Diarrhoeal Diseases and Primary Health Care in India

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Summary

Acute diarrhoea is a major public health problem which can prevent the achievement of the goal of health for all by the year 2000. Available information on the epidemiology and aetiology of acute diarrhoea in India is discussed and suggestions made regarding the public health approach which would improve the primary care in this important area.

"Health for all by the year 2000" is a national priority to which the medical profession in India must be totally committed. An essential prerequisite for achieving this goal is the availability of an ideal primary health care system to all citizens of India. Diarrhoeal diseases have been estimated to cause about 12 million deaths per year world-wide in children below the age of 5, of which more than a 10th, 1.5 million, occurs in India (Rohde & Northrup, 1976). The control of diarrhoeal diseases is therefore a major priority for achieving health for all. A national Control of Diarrhoeal Disease programme has been initiated by the Government and a major health education campaign, initially for medical practitioners, is under way. The maintenance of oral rehydration in patients with diarrhoea, the availability of oral rehydration salts at the grass root level, and the promotion of breast feeding are the thrusts of this programme. This paper presents the available information on the epidemiology and aetiology of acute infectious diarrhoea in India and suggests several lines of approach which can lead to the attainment of the goal of "Health for all by the year 2000".

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Definitions and background

Diarrhoea is a symptom caused by the excessive excretion of faecal water. Under normal physiological circumstances, the human colon can absorb large amounts of sodium and water from the liquid chyme presented to it by the ileum. The colon excretes the solid matter with some water as faeces. The capacity of the colon to absorb water is estimated to be of the order of 15 litres per day. Therefore for diarrhoea to occur, either the colon has to be damaged with colonic water malabsorption or the reserve capacity of the colon to absorb water should be overwhelmed. Two major mechanisms in the pathogenesis of diarrhoea are now recognised. In the first, an enterotoxin, the classical example being cholera-toxin, stimulates the secretion of large amount of water by the small intestinal cells, by activating the adenylate cyclase enzyme chain (Michael Field, 1979) The amount of water that is presented to the colon far exceeds the absorptive capacity and watery diarrhoea results. In addition to *Vibrio cholera*, a variety of other enteric pathogens including enterotoxigenic coliforms and *Campylobacter* are known to produce enterotoxins. The second well recognised mechanism in the pathogenesis of acute diarrhoea is actual invasion of the tissues by pathogens. In the small intestine, tissue invasion by rotavirus is the classical example of this (Hamilton *et al*. 1976) This destroys the mature enterocytes on the small intestinal villi, leading to villous shortening and a replacement of the mature cells by functionally immature new enterocytes. This leads to water and solute malabsorption, which is compounded by the osmotic effect of the unabsorbed carbohydrate in the lumen of the intestine. Invasive bacterial and parasitic pathogens are better recognised in the colon, such as acute diarrhoea due to *Shigella* (Kesh *et al*. 1982) *Salmonella* and *E. histolytica*. Diarrhoea due to these invasive pathogens of the colon, is associated with blood and mucus in the stools and is usually clinically designated as dysentery. Although these two mechanisms of pathogenesis of diarrhoea are well recognised, in any series of patients admitted and studied in hospitals, these mechanisms account for only a third or less of the patients and in the others either enteric pathogens are not recognised or if they are identified, the exact pathogenesis of the diarrhoea is not understood.

Epidemiology of diarrhoea in India

Epidemiologically diarrhoea can be classified as endemic diarrhoea, epidemic diarrhoea and travellers' diarrhoea.

Endemic acute diarrhoea

Several surveys from different parts of India give the prevalence of endemic acute diarrhoea in the community as three episodes per person year in children.
below the age of 36 months; 1.5 episode per person year in children below the age of 5 years, and less than 0.5 episodes per person year in all older age groups, including adults. In selected population groups, such as periurban slum communities, the incidence of acute diarrhoea may be higher. Most episodes of acute diarrhoea are short and self-limited and the median duration of episodes has been found to be about 2.5 days. It is also known that it is only about one of every 30 episodes or so of acute diarrhoea that occur in the community that require hospitalization. These statistics do not spell out the magnitude of the problem unless they are transformed in terms of the population of our country. With approximately 15 million births per year, these figures suggest that there would be a 135 million episodes of acute diarrhoea in children below three years of age and a further 45 million episodes in children 4 and 5 years old. In older age groups, a further 7.5 million episodes of diarrhoea can be estimated to occur per year. About 6 million of the 180 million episodes of acute diarrhoea in children below 5 years would require medical attention and it is from this that atleast 1.5 million children are dying every year in our country.

