

# WATER CONTAMINATION AND ITS RELATED DISEASES

Pages with reference to book, From 90 To 92

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Diarrhoeal diseases and other infections often occur due to consumption of contaminated water. Contamination can occur at the source, between source and storage points or in storage tanks. Defective joints, syphonage, rusted pipe lines and crossing over of sewage pipe lines are the main causes of contamination. The greatest risk of contamination is during distribution which is directly related to the distance from the filtration plant to the locality. Water quality at home is further spoiled by children and animals.<sup>1</sup> The degree of contamination varies in different areas according to the hygienic and living standards of the population. Ideally, drinking water should not contain any pathogenic micro-organisms and a colony count between 10 to 100 colonies is considered as contaminated. Contaminated water may look clean and be tasteless and odour-less but microscopically it contains harmful microbial agents. Contamination in treated water results from excess of turbidity, inefficient disinfection practices, cross connection or loss of water pressure. Drastic changes in water pressure may dislodge bacteria from colonization sites in the slime and sediments lining the pipe wall and result in unpredictable and fluctuating collection of organisms. Defective chlorination also results in poor quality of water.<sup>2</sup> There is good evidence that, at least in some places, water is the major vehicle of transmission of diseases.<sup>3</sup> Diseases related to water are classified according to the mechanism of transmission, as water-borne, water washed and water based or those associated with water related insect vector. Waterborne outbreak is defined as an incident in which two or more persons experience similar illness after consuming water, or epidemiological evidence implicate water as the source of illness.<sup>4</sup> Water-borne and water related diseases overlap each other and probably are the biggest killers in developing countries. Most infective agents of diarrhoea are transmitted by orofaecal route, water being the transmitting agent in most diseases like cholera, typhoid, dysentery, hepatitis, and parasitic infestations.<sup>5</sup> Water washed infection are related to skin and eye infections which can be controlled by improved hygiene. Schistosomiasis and guinea worm infections are water based in which a pathogen spends an essential part of its life in water or an aquatic host. Disorders which depend on water related insect vector include malaria and filariasis. Dental disease and endemic goitre are both water-borne and water related diseases. Three types of micro-organisms are found in water, viz., natural aquatic bacteria, soil dwelling organisms (harmless) and organisms of the intestinal tract (diseases producing). Bacterial population in the water varies from day to day depending upon the quality and quantity of food available to these organisms. The presence of organic matter is favourable to bacterial growth while some inorganic metals like silver, copper, aluminium have an inhibitory effect, Iron and manganese inhibit the growth of some but encourage that of other bacteria. Coliform organisms (*E. coli*, *Citrobacter*, *Enterobacter* and *Klebsiella* species) are recognised as suitable microbial indicator of drinking water quality. They are derived from faeces of warm blooded animals, vegetation and soil, and, therefore, they may contaminate water by entering through non metallic construction material.<sup>6</sup> Coliforms, if found in treated water, suggest inadequate treatment or post treatment contamination. Presence of faecal streptococci in water indicates faecal pollution. These organisms rarely multiply in polluted water and are more resistant to disinfection than coliforms. *Cl. perfringens* are anaerobic spore forming organisms present in faeces in smaller numbers than *E. coli*. They can survive in water for a longer time and are more resistant to disinfection than the coliform group. Their persistence in disinfected water, therefore, indicates deficiencies in treatment, and prolonged pollution of water supply. Other microorganisms like *Pseudomonas aeruginosa* have been advocated to assess the hygienic quality of drinking water. Presence of these organisms indicates the general cleanliness of the

distribution system and the quality of bottled water. *Pseudomonas* can grow on material used in the construction of distribution and plumbing system and at times it occurs in drinking water without coliform organisms<sup>7</sup>. Although the presence of this organism in potable water cannot be ignored but its isolated presence should not be used as an indicator of faecal pollution. *Campylobacter jejuni* and Norwalk like virus are also documented as cause of waterborne outbreaks. Apart from bacteria, parasitic infestation can also occur due to contaminated water. Cysts have been recovered from sewage water entering the treatment plant at various sites. Chlorination of water inactivates organisms but not cysts<sup>8</sup>. Waterborne giardiasis occurs due to untreated surface and ground water. Giardiasis is directly related to the dose of infecting agent and the amount of water consumed per day. In one study residents living in giardia prevalent area for over 2 years had a lower attack rate than the short term residents<sup>9</sup>. Outbreak of amoebiasis occurs due to water supply being contaminated with sewage. Ascariasis can also occur due to contaminated water as the eggs resist most chlorination procedures and can remain viable in water for a long time<sup>10</sup>. Waterborne diseases mostly affect children resulting in high mortality, carrier state, disability and retarded growth. Transmission of waterborne disease can occur through mechanical vector like contamination of food utensils and food handlers. The ingested dose of a pathogen required to cause diarrhoea depends upon a number of host factors. Although *Shigella* may be waterborne but its transmission is usually due to person to person contact living in poor hygienic conditions. Cholera is usually waterborne and Salmonellosis food borne. In order to prevent contamination, consideration should be given not only to the source of drinking water but also to the treatment, method of delivery to the consumer and frequency with which it is examined. Intermittent water supply should be avoided, more attention should be given to joining and bending technique. Pipes should be checked and replaced regularly. Disinfection is the main method of controlling pathogenic bacteria and viral agents. Chlorine is the commonest disinfectant used in most countries but where parasitic infestations are suspected disinfection must be supplemented with flocculation and filtration to remove cysts, worms and ova<sup>8</sup>. For effective disinfection it is important that turbidity should be as low as possible and, when chlorinated, p should be less than 8.0. Public education on the importance of water and sanitation should be given. Water should be supplied through pipes to every house to prevent infection<sup>5</sup>. A preliminary study conducted at Pakistan Medical Research Council Research Centre, Karachi indicated bacterial contamination in 89% water samples collected from various areas of Karachi. Contamination was both in the overhead tanks (91%) and taps (87%). Bacteria isolated were *pseudomonas* followed by *E. coli*, *A. faecalis* and *Kiebsiella*. *Pseudomonas* was often found alone in water samples, it is significant only when isolated with faecal bacteria. In various .areas of N.W.F.P., water collected from open wells were found contaminated with coliforms and *Strept faecalis*<sup>11</sup>. Water consumed from springs, streams and shallow wells is not safe as faecal contamination was found in 57% and non-faecal in 24%. Bacteria isolated were mainly *E. coli* (51%) and *Klebsiella* (14%)<sup>12</sup>. During epidemics, floods and other disasters when normal water supply is temporarily disturbed, examination of water samples should be more frequent. In conclusion it can be said that improved water supply and proper disposal of excreta will have a substantial impact on reducing morbidity and mortality due to water-borne diseases.

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