A STUDY OF SOME FACTORS INFLUENCING THE OUTCOME OF ACUTE CHILDHOOD DIARRHOEA AT THE PAEDIATRIC OBSERVATION WARD OF KENYATTA NATIONAL HOSPITAL

BY

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D E C L A R A T I O N

I certify that this thesis is my own original work and has not been presented for a degree in any other University.

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This Dissertation has been submitted for the examination with my approval as University Supervisor.

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LIST OF ABBREVIATIONS

K.N.H.	Kenyatta National Hospital
POW	Paediatric Observation Ward
ORS	Oral Rehydration Solution
WHO	World Health Organization
EPEC	Enteropathogenic Escherichia coli
ADM	Admission
REW	Review
IV	Intravenous
SAL	Salmonella
SH	Shigella
SD	Standard Deviation
ETEC	Enterotoxigenic Escherichia coli

SUMMARY

Factors affecting the outcome of acute childhood diarrhoea in children below five years during ward stay and after one week of discharge were studied.

Over 90% of children studied were aged below two years, with a peak age in the 6 - 11 months age group. Out of a total of 105 children, 61 were males and 44 were females.

52.3% of the children studied had normal nutrition, 24.7% were underweight, 8.6% had kwashiorkor, 4.8% had marasmus and 9.6% had marasmic-kwashiorkor.

Rotavirus detection and cultures for enteropathogenic organisms was done for all the children. Rotavirus was detected in the stool of 21 children, accounting for 51% of all the isolates at admission. EPEC was the most commonly isolated entero-bacteria with twelve occuring as single infections and four as mixed infections, giving a total of 16(38% of total isolates). Other stool agents isolated included shigella, salmonella and campylobacter; these accounted for 4.9%, 3.8% and 0.9% respectively of the total isolates. V. cholera organisms were not isolated.

Malnourished children had a worse outcome compared to children with normal nutrition in terms of duration of diarrhoea and mortality. Duration of diarrhoea also tended to increase with age.

Children with Rotavirus had a mild illness with a mean duration of diarrhoea of 7.6 days. Isolation of EPEC was associated with prolongation of diarrhoea - the mean duration being 15.5 days in wellnourished children and 16.7 days in malnourished children.

Children with Rotavirus were successfully rehydrated with oral rehydration solution alone. 76% of children requiring intravenous hyration had EPEC isolated in their stool. Supplimental feeding after the initial four hour rehydration period advocated was noted to be insignificant. This occured both for breasfed children and children on other diets.

Thirty three children returned for review one week after discharge from the ward. One child had Rotavirus persisting in stool, one had salmonella and two had EPEC persisting. Causative agents isolated for the first time at review were seen in eight of the reviewed children. One patient had Rotavirus, five had EPEC and two had salmonella. Isolation of salmonella and EPEC at review was associated with use of antibiotics while on the ward.

INTRODUCTION

Acute childhood diarrhoea is a major health problem world wide. In the United States of America for example, childhood diarrhoea still ranks second to respiratory diseases as the cause of non-surgical paediatric ward admissions.(1)

In the developing world, diarrhoea is a major cause of mortality and a cause of prolonged morbidity.(2-6) A review by Booth et al reveals that in 1972, 500 million episodes of diarrhoea are estimated to have occured in children under five years in Asia, Africa and Latin America, with an expected mortality of 1-4%.(5)

In Kenya, acute childhood diarrhoea is a common cause of admissions to hospitals. Mutanda found it accounted for nearly 20% of admissions to the Paediatric Observation Ward (POW) of Kenyatta National Hospital (KNH). Approximately the same figure was obtained for Gertrude Garden Children's Hospital and Aga Khan Hospital.(7)

A major contributory factor to the high mortality and morbidity rates observed is malnutrition.(3-6, 8-10) In a study of the nutritional status and severity of diarrhoea among preschool children in rural Nigeria, Tomkins found that the stunted child has the same attack rates as the well nourished child but that the duration of diarrhoea for the stunted child is longer.(9) The wasted child however, was found to have more frequent and more protracted episodes of diarrhoea.