Epidemic diarrhoea

Unfortunately the data on epidemics of diarrhoea are very limited in our country, although from time to time, outbreaks of gastroenteritis and cholera are reported in the newspapers. There is no centralized system of collecting statistics for epidemic surveillance either at the State or the Central level and this would appear to be a priority to obtain the information necessary for controlling epidemics of diarrhoea. A limited surveillance of about 207 villages, maintained by our unit, has detected 40 epidemics of diarrhoea in the last 20 years (Mathan et al. 1984, Kapadia et al. 1984, Patel et al. 1986). We have shown that the majority of epidemics have a common source beginning, usually from contaminated water supply and a subsequent secondary person to person transmission. A concerted effort to control the ravages of diarrhoeal epidemics in the rural population is necessary. This is in addition to the measures already existing to control epidemics of diarrhoea where large groups of people gather, such as the Kumbamela.

Travellers’ diarrhoea

Travellers’ diarrhoea is a major problem particularly for tourists coming to our country and also for indigenous tourists travelling from one part of the country to other. This can essentially be considered to be the result of exposure of a nonimmune individual to a pathogen to which he is not accustomed. If an
adequate dose of the pathogen infects the individual’s gastrointestinal tract, he is likely to develop diarrhoea. Several studies in tourists have shown that pathogens such as toxin producing coliforms or Campylobacters are of particular importance in travellers’ diarrhoea. In the context of primary health care for India, travellers’ diarrhoea is not a major problem but its elimination from our population or an adequate preventive measure is likely to improve considerably the inflow of tourists into our country.

Aetiological agents

Since most acute diarrhoea is the result of infections of the gastrointestinal tract, a consideration of the aetiological agents is important. Bacteria, viruses and parasites can give rise to acute diarrhoea. Till the early 1970s, even from most developed countries, detailed studies of aetiological agents in acute diarrhoea identified pathogens in only about a third of the patients. It was assumed that there were undetected bacterial pathogens and that enteropathogenic viruses were a major problem. The identification of toxin producing coliforms, Campylobacter and rotavirus stimulated extensive aetiological studies in different parts of the world. In 1986, with the available technology, it is now possible to identify at least one presumptive aetiological agent in upto 75 per cent of all children with acute diarrhoea who come to major treatment centres without prior antibiotic therapy (Maiya, 1977; Mathan and Mathan, 1985) However, there is very little information about the role of aetiological agents in causing diarrhoea in the community. This information is essential to plan adequate measures of control.

Published work from India shows that the rotavirus is responsible for only less than a quarter of children with acute diarrhoea who come to hospital. In certain areas like Calicut on the west coast of India, the prevalence of rotavirus diarrhoea is very much higher almost approaching 100% of cases in some months. From other parts of India, bacterial aetiological agents have been isolated with greater frequency. One of the problems in identifying a single pathogen as responsible for diarrhoea in a patient is that in most reports from India, more than one pathogen has been identified in about a third of the patients. It is very difficult to say which is the responsible pathogen when rotavirus, toxin producing coliforms and Salmonella are identified from the stool of a child.

The aetiological approach to planning control of diarrhoea is further complicated by the fact that it is now well established that enteric pathogens,
bacterial, viral and parasitic are widely prevalent even among the healthy asymptomatic populations in many developing countries (Moe, 1985; Mathan and Rajan, 1986; Mathan et al., 1981) The significance and importance of the wide prevalence of pathogens in the healthy population is not yet understood, although it is known that this is a reflection of environmental contamination.

In any consideration of acute infectious diarrhoea, in India, special attention has to be paid to cholera. Cholera is endemic in the Gangetic delta and seasonal outbreaks occur from time to time. Sporadic cases of cholera have also been reported from other parts of India, but major epidemic outbreaks have not been reported in recent years. However, since the factors that determine the occurrence of cholera outbreaks are not yet fully understood and the organism is endemic in our country, the possibility of large epidemics or pandemics of cholera have to be kept in mind when planning strategies.

*Shigella* epidemics have been a fairly recent occurrence in India. Prior to the 1970s, *Shigella* were isolated sporadically but during the early 1970s, there was a large pandemic of shigellosis which involved Bangladesh and southern India (Mathan et al., 1984, 1981, Rahaman & Aziz, 1981) Again in the 1984 summer, in north-eastern India, a large pandemic due to shigella *dysenteriae* type I was a major public health problem.

