Epidemic shigella dysentery in children in northern KwaZulu-Natal

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Objectives. To describe the epidemiology, clinical features, management and outcome of children with *Shigella dysenteriae* type I infection admitted to a rural district hospital.

Design. Prospective cohort study.

Setting. Hlabisa Hospital, KwaZulu-Natal.

Subjects. Children aged under 12 years admitted with a history of bloody mucoid diarrhoea between February and December 1995.

Main outcome measures. Number of admissions, age, sex, clinical features, complications and outcome.

Results. Between February and December 1995, 158 cases of bloody diarrhoea were admitted, compared with 6 the previous year. *Shigella dysenteriae* type I, resistant to ampicillin, tetracycline, chloramphenicol, trimethoprim and sulphamethoxazole, but susceptible to nalidixic acid and ceftriaxone, was isolated. The mean age of patients was 30 months. Patients typically presented with frequent bloody mucoid diarrhoea, fever, abdominal pain and dehydration. One hundred and sixteen (73%) recovered, 17 (11%) were transferred for tertiary care, 4 (3%) absconded, and 21 died (case fatality rate = 13%; 95% confidence interval (CI) 8 - 20). Seventeen (11%) developed haemolytic uraemic syndrome and 4 (3%) a protein-losing enteropathy.

The malnourished (adjusted relative risk (RR) 3.3, 95%CI 1.6 - 7.1; $P < 0.01$) and those aged less than 2 years (adjusted RR 4.2; 95%CI 1.0 - 17.2; $P = 0.05$) were more likely to die. Dysentery deaths accounted for 19% of total paediatric hospital mortality.

Conclusion. A serious epidemic of shigella dysentery has established itself and is having a significant impact in this area. The virulence and drug resistance of the organism has resulted in high levels of morbidity and mortality. Broad public health measures will be needed to contain the epidemic. Further community-based surveillance is urgently needed, as is research to determine modes and risk factors for transmission.

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Epidemic dysentery caused by multidrug-resistant *Shigella dysenteriae* type I, which is estimated to have killed up to 300 000 people in central and southern Africa in the last 4 years,[1] has now reached South Africa. King Edward VIII Hospital, Durban, reported three times as many cases of paediatric dysentery in the first 2 months of 1995 as in the whole of most years prior to 1994.[2] This species of shigella has not previously been isolated in South Africa, but is similar to the strain responsible for epidemics in Zaire and Rwanda.[2] Laboratory surveillance suggests that northern KwaZulu-Natal is facing the initial brunt of this epidemic.[3]

The emergence of shigella dysentery is an important public health threat. Shigella is extremely infectious,[4] and serotype 1 of *S. dysenteriae* is exceptionally virulent and is associated with much higher rates of complications, such as the haemolytic-uraemic syndrome (HUS), encephalopathy and intestinal perforation. As in the present South African situation, the organism is often resistant to most antibiotics (e.g. ampicillin, co-trimoxazole, tetracycline and chloramphenicol) commonly used in treatment. Unfortunately conditions in many parts of South Africa are still conducive to the rapid spread of this bacterium. It is therefore important for medical officers, paediatricians and public health officials to be fully aware of the epidemiology and management of shigella dysentery.

The aim of this study was to describe the epidemiology, clinical features, management and outcome of children with *S. dysenteriae* type I admitted to a rural district hospital in northern KwaZulu-Natal.

Methods

Setting

Hlabisa health district is situated in northern KwaZulu-Natal, and extends from the Umfolozi River in the south to the town of Hluhluwe in the north. It incorporates both the coastal region and the higher inland area and serves a predominantly rural population of 205 000 people. The rainy season is from October to March, but the area has suffered a severe drought for the last few years. As in many rural areas potable water is scarce, and most people draw water from unprotected sources such as rivers. Latrines are not commonly used.

Hlabisa Hospital is a 450-bed rural district hospital. The 30-bed paediatric ward admits about 1 400 children a year, and of these about 200 have diarrhoea as a primary diagnosis. Prior to the current epidemic there were between 5 and 10 admissions for dysentery, with unidentified aetiology, each year.

Subjects

All children under the age of 12 years admitted to the paediatric ward and intensive care unit with a diagnosis of dysentery between February and December 1995 were included in the study. Dysentery was defined as a history of passing loose, bloody mucoid stools. Children with dysentery were admitted if they were pyrexial, grossly dehydrated, had abdominal swelling or guarding, were malnourished or had reduced levels of consciousness.

