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A Clinical and Bacteriological Study of Acute Diarrhea in Children with Special Reference to Serum Electrolyte

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KEYWORDS
Diarrhea, Isonatremic dehydration, Children

ABSTRACT:

Aim and Background: Diarrhea is major public health problem in developing countries. An estimated 1.8 billion episodes of diarrhea occur each year and million children under the age of 5 years die of diarrhea , 80 percent of these deaths affect children under the age of two years. The episodes are generally associated with other infectious diseases, making treatment and prevention more difficult. Materials and Methods: Children under 5 years of age with history of diarrhea of less than 14 days duration admitted to the pediatric wards in Meenakshi Medical College Hospital and Research Institute. Methods of collection of data`s by direct questioning and examination of the study group children. Results: In the present study the maximum number of cases belong to the age group of 7-12 months (33%), and the incidence of diarrhea below 2 years was 87%. Conclusion: In the present study we conclude that the Bacteriological study and sensitivity pattern helps us to identify the most prevalent organism in the locality and to select the most appropriate drug and thus reducing the cost of treatment, lsonatremic dehydration was the commonest.

1. Introduction

The prevalence of diarrhea morbidity in children can be substantial, reaching up to one-third within the first two years of life. Overall, children experience illness due to diarrhea for approximately 10 to 20 percent of their initial three years [1].

Recognizing the severity of this issue, the World Health Organization (WHO) launched the Diarrhea Diseases Control Program in 1980, responding to the alarming statistic that around 4.6 million children were succumbing to dehydration-induced diarrhea each year. Recent advancements, particularly in oral rehydration therapy, have shown promise in preventing about 3 million dehydration-related deaths annually. In regions within the tropical belt, diarrhea-related deaths account for 15 to 40 percent of all fatalities among children under 5 years [2].

The heightened incidence of morbidity and mortality associated with diarrhea is intricately linked to various factors, including malnutrition, poverty, inadequate education, low socio-economic status, unsanitary living conditions, the inclination toward early substitution of breast milk, and the practice of bottle-feeding. Repeated episodes of diarrhea further compromise the nutritional status of underprivileged children, rendering them more susceptible to infectious diseases. Consequently, diarrhea emerges as a significant contributing factor to malnutrition, creating a cyclical vulnerability where malnutrition, in turn, predisposes the child to subsequent bouts of diarrhea [3].

Given the critical interplay of these factors, there is a pressing need for periodic assessments of the bacteriological patterns of diarrhea and therapeutic interventions. Such evaluations are not only crucial for effective treatment but also serve as a preventive measure against the dreaded complications associated with diarrhea.

This present study endeavors to delve into both the clinical and bacteriological aspects, as well as serum electrolyte levels, in cases of acute diarrhea among children aged less than 6 months to five years. The

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study spans a duration of 1 ½ years, aiming to contribute valuable insights into the understanding and management of this prevalent and impactful health concern in pediatric populations.

Materials and Methods

Children under 5 years of age with history of diarrhea of less than 14 days duration admitted to the pediatric wards in Meenakshi Medical College Hospital and Research Institute. Methods of collection of data`s by direct questioning and examination of the study group children. Sample size; 160. The sample size was calculated using 80% of the average number of G.E. cases (between 6 months - 5 years of age) admitted to Meenakshi Medical College Hospital and Research Institute for the past one year during the period of 2020-21. All the children's were selected based on inclusion and exclusion criteria. In inclusion criteria includes children with acute diarrhea defined as diarrhea less than 14 days were included in the study, As far as possible only cases which have not received any antibiotics were included so that the bacterial isolations are not suppressed, Age between 6 months - 5 years and Diarrhea referring to frequent liquid stools.

Procedure after case selection

1. A detailed history was taken and clinical examination performed as per the proforma
2. An evaluation of degree of dehydration was done according to the proforma.
3. Blood samples were collected for routine hematological indices (Hb % TC, DC, PCV) and estimation of serum electrolytes and blood urea, before starting therapy.
4. Two samples of stool were collected one sample in a sterile bottle for microscopic examination. The other in a sterile test tube for culture sensitivity study and hanging drop preparation.