It is clear from the available published data that no single organism can be incriminated as the outstanding pathogen responsible for the majority of cases of diarrhoea in India. Bacterial pathogens appear to be more predominant in our country and *Vibrio cholera* and *Shigella* are of particular importance.

**PRIORITIES IN THE PRIMARY HEALTH CARE APPROACH**

**An information network**

Accurate and regularly updated information of the incidence and prevalence of diarrhoeal disease is an absolute necessity in planning priorities in control and therapy of diarrhoea. Till such information is readily available, all that is done to control diarrhoea will be on an arbitrary basis. Since the primary health care network, from the basic grass root level community health worker to the District Hospital and the tertiary care medical centres, is, at least
in theory, established, an adequate transmission of information from these various levels to a centralised agency with appropriate feedback would be necessary. An information-gathering network of this nature is crucial not only for diarrhoeal diseases, but for most other components of the primary health care package. Unfortunately the establishment of such an information network seems very far from the present situation in India.

Health education

Knowledge action and practice studies which have been carried out in several regions in the country suggests that there is a great hiatus as far as diarrhoeal diseases knowledge is concerned in our rural population. There are many different terms which are used by people in rural communities to describe diarrhoeal episodes and the knowledge about the necessity to ensure hydration during episodes of diarrhoea is virtually absent. In fact it is the practice in many communities that a person who is having diarrhoea is denied water and food till the episode settles down. Such an approach would ensure, particularly during the hot dry summer months, that diarrhoea would rapidly lead on to severe dehydration, its complications and death. The health educational approach to correct this system needs to be at two levels. For the entire community, the health education needs to be undertaken vigorously using all available mass media of contact and particularly exploiting the availability of television and using community health workers. In addition to this, the curricula in schools needs to be suitably altered to ensure that information about the nature, causation and simple treatment of diarrhoeal disease is provided at the village level. This needs to be complemented by specific target oriented health education particularly targeting the mothers of under 5s. The second component of health education is for the medical professions. It is even now true that large numbers of people with acute diarrhoea are given antibiotics, which in certain circumstances such as salmonella infection, may even be deleterious to the patient. The indiscriminate use of Chloramphenicol at the time of an epidemic of diarrhoea due to rotavirus led to the emergence of the first Chloramphenicol-resistant S. typhi in India.

Oral hydration

The maintenance of hydration of an individual affected by acute diarrhoea will in 99.9% of the cases ensure his survival and rapid recovery. Our present
knowledge of the status of oral hydration developed from the discovery of the cholera toxin and the fact that even while the small intestine is secreting large amounts of fluid under the effect of this toxin, glucose mediated absorption of sodium and water is unaffected. Therefore, if patients with severe diarrhoea and dehydration are given an adequate amount of fluids containing glucose and electrolytes, hydration can be maintained although this does not reduce the duration and severity of the diarrhoea. A large number of field trials has established the efficacy of this approach, which forms the basis of our national control of diarrhoeal diseases programme. Packets of oral rehydration solution powders containing glucose, sodium chloride, sodium bicarbonate and potassium chloride are made available at the primary health care worker level. These packets are produced in a subsidised fashion and in theory should be available to anybody who requires it. Unfortunately this network is not yet fully functional and in a recent survey carried out by our group in three primary health care blocks near Vellore, availability and utilisation of oral rehydration salts were very poor. Furthermore, the ingrained cultural trend to withhold fluids from individuals having diarrhoea is a major deterrent to the wide use of this approach. It is clear that more research is needed to work out the ideal ways in which maintenance of oral hydration can be ensured when episodes of diarrhoea occur. The experience in other countries where large public health campaigns have been mounted is not very encouraging. This would appear to be an area, where medical scientists need to work in close association with sociologists and anthropologists to work out the ideal technique for effecting this therapy.

The search for an ideal ORS preparation is still continuing. There are proponents who would suggest that citrate should replace the bicarbonate in the solution and others who advocate the use of a rice flour based solution. There are some indications that the rice flour based solution reduces the severity and duration of diarrhoea but considerable more work needs to be done before final answers can be given. However, there is absolutely no question that in reducing the mortality from diarrhoea, the efficacies utilization of the oral hydration strategy is the most important line of action available now.

