showing a higher frequency and greater severity of bloody diarrhoea in non-breast fed children.[28 29] The lack of association with non-bloody diarrhoea is consistent with another study from Bangladesh questioning the protective role of breast feeding against rotavirus and, to a less extent, *Campylobacter jejuni* and enterotoxigenic *Escherichia coli*.[30]

Anti-infective properties of breast milk affect mainly the gut.[6] The lower incidence of respiratory infections in breast fed infants reported from several other studies seems to be due to the confounding effect of smoking.[31] There was no relation in our study between breast feeding and acute respiratory infection.

The difference in arm circumference between breast fed and weaned children, though statistically significant after correction for age, was small. Improving nutritional state did not seem to be the only mechanism by which breast feeding enhanced child survival. Anti-infective properties of breast milk may be more important than its nutritional content, certainly in the age range studied.[32]

Lower mortality in breast fed children was associated with a significantly lower prevalence of bloody and of chronic diarrhoea and lower case fatality rates of these two diseases. This might be explained in terms of the anti-infective properties of breast milk[33-36] and of its value in the management of protracted diarrhoea.[37]

Breast feeding was associated with a lower mortality only children with an arm circumference below 111 mm. These child may be considered as critically malnourished, as 125 mm is recommended cut off point for defining severe malnutrition.[38] T may explain their high relative risk of dying. The selective impac breast feeding on these children may have been due to the h prevalence of infections among them.[39] It may also be related to fact that sick malnourished children continue to suckle even wh they are too weak to take any other food.[40]

Continuing breast feeding for three years may confer a substan benefit in communities with a high prevalence of malnutrition, a the practice should be encouraged. Family planning may help, pregnancy was the most common cause of stopping breast feedi early in this community.[25]

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Patient and general practitioner delays in acute myocardial infarction

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Abstract

The longest component of the total delay in coming under coronary care is patient delay, and it has been suggested that public education might be used to make it shorter. The patterns of patient delay were studied in 450 patients with acute myocardial infarction uncomplicated by cardiac arrest out of hospital, of whom 243 had a previous history of ischaemic heart disease. Patient delays had a skewed distribution with a modal delay of up to one hour, a median delay of two hours, and a mean delay of 10 hours. Two thirds of patients had sought help from their general practitioners within four hours of the onset of symptoms. During the first four hours the longer that patients delayed the lower was the subsequent mortality (27%, 18%, and 9% for delays of one hour or less, up to two hours, and up to four hours, respectively), but patients who delayed four to eight hours had the highest mortality of all (38%). Neither the median value nor the pattern of patient delays was altered by a previous history of ischaemic heart disease.

There were pronounced differences in doctor delays, depending on the patient's age, delay time, and ultimate place of treatment, showing that the doctors' behaviour was influenced before they had seen their patients. Nevertheless, the median total delay for patients aged up to 70 was one hour 35 minutes, and a higher proportion of patients were seen early after infarction than in recent hospital trials of thrombolytic treatment.

These findings suggest that the patients' call for help and the doctors' response may be at an instinctive level according to the patients' distress; these patterns of behaviour may be difficult to modify by public education.

Introduction

In recent trials of thrombolytic treatment given in coronary care units the earlier that treatment was started after the onset of symptoms the greater was the reduction of late mortality from myocardial infarction.[1,2] The largest single component of the total time for a patient with myocardial infarction to come under coronary care is that taken by the patient to decide to summon help.[3] In several reports median patient delays have been between

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one and two hours, but factors associated with patient delay have not been studied in detail.

It has been hoped that patient delay might be shortened by educating the public about symptoms of myocardial infarction and the importance of reporting them early. Besides its relevance for early thrombolytic treatment, summoning help promptly is important for successful resuscitation from cardiac arrest, a complication that occurs early in myocardial infarction.

In this paper we examine the patterns of behaviour of patients with acute myocardial infarction uncomplicated by early cardiac arrest and consider the scope for altering patient behaviour by education.

Patients and methods

Four hundred and fifty patients were selected from a consecutive series of 1011 with heart attacks that occurred in general practices equipped with defibrillators.[6] Each practice had one doctor on duty throughout the 24 hours for emergency calls, who carried a radiopager and had a defibrillator in the car. Practice receptionists were told to pass on quickly to the duty doctor calls about suspected heart attacks. By means of a weekly visit or telephone call to a nominated practice representative data on all heart attacks in these practices were obtained. A record was kept by the doctors of the time between the onset of symptoms and the request for a doctor to visit ("patient delay") and the interval between the receipt of the call and the arrival of the doctor ("doctor delay").

Only patients with definite acute myocardial infarction whose first medical contact was the general practitioner and for whom a patient delay time was available are included in this study. Patients who were dead when the general practitioner arrived or in whom a resuscitation attempt was made are excluded.

Myocardial infarction was diagnosed by a history of characteristic chest pain lasting at least 20 minutes, plus either an electrocardiogram showing infarction or a rise in cardiac enzyme activities above normal, or unequivocal serial electrocardiographic changes of infarction, or evidence at necropsy of recent myocardial infarction.

Wilcoxon's test and Kendal's rank correlation were the non-parametric statistical tests used.

Results

Figure 1 shows the numbers of patients with various delay times presented logarithmically. The distribution was extremely skewed, the modal patient delay being up to one hour, the median two hours, and the mean 9·9 hours. Within the first four hours of patient delay there was a reduction of mortality from 27% for a delay of one hour or less to 18% for a delay of up to two hours and to 9% for a delay of up to four hours; these differences were significant ($\chi^2=7\cdot88$; df$=2$; $p<0\cdot05$). The highest mortality of any group (38%) was in those presenting at four to eight hours, and the next highest (32%) among the 22 patients who presented more than 64 hours after the onset of symptoms. Table I gives the numbers of patients with various delay times stratified