The samples were immediately submitted to the laboratory for analysis. When immediate analysis was not feasible, the samples were refrigerated overnight. Preferably early morning stool samples were collected for the study.

Procedure for taking stool for culture

After the admission the perineum was cleaned thoroughly with sterile swabs, after washing the hands with soap and water. The stool was collected in a sterile bottle or a sterileswab and the sample The stool was collected in a sterile bottle or a sterile swab and the sample thus taken was inoculated into the Selenite F broth and in case of suspected cholera cases to alkaline peptone water. This was then immediately taken to the Microbiology department. For cases admitted during the evening, night or early morning hours, the sample collected were kept in the refrigerator at 4 C till the bacteriology department opened.

Micro biological methods

Fresh stool samples were obtained from each patient before initiation of therapy and transported immediately for detection of established enteropathogens using standard techniques. A battery of culture media including Mac Conkeys agar, deoxycholate agar, xylose-lysine deoxycholate agar and salmonella differential agar were used. The isolates were identified by standed methods and were tested for their susceptibility to various antimicrobials by dry disk diffusion techniques.

Biochemical Methods

All the biochemical parameters were analyzed by standard kit methods.

Results

The study extended over a period of 18 months, from 2021 to 2022. During the period of study, the total number of cases admitted to the pediatric ward was 1596 case. Among them gastroenteritis occurred in 239 cases. There were 174 cases of acute diarrhea in children under 5 years of age. Among these 160 cases were taken for the study according to the inclusion and exclusion criteria.

Age wise distribution

In the present study the maximum number of cases of diarrhea occurred in children aged 7 to 12 months (33%) followed by 1 to 6 months (24%) and 13 to 18 months (22%). Children below 18 months constituted (79%) of the study group. This tabulation shows that common incidence age group 6-12 months of 49 cases out of 160 cases. **(Table.1**)

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Table 1 Age group common incidence in acute diarrhoea

Age in months	Total number of cases
6-12	49
13-24	47
25-36	21
37-48	31
49-60	12
TOTAL	160

Sanitation Facility

Table 2 shows that the factors such as open field defecation and open drain around the house suggesting poor sanitation were found in 78% of the cases. Only 22% of the cases had good sanitary conditions. This tabulation and graph chart shows good and poor sanitation. In this 124 have poor sanitation and 36 have good sanitation.

Table 2 Sanitation facility

SANITATION	FREQUENCY
GOOD	36
POOR	124
TOTAL	160

Diarrhea duration

The average duration of diarrhea prior to admission was 2.28 days. 65% of the patients presented to the hospital within two days of the onset of the loose stools, while 31% presented 3 to 4 days after the onset of loose stools and 4% of the cases presented 5 to 7 days after the onset of loose stools.

Frequency of loose stools

The average frequency of loose stools 10.1 times per day. The frequency of stools in majority of the cases varied from 9 to 12 stools/day (59%), while 37% of the cases had 4 to 8 stools/day. 14% of the cases had 13 to 20 stools/day and 3% had more than 20 stools/day. (Table.3)

Table 3 Average frequency in a day of acute diarrhea

Average frequency in a day	Total number of cases
4-8 episode	59
9-12 episode	67
13-20 episode	28
>20 episode	6
Total	160

Clinical features associated with diarrhea

Table.4 shows the clinical feature commonly

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manifest. In this vomiting 116 ,fever 91 abdominal distention 28,perianal redness 7, acidotic breathing 28 cases. In this vomiting and fever most clinical manifestation manifests.

Table 4; Clinical features of patients

Clinical features	Positive	Negative	Total
Fever	91	69	160
Vomiting	116	44	160
Abdominal distention	28	132	160
Perianal redness	7	153	160
Acidotic breathing	28	132	160

