The Largest Mass Poisoning in Recorded History

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Bangladesh is a country laced with rivers and ponds, sources of surface water that have supplied its population’s needs for centuries. Unfortunately, however, innumerable lives were being lost from diarrheal diseases contracted by drinking surface water contaminated with bacteria. Consequently, in the 1970s and 1980s, the Bangladeshi government collaborated with international aid agencies led by UNICEF to build tubewells (hand-operated pumps that draw water from underground aquifers) in every village. In addition to providing access to pathogen-free water, the tubewells were welcomed because they brought relief to village women who used to trudge vast distances with pails dangling off their arms and pots of water balanced on their heads. By the 1990s, 95 percent of the country had access to tubewell-drawn water. Ten million tubewells had been installed in the country of 146 million in what was touted as a rare public health and humanitarian success story.1

However, after the reporting of unusually high incidences of bladder and lung cancer as well as gangrene amongst villagers, the world community was confronted with the realization that Bangladesh’s groundwater was contaminated with high arsenic levels, effectively putting almost the entire nation under increased risk of arsenicosis. Fifty-nine of sixty-four districts report arsenic levels above 0.01 mg/L (the acceptable upper limit as defined by the WHO).2 The unprecedented situation has been described by the World Health Organization as the biggest outbreak of mass poisoning in world history.3 “Twenty thousand people could die each year,” according to the United Nations Development Programme in Bangladesh.4

UNICEF stated that “at the time, standard procedures for testing the safety of groundwater did not include tests for arsenic [which] had never before been found in the kind of geological formations that exist in Bangladesh.”5

“It is a terrible public catastrophe,” said Allan Smith, professor of epidemiology at the University of California, Berkeley and a WHO consultant who has been actively investigating the arsenic crisis. Smith warns that one in ten adult deaths in Bangladesh could soon be from arsenic-triggered cancers of internal organs, particularly the bladder and lungs where the arsenic preferentially deposits.6 Bangladeshis are rendered more vulnerable by poor nutrition, the large volumes of water they drink and because of indirect ingestion from the consumption of rice irrigated and cooked in contaminated water.

Dipankar Chakrabarti, director of environmental studies in Jadavpur University in Calcutta, has worked tirelessly to expose the arsenic crisis. He has described the southeastern Bengali village of Seladi as “in all probability the most arsenic-contaminated village in the world.” Seventy-two of seventy-three tubewells in Seladi are contaminated. Some wells evince four hundred times the WHO limit for arsenic.7

It is suspected that the arsenic originates in the Himalayan sources of the Brahmaputra and Ganges Rivers and that it has rested undisturbed for millennia in alluvial mud layers underlying the nation’s river deltas. David Kinniburgh of the British Geological Survey has studied arsenic’s travel route into the tubewells.8 He explains how the mud in Bangladesh is thicker and flatter than anywhere else on the planet. It can take several millennia for the underground water to seep through the mud before it spills into the Bay of Bengal. In the meantime, the water slowly absorbs arsenic. Its presence in the water is tasteless and invisible.

Arsenic poisoning can be a highly insidious process, taking anywhere from 2-20 years of exposure for symptoms to develop. The telltale signs of arsenicosis include:

**SKIN EFFECTS:** Symmetric hyperkeratosis of the palms and soles is a characteristic finding after long-term ingestion of arsenic in drinking water. Hyperpigmentation of the skin occurs throughout the body.

**GI EFFECTS:** The chronic absorption of arsenic occasionally produces hepatocellular toxicity which may be the result of an inhibition by arsenic of the enzymes involved in cellular metabolism. Trivalent arsenic binds readily to sulfhydryl groups of enzymes and has been shown to inhibit pyruvate dehydrogenase function, resulting in the swelling and distortion of hepatic mitochondria. Chronic exposure to arsenic can manifest as hepatomegaly and liver cirrhosis. Non-cirrhotic portal hypertension may develop in some cases. Obstruction of bile ducts may cause jaundice. Gastric symptoms include nausea, loss of appetite, constipation or sometimes diarrhea.
RENAL SYSTEM EFFECTS: Urine may be coloured red or green and in some cases dysuria and anuria develops from renal tubular necrosis.

CARDIOVASCULAR SYSTEM EFFECTS: Peripheral vascular disease has been observed among persons in Chile and in Taiwan who also suffered from chronic exposure to arsenic in drinking water. These progressed in severe cases to frank gangrene of the extremities associated with endarteritis obliterans. Myocardial degeneration and cardiac failure may result from chronic arsenic poisoning.

NERVOUS SYSTEM EFFECTS: Peripheral neuropathy affecting primarily sensory function has been encountered in several studies of persons with chronic exposure to arsenic. Symptoms accompanying arsenical neuritis are burning, tingling sensations, pain and tenderness in the affected limb. The extremities show a decrease in touch, pain and temperature sensation. Tendon reflexes are absent or diminished, Knee jerks are usually lost. Headache, drowsiness, confusion and convulsions are seen in both acute and chronic arsenic intoxication.

HEMATOLOGICAL EFFECTS: Chronic exposure to arsenic has been associated with disrupted erythropoiesis. Anemia, leukopenia, thrombocytopenia may develop.

CARCINOGENECITY: Arsenic has been found to cause cancer of the skin, liver, lung, urinary bladder, prostate and possibly lymphatic tissues. Arsenic exposure has been associated with three types of skin cancers: Bowen's disease, basal cell carcinoma and squamous cell carcinoma.

So far there is no specific treatment for chronic arsenicosis. Chelation therapy, vitamins and a nutritious diet have been shown to enhance recovery from some symptoms.

As a first step in the massive struggle to deal with the crisis, aid workers are testing the tubewells and painting contaminated ones red. Some are suggesting that the only long-term solution is to begin sinking deeper wells to tap cleaner water. However, the financial cost of installing these wells in addition to surface tanks and distribution pipes is staggering. Also some deep tubewells in West Bengal have started bringing up arsenic years after they were first dug.

Another proposition is to collect rainwater in large tanks. This will work in some places, explained Shahida Azfar from UNICEF, but “there is not enough rain all year for that to be feasible as the main strategy.” Unfortunately, efforts to treat the contaminated water using filters and chemical treatments have been tried without much success. Few workable solutions have come to light so far, but the number one priority at the moment is to assay each tubewell for contamination levels. As Fred Pearce wrote in the UNESCO-Courier, “Each village needs its own plan. And none of them can begin planning until [each] knows which of its tubewells are pouring poison into villagers’ buckets.”

For further information on the situation and for suggestions on how you can help, visit the West Bengal and Bangladesh Crisis Information Centre at: http://bicn.com/acic/