Following isolation of *S. dysenteriae* type I from the initial cases, any child presenting with dysentery was presumed to have shigella dysentery.

Analysis

Data capture and analysis were undertaken with Epi-Info version 6.02 (Centers for Disease Control, Atlanta, USA). Continuous data were compared by the non-parametric Kruskal-Wallis test. Comparison of categorical data was by the chi-square test. Exact confidence intervals are reported and all *P*-values are two-tailed with values of less than 0.05 considered statistically significant. The Mantel-Haenszel chi-square test was used for stratified analysis. Associations between variables are reported as relative risks (RRs).

Results

Between February and December 1995, 358 children with a primary diagnosis of diarrhoea were admitted to Hlabisa Hospital; 200 had non-bloody diarrhoea and 158 (44%) had dysentery. By comparison, during the same period in 1994, only 6 children had been admitted with dysentery, while the number with non-bloody diarrhoea was around 200. *S. dysenteriae* was isolated from the stool specimens of initial patients in the Hlabisa Hospital laboratory, and was confirmed at the Department of Medical Microbiology, University of Natal, Durban, where the organism was typed as *S. dysenteriae* type I. Isolates were resistant to ampicillin, tetracycline, chloramphenicol, trimethoprim and sulphamethoxazole, but were susceptible to nalidixic acid and ceftriaxone. The mean age of children with dysentery (Fig. 1) was 30 months (range 3 - 144), and there were more boys (91; 58%) than girls. Patients typically presented with frequent bloody diarrhoea, fever, abdominal pain and dehydration.

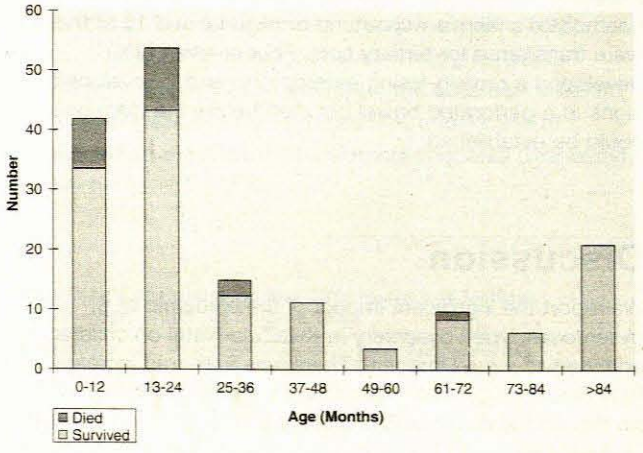

Fig. 1. Age distribution of admissions and mortality.

Nutritional status

Forty-four (28%) children were underweight for age and 18 (11%) were severely malnourished, i.e. had kwashiorkor, marasmus or marasmic kwashiorkor.

Outcome

In all, 116 children (73%) recovered and were discharged well, 17 (11%) were transferred for tertiary care and 4 (3%) absconded from the ward. Twenty-one children were known to have died (case fatality rate 13%; 95% CI 8 - 20). Ten children died within 2 days of admission.

When data were adjusted for age, severely malnourished children were more likely to die than well-nourished children (RR 3.3; 95% CI 1.6 - 7.1; $P < 0.01$). When nutritional status was adjusted for, those aged less than 2 years were also more likely to die (RR 4.2; 95% CI 1.0 - 17.2; $P = 0.05$) (Fig. 1).

Mortality from dysentery accounted for 19% of total hospital paediatric mortality. The case fatality rate was lower in the second half of the epidemic (July - December) (RR = 2.53; 95% CI 1.0 - 7.2; $P = 0.05$) (Fig. 2).

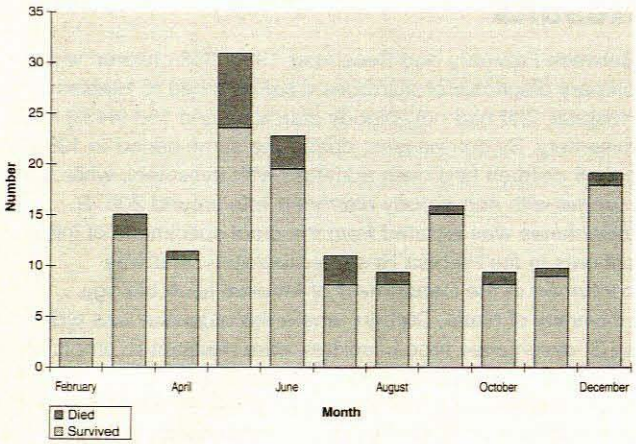

Fig. 2. Monthly admissions and deaths.