Malnourished children are prone to infections and these further exacerbate diarrhoea and more malnutrition. To interrupt this vicious cycle, continued feeding is advocated during an acute episode of diarrhoea. High carbohydrate foods especially disaccharides and monosaccharides should be avoided as they tend to overwhelm damaged absorptive mechanisms[11]. Instead, it is thought that graded concentrations of protein and fatty foods are better tolerated.

It has been shown in some animal studies that intraluminal food stuffs increase intestinal digestive enzymes and stimulate faster cell regeneration[12]; so that a child with diarrhoea who is starved ends up with an atrophic absorptive mucosa compared to the child who is fed early.

Breast milk is of great value especially in the developing countries where infections are prevalent. Diarrhoea has been shown to be more prevalent in infants from lower socio-economic strata who are artificially fed[6,12,13]. Apart from the immunological value of breast milk, breastfeeding has also been shown to increase energy and protein intake of children with diarrhoea when compared to children who are completely weaned[14].

Infection is an important aetiological factor in acute childhood diarrhoea, Rotavirus and enteric bacteria being the most important agents[15-18]. The isolation rate of these agents varies from place to place and in the same locality the variation may also be seasonal [15, 19-20]. Isolation rates for causative agents also vary depending on the sensitivity of the detection methods employed. Technical methods currently being used enabled

the isolation of a bacterial or viral pathogen in 70% of infants studied by Black et al in 1980[20]. This increased detection rate is largely due to the increased detection of enteric viruses.

In the Sudan, Erwa et al[21] found that bacterial pathogens accounted for 34% of agents in children admitted to the ward with dehydration due to diarrhoea. EPEC was the most commonly isolated enterobacteria and accounted for 25% of all agents isolated. In Ethiopia, Thoren et al[22] in a study of the aetiology and clinical features of severe infantile diarrhoea found that Rotavirus isolation occured in 49% of patients while bacterial pathogens accounted for 43%. EPEC isolation was again the most commonly isolated enterobacteria, accounting for 19%.

The aetiology of acute childhood diarrhoea in our setting has been investigated exhaustively in several papers[23-26]. Shukla[26], in a survey of infantile and childhood diarrhoeal diseases admitted to POW found that bacterial pathogens accounted for 28.5% of cases, Rotavirus accounted for 50% and adenovirus accounted for 2%.

The aetiology of diarrhoea in malnourished children at K.N.H. has also been reviewed by Mutanda et al[24]. They found that Rotavirus, campylobacter, shigella and salmonella were equally isolated from children with marasmus, kwashiorkor and in children of normal nutrition. However, EPEC was isolated more frequently from children who had diarrhoea with marasmus.

The discovery of a glucose coupled sodium transport mechanism in the small intestines led to the formulation of glucose electrolyte solutions[6,11,27]. This mechanism leads to a net water absorption and has been shown to remain intact in acute childhood diarrhoea.[27] On the basis of these observations, World Health Organization (WHO) came up with a formulation for an oral glucose electrolyte rehydration solution (ORS). Where it has been extensively used, ORS has led to a decline in mortality associated with diarrhoeal dehydration[28-33]. In a refugee camp in East Pakistan, the case fatality rate from dehydration due to diarrhoea was noted to drop from 30% to 3% with the introduction of ORS[28]. However, although it is an effective and relatively inexpensive intervention, it is thought to have little impact on diarrhoeal morbidity[29].

In a study of some clinical aspects of acute childhood diarrhoea at K.N.H., Wasunna et al[25] found that the majority of children (91.6%) admitted due to acute childhood diarrhoea could be managed successfully on oral rehydration solution alone. The mortality in this study was found to be 1.3%, but children with prolonged diarrhoea and malnutrition were excluded. Also excluded were children who had been on antibiotics during the period of illness.

Apart from rehydration of a child with diarrhoea, the ultimate prognosis and outcome of an episode of diarrhoea depends on several factors. Some of these have already been mentioned above. The influence of these factors on the outcome of childhood diarrhoea during and after rehydration in the ward is not known. This study attempts to provide such knowledge.