Hydration status

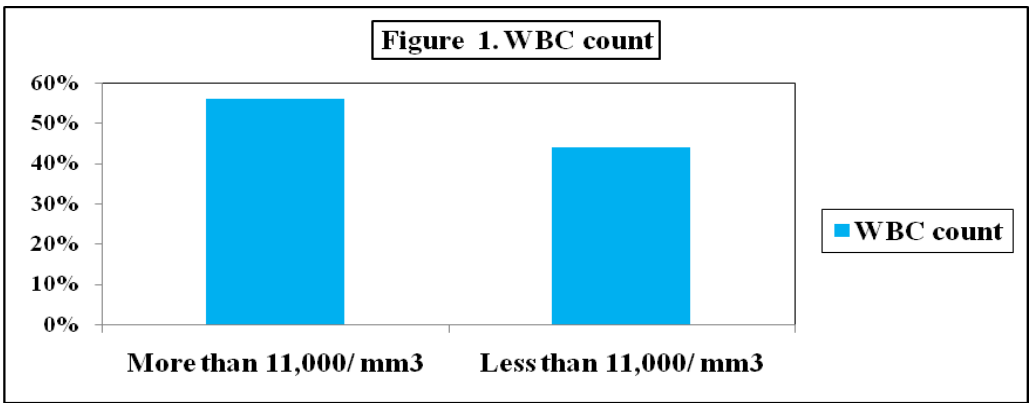
Table 5. Indicates that the Moderate hydration was present in 76% of the cases and 13% had severe dehydration and 11% had mild dehydration

Table 5 Grade of dehydration

Grade	No of cases
Mild dehydration	17
Moderate dehydration	122
Severe dehydration	21
Total	160

Total WBC count

Figure.1. shows that the total WBC count was more than 11,000/mm^3 in 56% of children and 44% had their total WBC count below 11,000/ mm^3.



Stool examination

Figure.2. indicated that the microscopic examination of stool was carried out soon after admission. Fresh stool was taken and was examined under microscope with saline and iodine preparations. Puscells > 10/HPF was seen in 37% of the cases and RBC's were

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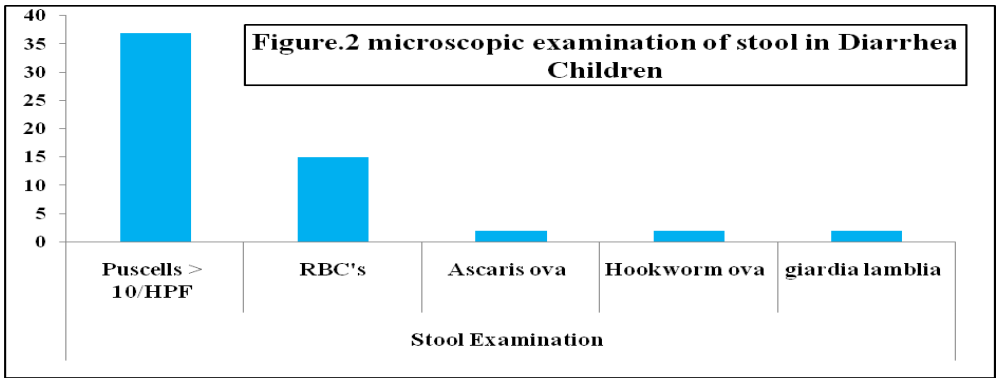
seen in 15% of the cases. Ascaris ova were present in 2% of the cases, Hookworm ova were seen in 2% and giardia lamblia (vegetative form) were seen in 2% of the cases.



Type of dehydration based on serum sodium level
In the present study majority of the cases (54%) had isonatremic dehydration. 41% had hyponatremic and 5% had hypernatremic dehydration. The mean serum sodium level lwas 135.76mEq/l. (Table.6)

Table.6. Serum sodium concentration in acute diarrhea

Type of dehydration	No. Cases
Hyponatremia<135meq/l	65
Isonatremia 135-150	87
Hypernatrima>150	8

Type of dehydration based on serum potassium level
Majority of the cases (81%) had normal serum potassium levels (3.5- 5.5mEq/l). Hypokalemia (<3.5mEq/l) was seen in 19% of the cases. None of the cases had hyperkalemia in the present study. **(Table.7)**

Table.7 Serum potassium concentration in acute diarrhea

Serum potassium	No. cases
Hypokalemia (<3.5 meq/l)	41
Normokalemia (3.5-5.5 meq/l)	119
Hyperkalemia(> 5.5 meq/l)	0

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Serum chloride level

Hypochloremia (<95mEq/l) was observed in 17% of the cases, normochloremia(95 - 105mEq/l) in 73% hyperchloremia (>105mEq/l) in 10% of the cases. **(Table. 8)**