Complications

Seventeen children (11%) developed HUS (defined as haemolytic anaemia with anuria or oliguria) and 15 of these were transferred for tertiary care. Four children (3%) developed a protein-losing enteropathy, and 1 developed signs of a perforated bowel but died before the diagnosis could be established.

Discussion

We report the significant impact of the epidemic of *S. dysenteriae* type I dysentery in KwaZulu-Natal on children admitted to a rural hospital. There was a 26-fold increase in the number of dysentery admissions during the study period, and almost 1 in 5 children who died in hospital died of dysentery.

This was a hospital-based study and did not consider cases occurring in the community that did not reach health facilities, or cases managed in clinics and the outpatient department (of which there were many). It therefore only provides an indication of the magnitude and severity of the epidemic. Community-based studies are required to provide a more comprehensive picture. Although amoebic dysentery is endemic in this area, *Entamoeba histolytica* does not cause large epidemics of dysentery with high fatality rates. Investigations of dysentery epidemics in central Africa show *E. histolytica* infections to be rare.[5,6] Furthermore, our laboratory and those in neighbouring hospitals have consistently grown *S. dysenteriae* type I from children with dysentery during the current epidemic, and this was confirmed at a reference laboratory. It is therefore reasonable to assume that virtually all the 158 cases of dysentery reported here were caused by *S. dysenteriae* type I, although a microbiological diagnosis was not obtained in all cases.

This epidemic has serious public health consequences. The exceptional virulence and resistance of this organism have made clinical management difficult. We have adopted the following approach. All children undergo full blood counts (including platelets), and urea and electrolyte and creatinine estimation on admission. If severely dehydrated they receive intravenous fluids (plasmalyte or Ringer's lactate solution if hyponatraemic, half-strength Darrow's solution if serum sodium levels are normal), otherwise oral intake is encouraged. Children with signs of systemic toxicity are given parenteral ceftriaxone; those who are less sick are given nalidixic acid. In most cases the dysentery takes about a week to settle and children are discharged as soon as they are eating and stool frequency has decreased.

Nearly 40% of our patients were either underweight for age or severely malnourished. It is thought that malnutrition may contribute to increased mortality by increasing susceptibility to secondary infection.[7] Therefore malnourished children should be more closely monitored for secondary infections, especially those caused by Gram-negative organisms. It should also be noted that the child will be catabolic and attention must be paid to the provision of nutritional support. Both severe malnutrition and young age were independent risk factors for death.

The proportion that developed HUS is also noteworthy. This dangerous complication was usually heralded by falling urine output and development of anaemia. Almost half the patients were admitted with normal biochemical and haematological findings, and deteriorated a few days later. This highlights the need for careful daily clinical and laboratory review. We noted that mothers were very good observers of falling urine output. If HUS is suspected, it is important urgently to check renal function and blood count and to discuss with a referral centre the need for possible dialysis. Such children can deteriorate very quickly. We were unable to follow these children up, and cannot report on their outcome either in terms of mortality or renal function.

The case fatality rate of 13% is in keeping with international experience.[8] Over the course of the epidemic, the case fatality rate fell. The age distribution, complication rate and proportion of malnourished children remained the same and we believe the fall in mortality may be attributed to our increased awareness of the complications and management of this disease and the development of treatment protocols. It is essential that a teaching programme of the clinical manifestations and management of shigella dysentery be instituted for clinic staff and medical officers, along with the wide distribution of standardised treatment protocols.

International experience suggests that this epidemic is not going to be short-lived. At Hlabisa we are now redirecting our energies towards increasing community awareness and instituting preventive strategies. A clinical case definition of a history of bloody mucoid diarrhoea has been adopted and health workers are asked to notify all cases that they see. A surveillance system has been established to determine the distribution of disease in order to target interventions and to evaluate their effectiveness. Research is needed to determine modes of and risk factors for transmission.

The emergence of this epidemic has once again reminded us of the many social, economic and health needs of our communities. It is crucial that we take this opportunity to galvanise all departments involved in delivering primary health care and start the process of improving the water and sanitation and health facilities in impoverished areas.

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