Breast feeding

It has been known for several decades that the most severe episodes of diarrhoea which lead to malnutrition and mortality occur around the time of
weaning and that early weaning or the absence of any breast milk is a major factor in mortality due to diarrhoea. In our country, fortunately breast feeding is still the norm although there is a slow inroad from artificial foods and early weaning. The problem sometime is inadequate amount of breast milk when the child is kept on the breast for too long. There are several studies ongoing in the country into the practices of breast feeding and the information from them have to be interwoven into the network of primary health education, so that breast feeding can be optimised as a means of reducing the incidence of acute diarrhoea. The ideal way to wean children from breast milk needs also to be widely publicised. As far as possible, traditional practices should be incorporated in this so that the advise will be acceptable to the large masses in rural areas.

Water supply

The provision of adequate water for drinking and washing purposes is accepted as one of the priorities in our country. Unfortunately, there are still may thousands of villages where women and children have to walk miles to collect one or two pots of water for the day’s use. Lack of water leads to inadequate washing of utensils and poor personal hygiene and has been shown to directly contribute to the incidence of diarrhoeal episodes. It is important to remember that adequate water should also be of such quality that it is potable and free from most contaminants. Mere provision of an electric pump to pump water up to an overhead tank which is then distributed to a system of street taps in a village intermittently either once a day or once in two or three days, which has been effected in several of our villages, not only is unsatisfactory, but may be counter productive. Epidemics of acute diarrhoea have occurred where the common source through which the infection was distributed was such water supplies. The supply of water has to be in such a fashion that it is culturally acceptable to the rural masses. Further study is needed to work out the modalities of this.

Environmental sanitation

Facilities for disposal of human and animal excreta and of garbage in our villages is lacking. The problem here is one of educating the villagers of the necessity for an appropriate disposal system and to provide the funds that will be necessary for ensuring that such a system can work. In many villages where large community latrines have been built, they have been largely unutilised due
to the unavailability of water. Some villagers have used the cement concrete buildings very effectively for storage of grain! This again would appear to be an area, where concerted research by medical scientists, engineers and sociologists is likely to pay dividends.

Immunization

Since infections are responsible for most episodes of acute diarrhoea, appropriate immunisation would appear to be the ideal way of controlling this public health problem. An injectable cholera vaccine has been in use for many years and it is well recognised that this vaccine is ineffective (Whitlock, 1986). It has been recognised for many years that the optimal immunisation of the gastrointestinal tract is to stimulate the gut associated lymphoid tissue. There has been major problems in designing and developing vaccines which could effectively do this. Recent development of a typhoid vaccine using a mutant Salmonella typhi designated TY21A and its demonstrated efficacy in field trials has given a considerable impetus to this field. There are several approaches which are being pursued for the development of a vaccine. Rotavirus vaccines have been developed and are now being field tested. Initial reports in tests in the developed countries suggested that this vaccine was very effective. However, preliminary reports of a large scale trial being carried out in a developing country are not so optimistic. Priority from the point of view of India, would be for the development of an effective oral cholera vaccine and an effective vaccine against Shigella. A rotavirus vaccine, in view of the low prevalence of this as a cause of hospitalisation in children for diarrhoea, would appear to be of low priority for India. There is work going on in different parts of the world in developing effective oral cholera and Shigella vaccines. Ideally, these vaccines should be developed in a single organism such as the TY21A, so that by giving a single immunising dose, immunity against a wide variety of gut infections can be developed.

Basic knowledge about gut immunity is still very preliminary and there are very large gaps in what we know of how this system works and how it protects against infection. Till such knowledge is available, development of a vaccine is going to be by trial and error. Many questions have been raised about the characteristics of an ideal vaccine for a developing country like India and these will have to be satisfactorily answered. The cost of developing and manufacturing a vaccine is only a small fraction of the total cost of mounting a major immunization programme in a country like India.
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Conclusions

Even when India is approaching the 1990s and the beginning of the 21st century, diarrhoeal diseases continue to be a major public health problem contributing significantly to infant and childhood mortality. As outlined above, considerable work needs to be done particularly in areas of operational research to find out optimal means of preventing the mortality. More basic research is needed to develop ideal vaccines for the control of diarrhoeal diseases. It would be relevant for much of this work to be done in India. The priorities of other countries with regard to the type of vaccine development etc., are different from the priorities of India and this would appear to be an area where we should lay down our priorities and make a plan of action which should give us returns in the near future.

References