Table 8. Serum chloride concentration in acute diarrhea

Serum chloride	No.cases
Hypochloremia<95	28
Normochloremia(95-106)	116
Hyperchloremia>105	16
Total	160

Discussion

Diarrheal diseases in the pediatric population are a major cause of mortality globally and more in the developing countries. With the advancement in medical sciences the inner secretes of their diseases are being understood and better way of management is at our disposal.Most diarrheal episodes occur during first 2 years of life. Incidence is highest in the age group 6-11 months when weaning often occurs (WHO 1992).

In the present study the maximum number of cases belong to the age group of 7-12 months (33%),and the incidence of diarrhea below 2 years was 87%. A similar high incidence during the first 2 years was reported by Joshi CK ,et al (1980) [4] 73.8%. The high incidence of diarrheal disease in the first 2 years of life is probably related to faulty weaning, unhygienic handling and storage of milk and food, higher incidence of parental infection, malnutrition, development of mouthing habits at this age as suggested L Khanduja et al [5]. To these factors can be added immaturity of the immune system of the body rendering it susceptible to an attack by the enteric pathogens, especially in association with malnutrition.

Seasonal distribution

Seasonal variation of this study sample (160 cases) could not be given as they were selected from "the total diarrheal cases" fulfilling the inclusion and exclusion criteria already laid out.

However among "the total diarrheal cases" (239) admitted during the period of this study, majority of them occurred during May (20), June (24),July(27),Aug(24) and Sept (18). Similar observations were reported by Naruka.B.S. et al (1974) who quoted 75.2% of diarrheal admissions during the months of May to September and 24.8% in the remaining 6 months. In a study by Srivastava J R in 1968 [7] half of the total admissions were in May to August. The high incidence in summer is said to be due to free growth of saprophytic organisms in the contaminated food and also multiplication by bacteria in milk and food. The high incidence in the beginning of the rainy season said to be due to fly season which is seen during and after light rains when flies act as vector.

Poor sanitation leading to faeco-oral spread was noted in majority of the cases. Only 22% of the families were using sanitary latrines while the remaining 78% of the patients practiced open air defecation. Karmar kar et al [8] reported that 26.1% and 38.15% respectively of the patients were using sanitary latrines.

In a study of 2835 infants and children with acute diarrhea between 1960 - 64 by Udani P.M et al(1968) [9], significant lower respiratory infections were detected in 21.4% of cases; 2.8% had skin infections and 4.2% had associated parasitic infection. Manchandaand Arora[73]reported 21% of cases with parenteral infections such as pharyngitis and tonsillitis, bronchopneumonia, UR1, boils and otitis. Naruka BS et al [6] reported associated infections in 16% of their cases. In our study, parenteral infection was seen in 21% of the cases studied, which is similar

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to that reported by Manchanda and Arora. Sood [10] in 1963 and PM.Udani [9] in 1968 have all reported that respiratory infection was the commonest condition found in association with gastroenteritis which was also the case in the present study.

The average duration of diarrhea before admission was 2.28 days. This corresponds with that described by Samantary et al, 1982 [11]. Chaomin Wan et al, 1999 [12] reported an average duration of 1.77 days (42.52 hours) before admission.

The mean frequency of diarrhea before admission in present study was 10.10 stools per day. However Chaomin Wan et al 1999 [12] and Athavale et al[13] reported a mean frequencyof 15.66 and 13.09 $\pm$ 0.94 stools per day respectively. Naruka et al reported yellow coloured stools in 76.4% and greenish in 17.46%.

The consistency of stools in our series varied from watery stools to semisolid stools. Majority of the cases had watery stools (81%) and 19% had semisolid stools. Similar results were noted by Naruka et al (1974) [6] Reddiah VP et al 1991 [14] and Kamala CS et al, 1996 [15], who quoted figures of 83%, 76.6%, 86.137%, 91.84% respectively.

In majority of the cases 66% there was no blood or mucus in the stool, 25% had only mucus, 1% only blood and 8% had both blood and mucus in stool. These findings are similar to those reported by Naruka et al. In a study by Naruka et al 64.7% showed no mucus or blood in stools, 28.3% had only mucus while both mucus and blood was present in 5.8% of cases. Only 1.2% presented with blood in stools.