AIM OF THE STUDY

To identify some of the factors which influence the outcome of acute childhood diarrhoea during hospital stay and seven (7) days after discharge.

OBJECTIVES

1. To relate the outcome of acute childhood diarrhoeal disease to the following:

   a. Causative agents isolated from stools of patients taken on day of admission.

   b. Nutritional status of the subjects

   c. Pattern of feeding during the illness

   d. Persistence of enteric agents in stool seven days after discharge from hospital.

MATERIALS AND METHODS

1. The months when the study was undertaken

This study was undertaken from September, 1984 to March 1985. The study season has been found to have the highest incidence of diarrhoea annually[7].

2. Place of study

This study was carried out at the Paediatric Observation Ward of Kenyatta National Hospital. This is an emergency admissions ward where urgent treatment is provided over a period of 24-48 hours from where those children requiring more prolonged treatment are referred to the relevant main paediatric wards. Patients are admitted to POW from Paediatric Outpatients' Clinic. This unit receives patients referred from other health units within the city and from all over the country.

3. Patients studied

Infants and young children under five years of age admitted to the POW with dehydration due to acute childhood diarrhoea were selected for the study. The patients were selected on a random basis on average one per day from Monday to Friday between nine a.m. to four p.m. The first patient satisfying the following criteria was selected for the study:-

a. Diarrhoeal disease with dehydration was the only cause for admission.

b. There was undisputed parental consent for admission into the study.

c. The children were sick enough to require rehydration in the ward for a period not less than twenty four hours.

d. Patients had been in the ward for less than one hour.

4. Clinical Examination

A full history was taken, and physical examination was performed on each child and a study proforma giving the following information was completed:-

- age in months
- sex
- date of admission, discharge and review
- weight
- degree of dehydration
- duration of diarrhoea
- clinical diagnosis
- nutritional status
- type of feeds given.

While in the ward, the children were reviewed every day and their progress noted. Treatment for each child was recorded and the pattern of feeding observed and noted.

5. Assessment of Nutritional Status

The Wellcome classification[34] was adopted for the classification of the nutritional status of the children. Patients were weighed unclothed using the "Toledo Scale model 1361 Sentinel" spring balance.

The degree of dehydration was assessed according to the WHO guidelines[35] and the actual body weight estimated by adding 3%, 8% and 13% as the estimated body weight loss due to mild, moderate, and severe dehydration respectively. No attempt was made to correct the weight loss due to the on-going short-term nutritional deprivation as advocated by Khin-Maung-u et al.[36]

6. Collection of specimens

The stoools were collected from study patients within one hour of admission to the ward. The stools were put into plastic containers. In cases where stools were too watery, rectal swabs were used to induce stool passage with the plastic containers strategically placed to receive the specimen. The collected stools were forwarded to the centre for Microbiology Research (MRC) within one hour of collection. Patients were reassessed after 4 hours, 6 hours and 18 hours on the first day and thereafter, on a daily basis until discharged. On the day of review, repeat stool samples were taken from each patient who returned where possible. Patients or their parents were also re-interviewed about the progression of their diarrhoeal illness.

7. Examination of stools

Standard microbiological techniques were used to culture stools and for the identification of enterobacteria.[37-38]

E. coli colonies growing on MacConkey's agar plates were typed for pathogenicity using standard typing antisera.[38].

Non-lactose farmenting colonies growing on the salmonella/ shigella (SS) agar plates were put on to tripple sugar ion (TSI) agar slants. They were identified as shigella species or as salmonella species following Edwards and Ewing typing scheme.[37]

Campylobacter species were identified by staining suspicious colonies with 1% carbol fuchsin and observing the typical morphology of the organisms. The organisms were further confirmed as campylobacter by biochemical tests.[39] All patients were screened for cholera on TCBS (Thiosulphate citrate bile-salt) agar but no cholera-like colonies were grown.