No definite and accurate correlation can be made between the consistency or frequency of stools and the severity of the disease. This is because, the child who passes only 4-6 stools a day and large quantity each time may be severely dehydrated than the one who passes 8-10 stools, but small quantities each time. But if a child is passing stools more frequently and in large quantity each time, the severity of illness naturally increases.

In the present study 76% of the patients had some dehydration, 10% had nodehydration and 14% severe dehydration. From this it cannot be said with certainty that some dehydration is common, because the case study was on hospital admissions and the proportion of study was small and this cannot be compared to larger group gastroenteritis.

Our observations are nearly in concordance with those of T.S. Daral et al (1985)[16] who reported some dehydration in 76.5% and 78.9% and respectively.

Dehydration was the common finding in all the cases. Variation in hydration status is dependent on the amount of volume losses in the form of vomiting and diarrhea.

Majority of the some dehydrated cases had frequency of loose stools ranging from 9-12 stools per day. But from this no conclusion can be drawn because frequency of loose motion is not the criteria but it is the amount of fluid and electrolyte loss per attack which influences dehydration for which we need pre-checked weight. This is not applicable to most of the cases in our study where the previous weight was not recorded or maintained due to ignorance and illiteracy in our community.

In our study 37% of the children hemoglobin had less than 10 g/dl. Naruka et al [6] reported this to be 66% and 35.5% respectively. The present study approximates the figures of Naruka et al.

In our series, total leukocyte count was more than 11,000 cells/cu mm in 56% of the children. Gill P et al [17] found leukocyte count greater than 12,000 cells/ cu mm in63.8% of children. In Athavle series leukocytosis was mentioned in 88% of the cases. The difference could be explained because the total WBC count is affected by a large number of other factors like associated infections, age of the children included in the study etc.

In our study stool examination revealed pus cells in 37% of the cases and RBC's were seen in 15% of the cases. These results are nearly in concordance with those o fNaruka et al who reported pus cells in 43% and RBC in 16% of their cases. Ghai OP et al and Gill et al in their study observed pus cells in 37.2% and 32% respectively.

Majority of the cases did not show any pus cells or RBC's in stool examination. 2%of the cases showed ova of Ascaris, 2% ova of Hookworms and 2% showed vegetative forms of Giardia lamblia.

The incidence of parasitic infestations depend upon community and personal soil, hygiene and diligence of the examiner.

In the present study isonatremic dehydration (130 - 150 m Eq/L) was the commonest (85%) followed by hyponatremic dehydration (< 130 m Eq/L) in 12% of cases and hypernatremicdehydration (> 150 m Eq/1)

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in 3% of cases. Daral JB et al [18]in their studies have reported the incidence of isonatremic dehydration as 79%, 59.3%, 77.7%. lqbalahmed et al reported hypernatremic in 62.5% of their cases.

In our study Hypernatremia was not seen as in western studies where the incidence as about 20% and some of the Indian studies like that of Gill P et al [17], Hypernatremia is usually seen in children given disproportionate electrolyte fluids, high solute feeds and inadequate fluid administration. Since majority of our cases (68%) were was malnourished and were usually given hypotonic fluids or plain water prior to admission. These may be some of reasons why hyponatremia was less frequent.

Hypokalemia was seen in 19% of cases and is comparable to that of Mittal et al [19] and Kumar Vetal [20] who reported hypokalemia in 19.5% and 22.1% there were no cases of hyperkalemia. Potassium deficits in PEM is well established, through the frequency of hypokalemia is variable, potassium depletion appears to play an important role in disturbances of renal function, water and sodium balance and cellular function, in our study of the 19 cases with hypokalemia 14 were malnourished.

Conclusion

In the present study we conclude that the Bacteriological study and sensitivity pattern helps us to identify the most prevalent organism in the locality and to select the most appropriate drug and thus reducing the cost of treatment, lsonatremic dehydration was the commonest. Microscopic examination of stools and routine blood counts did not show any typical findings. Appropriate fluid and antibiotic management resulted in prompt recovery.

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