8. Rotavirus detection

After culturing for bacteria, the remaining stool specimen were frozen at -20°C until needed for Rotavirus detection. Rotavirus was detected by enzyme-linked immunosorbent assay (ELISA) using a WHO kit and following the instructions provided.[40]

9. Type of feeding

Only children aged two years and below were analysed for type of feeding. Four groups were adopted for comparison and categorised as follows:-

a. Purely breastfed children

b. Children on breastfeeding plus other suppliments

c. Children purely bottle-fed

d. Children fully weaned on adult type diet

10. Management

No attempt was made to alter the routine policy of management of these patients. However, all modes of therapy for each patient were noted in the study proforma. The WHO formulated ORS was the mainstay of therapy. This was supplimented by feeding where possible. Antibiotic use as prescribed by the admitting doctor was noted. However, only antibiotics known to have some effect on enterobacteria were analysed. These included chloramphenicol, Trimethoprim/Sulphamethoxazole, ampicillin, gentamycin and kanamycin. Chloramphenicol was prescribed on suspicion of cholera during a cholera alert which occurred during the study period. The other antibiotics were perhaps prescribed for associated upper respiratory tract infection. The duration of ward stay for each patient was recorded. All patients were asked to return for review 7 days after discharge. Patients who developed severe systemic illness unrelated to diarrhoeal disease while on the ward were dropped from the study.

11. Outcome

The final outcome of acute childhood diarrhoea was evaluated in terms of the following:-

a. Duration of diarrhoea

b. Persistence or occurrence of diarrhoea within seven days following discharge.

c. Death.

A scoring system was adopted to facilitate comparison with other variables, "a" scored two points, "b" scored one point, while "c" scored no point.

12. Statistical Methods

Due to the skewed nature of the parameters, a log transformation had to be used in most of the measures.

The student T test for the differences in means was used in part of the analyses.

Analyses of variance was tested with the F. ratio test.

The X^2 test was used for the comparison of tables. Correlation coefficients were calculated to test the association of the various variables.

RESULTS

A total of 105 children were included in the study. Of these, 61 (58.1%) were males and 44 (41.9%) were females.

Table 1: Age Distribution of children studied

Age in months	Number	%
0 - 5	29	27.6
6 - 11	45	42.9
12 - 17	22	21.0
18 - 23	5	4.7
24+	4	3.8

$n = 105$

$\bar{x} = 8.05$

$\bar{x} \mp 2SD = 2.1 - 31$

The majority of the children observed were aged below two years, with a peak age observed in the 6 - 11 months age group as shown in table I.

Table II: Nutritional Status of children studied

Nutritional Status	Number	%
Normal	55	52.3
Underweight	26	24.7
Kwashiorkor	9	8.6
Marasmus	5	4.8
Marasmic Kwashiorkor	10	9.6
Total	105	100.0

48% of the children had some form of malnutrition or other as can be seen from table II.

From the stool cultures, pathogenic agents were isolated in 47(45%) of cases while in 58(55%) stool samples, no agents were isolated. The following agents were isolated in the order of the commonest. Rotavirus 24 (22.8%), EPEC 17 (16.2%), shigella 9 (8.6%), salmonella 4 (3.8%), campylobacter 2(1.9%) and ETEC 1 (0.9%). No *Vibrio cholera* was isolated from stool in all the study patients. This information is shown in table III. Multiple isolates are presented separately in the table.

Table III: Causative agents isolated in stool at admission

Single isolation	
Agent	Number
Rotavirus	21
Enteropathogenic E. coli	12
Shigella	5
Salmonella	4
Campylobacter	1

Mixed isolations	
Agents	Number
Rotavirus + Enterotoxigenic E. coli	1
Enteropathogenic E. coli + Shigella	3
Enteropathogenic E. coli + Campylobacter	1
Rotavirus + Shigella	1

No isolations	Number
No stool isolations	58

Rotavirus was the most common agent isolated, accounting for 51% of all isolates. EPEC was the second commonest and accounted for 38% while shigella was the third commonest cause, accounting for 19% of all isolates. Salmonella and Campylobacter jejuni contributed 8.5% and 4.2% of all isolates respectively. ETEC accounted for 2.1% of the isolates.

Table IV: Pattern of feeding of children studied Vs mean duration of diarrhoea

Group	Number	%	Mean duration of diarrhoea	95% confidence interval
Breastfed only	8	8.2	8.3	3.3 - 21.3
Breastfed and supplements (mixed feeds)	50	51.1	9.1	3.4 - 24.6
Bottlefed	27	27.8	10.5	3.5 - 31
Fully weaned	12	12.9	11.0	2.7 - 44.6

Log transformation was used in calculating the means. Significance tests were carried out between those children purely breastfed and those bottlefed, purely breastfed and those on mixed feeds and finally, those on some breast milk and those fully weaned. Breastfed children had the lowest mean duration of diarrhoea as compared to fully weaned children who had the highest mean. However, the differences were not found to be statistically significant.

Table V: Nutritional Status of children studied Vs age

Age in Months	Normal Nutrition	Underweight	Marasmus	Marasmic-Kwashiorkor	Kwashiorkor
0 - 5	17	8	1	1	2
6 - 11	23	15	1	4	2
12- 17	13	2	2	3	2
18- 23	1	1	1	1	1
24+	1	-	-	1	2
Total	55	26	5	10	9

Nutrition was noted to worsen with age. This was found to be statistically significant. Table V shows this relationship.

$$r = 0.430 \quad p < 0.05$$

The majority of children aged one year and below had normal nutrition or were underweight. Older children were fewer in number but the majority had the severer forms of malnutrition.

Table VI: Causative agents in well nourished children Vs mean duration of diarrhoea

	Mean Diarrhoeal Duration ($\bar{x}$)	Standard Deviation S.D.	95% Confidence Interval C.I.
Rotavirus n = 9	7.6	1.9	3.67-11.26
Enteropathogenic E. coli n = 4	15.5	5.35	7.8 - 31
Salmonella n = 2	11.4	2.5	5 - 25
Shigella n = 3	10.6	3.0	4.6 - 17.2
No agents n = 23	11.4	2.5	2 - 14.3

Key: SD = Standard deviation

The mean duration of diarrhoea of varying aetiology in well nourished children was compared.

Rotavirus was associated with the lowest mean duration of diarrhoea whereas that due to enteropathogenic E. coli was the highest. This difference was found to be statistically significant. For the other agents, the differences observed were not statistically significant. This is shown in table VI.

Table VII: Causative agents in malnourished children Vs mean duration of diarrhoea

	Mean diarrhoeal duration $\bar{x}$	Standard deviation S.D.	95% Confidence Interval C.I.
Rotavirus n = 13	8.5	3.18	4 - 18
Enteropathogenic E.coli n = 12	16.7	6.7	3.3 - 30.1
Salmonella n = 2	10.3	3.5	3.3 - 17.3
No agents n = 17	9.0	3.71	1.5 - 16.42

The mean duration of diarrhoea for patients with enteropathogenic E. coli was observed to be significantly higher than for all the others at the 5% level of significance. No differences were observed among the rest. Also of note is the increased number of enteropathogenic E. coli cases in the malnourished population, i.e. 70% of EPEC isolated were found from malnourished children. Table VII gives this information.

Key: S.D. = Standard deviation

C.I. = Confidence interval

Table VIII: OUTCOME OF REVIEWED PATIENTS AN

PT CODE	AGE MONTHS	DURATION OF DIARRHOEA IN DAYS	NUTRITIONAL STATUS	CAUSATIVE AGENTS ADM	REW
002	3	5	Normal	EPEC	-
034	2	5	Underweight	EPEC	-
039	12	5	Normal	-	-
072	7	5	Normal	Rotavirus	-
089	2	5	Normal	-	-
001	3	7	Normal	Rotavirus	-
091	35	7	Normal	-	-
047	12	7	Normal	-	-
100	8	7	Normal	-	EPEC
101	9	7	Normal	-	SAL
035	6	7	Normal	SAL	-
021	5	8	Normal	Rotavirus	Rotavirus
031	5	9	Normal	Rotavirus	-
016	7	9	Normal	SH	-
044	5	10	Normal	SAL	-
029	7	10	Kwashiorkor	EPEC	-
042	6	13	Marasmus	Rotavirus	-
015	14	14	Kwashiorkor	EPEC	-
081	6	14	Normal	SAL	SAL
058	4	14	Normal	EPEC	EPEC

POSSIBLE RELATED FACTORS

PATTERN OF FEEDING	MODE OF HYDRATION	ANTIBIOTICS	OUTCOME
Breastfed	ORS	-	Resolution
Breastfed	IV/ORS	-	Resolution
Breastfed	ORS	-	Resolution
Bottlefed	ORS	-	Resolution
Bottlefed	ORS	Chloramphenicol	Resolution
Breastfed	ORS	-	Resolution
Breastfed	ORS	Chloramphenicol	Resolution
Breastfed	ORS	-	Resolution
Breastfed	ORS	Chloramphenicol	Resolution
Breastfed	ORS	Chloramphenicol	Resoulution
Breastfed	ORS	Ampicillin	Resolution
Bottlefed	ORS	Ampicillin	Resolution
Breastfed	ORS	-	Resolution
Bottlefed	ORS	-	Resolution
Breastfed	ORS	Chloramphenicol	Resolution
Bottlefed	ORS	-	Resolution
Breastfed	ORS	Septrin	Persistent
Bottlefed	ORS	-	Persistent
Breastfed	ORS	Chloramphenicol	Persistent
Breastfed	ORS	Septrin	Persistent

Table VIII continued.

PT CODE	AGE MONTHS	DURATION OF DIARRHOEA	NUTRITIONAL STATUS	CAUSATIVE AGENTS ADM	REW
007	4	16	Normal	-	-
003	16	16	Normal	-	SAC
077	5	16	Kwashiorkor	SH	EPEC
013	12	17	Marasmic Kwashiorkor		EPEC
064	12	17	Underweight	-	-
037	4	24	Underweight	EPEC	EPEC Rotavirus
023	6	25	Normal	-	-
011	15	35	Marasmic Kwashiorkor	Rotavirus	EPEC
050	18	35	Marasmic Kwashiorkor	-	-

PATTERN OF FEEDING	MODE OF HYDRA-TION	ANTIBIOTICS	OUTCOME
Bottlefed	ORS	-	Persistent
Bottlefed	ORS	-	Persistent
Bottlefed	ORS	Chloramphenicol	-
Breastfed	IV/ORS	"	Dead
Breastfed	ORS	-	Persistent
Breastfed	IV/ORS	Chloramphenicol	Persistent
Bottlefed	ORS	Chloramphenicol	Persistent
Breastfed	ORS	Chloramphenicol	Persistent
Breastfed	IV/ORS	Chloramphenicol	Persistent

Table VIII shows particulars of children who returned for review after seven days of discharge. A total of 33 children were reviewed but stool was obtained and examined in only twenty-nine patients. Of these, only one had Rotavirus persisting in stool, one had salmonella and two had EPEC persisting.

The causative agents isolated for the first time at review were seen in eight of the reviewed patients. One patient had Rotavirus, five had EPEC, and two had salmonella. This table also shows that the majority of children requiring intravenous hydration had EPEC in stool. It also shows that diarrhoeal duration increases with worsening nutrition.

Using cross tabulation between the variables, the following observations were made in this study:-

1. Detection of Rotavirus did not seem to adversely affect the final patient outcome of acute diarrhoeal disease. The mean duration of diarrhoea for Rotavirus positive patients ($\bar{x}$ = 8.5) was lower than for patients without Rotavirus. However, the differences observed were not statistically significant. Rotavirus diarrhoea therefore was noted to be a self-limiting illness with good prognosis.

b. A correlation between the isolation of salmonella on admission with its isolation at review was noted i.e. those patients who had salmonella on admission were more likely to have it on review. A high correlation was also observed between isolation of salmonella and use of antibiotics $r = 0.496$ $P < 0.05$. Intravenous

hydration was required more frequently in salmonella positive patients, implying ORS therepy failure or a severer form of diarrhoeal illness.

3. Isolation of EPEC in stool on admission was associated with persistent diarrhoea. A low positive correlation between use of antibiotics and persistence of EPEC excretion in stool. ($r = +0.22$ $P > 0.05$). It was also noted that patients with persistent EPEC in stool were likely to be of poor nutritional status. The correlation however, was not statistically significant. ($r = {}^{-}0.307$ $P > 0.05$).

   Patients with persistent Enteropathogenic Escherichia coli in stool were likely to be of poor nutritional status. The correlation however was not statistically significant ($r = {}^{-}0.307$ $P > 0.05$). EPEC appearing for the first time in stool on review (?nosocomial infection?) occured more frequently in malnourished children.

4. A very high negative correlation was observed between duration of diarrhoea and nutritional status. ($r = {}^{-}0.612$, $P < 0.01$). A positive correlation was observed between nutritional status and outcome ($r = {}^{+}0.437$, $P < 0.05$) i.e. those children of better nutritional status were likely to have a better outcome.

5. A positive though not statistically significant correlation was observed between age and duration of diarrhoea ($r = {}^{+}0.355$, $P > .05$). This effect may be due to the fact that the older children were also more likely to be malnourished. Intravenous fluids were used more frequently in older children.

6. No significant differences were observed in terms of duration of diarrhoea between breastfed, bottlefed and children on mixed diets and there was no observed relationship with the final outcome. This effect may be due to the fact that most of the mothers who were recorded as breastfeeding at the beginning of the illness did not actually breastfeed during the course of the illness.

7. Morbidity in male children was observed to be significantly higher compared to females in terms of degree of dehydration, X^2 (2) = 7.69 $P < 0.05$.

DISCUSSION

This study was mainly descriptive. The author did not influence the management of these children while on the ward. Some of the parameters compared were not standardized; for example, the antibiotics used and the period for which the children took the medication also varied. These limitations should therefore be kept in mind while drawing interpretations from some of the conclusions in the study. However, these limitations could not be avoided in view of the study design.

Most of the children studied were aged below two years with a peak age in the 6-11 months age group. This age distribution is comparable to what has been observed previously in similar studies[6,15]. The male preponderance and increased morbidity in terms of diarrhoeal duration has also been noted previously.[6]

Rotavirus was the most commonly detected causative agent of acute childhood diarrhoea at admission. The children with Rotavirus had generally a mild self-limiting illness with a mean diarrhoeal duration of about 8 days. Persistent viral excretion at review occurred in only one patient out of twenty-three. The rest of the reviewed patients had normal stools. This is similar to what has previously been found. In a study on winter gastroenteritis in South Africa, Schoub et al [15] found that viral shedding (Rotavirus) was directly related to symptoms and that maximum viral excretion occured on the third to fourth days, rarely occurring after eight days. None of the children with Rotavirus in this study needed intravenous hydration while on the ward; and there were no deaths noted in

Rotavirus positive patients during follow-up. Also, all reviewed Rotavirus positive patients were well hydrated and had a normal stool consistency.

The role of enteric bacteria in the aetiology of acute childhood diarrhoea in this study compares closely with what has been observed elsewhere[15-24]. EPEC was the most commonly isolated enterobacteria. Twelve cases were isolated singly and four other cases occurred as mixed infections and most commonly with Shigella (3 patients). Twelve of a total of sixteen children with EPEC in stool were malnourished. The occurence of EPEC in malnourished children in our setting has previously been documented.[24]

Whether this is a primary or secondary effect is not very clear. But in one child in this study, nutrition was noted to worsen with persistent diarrhoea and EPEC excretion in stool. The issue needs further study.

Children with EPEC were noted to have more protracted diarrhoea and needed intravenous rehydration more often when compared to the others. Use of antibiotics was noted to increase the excretion rate of EPEC in reviewed patients. This same effect was also observed for salmonella positive children. This is consistent with the findings of Dixon.[41]

In this study, V. cholera was not isolated although there was an alert for cholera during part of the study period. Chloramphenicol was prescribed to all children admitted with a diarrhoeal illness during this alert period.

From the findings in this study, there appears to be no justification for the blanket use of antibiotics even in the face of a cholera threat; furthermore, it has been shown by Mutanda et al[42] that indiscriminate antibiotic use promotes emergence of certain types of nosocomial infections.

Increased morbidity and mortality was highly associated with poor nutritional status. Nutrition was also noted to worsen with age, an effect which has been noted in many under-developed countries and is thought to be directly linked to "weaning diarrhoea" which is considered to be an epidemiological entity.[19] It was difficult to analyse the different dietary items consumed by these children as they varied in type, quality and quantity for each child.

There were no significant differences observed in the final outcome of children breastfed and those bottlefed or on mixed diet. The number of wholly breastfed babies was small (a total of eight). Furthermore, most of the mothers who registered as breastfeeding did not actually breastfeed while on the ward. This was because they had been advised by medical staff - mainly nurses - to stop breastfeeding while rehydration was in progress. According to a WHO Manual for the treatment of established acute diarrhoea[35], rehydration of a child using ORS should take four hours during which the fluid deficit should be replaced. During this period, other feeds should be withheld to facilitate rehydration. Lactating mothers should however be encouraged to breastfeed a little at intervals with administration of ORS to correct the dehydration.

Thereafter, increased breastfeeding or any other highly nutritious food should be given. A breakdown in communication may be responsible for the lack of breastfeeding observed in this study; this fact needs to be explored further and any misinformation rectified. Children not breastfed should be given graded concentrations of formular initially and later full strength formula introduced as tolerated. It has been shown that a child who is fed while still having diarrhoea will have a higher stool volume output but will be nutritionally better off than one who is allowed to "rest the gut". Macfarlane et al[43] have used human milk in the management of protracted diarrhoea of infancy which failed to respond to a wide range of highly modified formulae. The importance of breastfeeding especially in our setting therefore cannot be over emphasized.

Seven of the study patients died on follow up, giving a case fatality rate of 6.6%. This higher figure agrees with what has previously been observed by Roy et al[44]. He found that during follow up, after treatment for acute childhood diarrhoea, children were found to have a significantly higher mortality than that generally observed in the community. The first three months appeared to be the most crucial and malnourished children were at highest risk.

Three of the patients who died had at least two hospital admission during the study period for the same problem. One of these patients had three hospital admissions before she succumbed due to severe dehydration. She had EPEC persisting in her stool and during the study period, her nutritional status changed from

normal to marasmic-kwashiorkor. EPEC was the only stool agent isolated in all the other patients who died.

In a study on diarrhoea in infants, Toledo et al[45] came up with the following findings:-

1. EPEC was the most frequent bacterial agent associated with endemic diarrhoea.
2. The illness produced was more severe than that associated with non-bacterial diarrhoea.
3. EPEC was associated with extensive patterns of drug resistance suggesting nosocomial infections as a cause.

In this study, EPEC was found to be associated with prolonged diarrhoea and worsening nutritional status. Where antibiotics were used, there did not appear to be any benefit of significance. The possibility of EPEC causing endemic diarrhoea in our community therefore needs to be investigated further. A child who has two hospital admissions for diarrhoea within three months should be screened for EPEC. Its importance in causing hospital acquired infections should be explored.

CONCLUSIONS AND RECOMMENDATIONS

1. EPEC is an important causative agent in childhood diarrhoeal disease in this hospital. Just how big a problem it is is not very clear. Any child who presents to the hospital with a diarhoeal illness lasting more than fourteen days should be screened for EPEC. It is therefore suggested that a previous history of diarrhoea in the recent past should be sought and should always be taken seriously.

2. The importance of prolonged diarrhoea as a result of cross infection within the hospital should further be investigated.

3. Supplimental feeding particularly breastfeeding where possible should be exploited much more than is occuring at the moment.

4. Blanket use of antibiotics should be discouraged in all diarrhoeal illnesses.

5. Of all medical personnel, nurses interact with patients most. An effort should therefore be made to update their knowledge on current recommendations in the treatment of childhood diarrhoeal disease.

6. Unless one is dealing with a moribund patient in whom there is no time, then antibiotics should be prescribed for specific pathogens after stool microscopy, culture and sensitivity when possible.

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