Epidemic Dropsy

Argemone mexicana L. (Papaveraceae), a native plant of the West Indies, has been naturalized in India. It grows widely and is popularly known as satyanashi (shailkanta in Bengal, bharbhanda in Uttar Pradesh). Its seeds are black in colour and similar to the dark-coloured mustard seeds (Brassica nigra) in shape and size. While adulteration of argemone seeds in light yellow-coloured mustard seeds (Brassica compestris) can be easily detected, it is difficult to detect when mixed with black-coloured mustard seeds. Accidental admixture of argemone seeds with those of mustard, growing in the same field, does not occur as the harvesting time of mustard (February-March) and argemone (May-June) is different. Argemone seeds are rich in oil (30%-35%) whose colour is similar to that of mustard oil.

Consumption of mustard oil contaminated with argemone seed oil is known to cause epidemic dropsy. Argemone poisoning was first reported from Calcutta in 1877. Since then, several outbreaks have occurred in different states of India as well as in Mauritius, Fiji Islands and South Africa. Except for the South African epidemic which occurred because of consumption of wheat flour adulterated with argemone seeds, all the other outbreaks were related to the intake of mustard oil contaminated with argemone oil. Usually, epidemics in India have been reported between July and September. The recent epidemic (1998) in Delhi and other states, which also started in August, is possibly the largest in India so far.

Extensive clinico-epidemiological studies were reported from the All India Institute of Hygiene and Public Health, Calcutta and from the School of Tropical Medicine, Calcutta. The clinical manifestations of argemone oil poisoning include vomiting, diarrhoea, nausea, fever, erythema, bilateral pitting oedema of the lower limbs, breathlessness, tachycardia, hepatomegaly, crepitations in the lungs and gallop rhythm. In severe cases, glaucoma and even death due to cardiac and respiratory failure have been reported. Normocytic hypochromic anaemia with increased erythrocyte sedimentation rate (ESR) is a constant feature. Pregnant women afflicted with epidemic dropsy either abort or give birth to stillborn foetuses. Symptoms similar to those of epidemic dropsy occur in human subjects fed argemone oil. While this implicates the adulteration of mustard oil with argemone oil in the causation of epidemic dropsy, little is known about the long term effects of this contamination.

S. N. Sarkar's pioneering work in 1948 attributed the toxic effects of argemone oil to two of its physiologically active benzophenanthridine alkaloids—sanguinarine and dihydrosanguinarine. Both these compounds are interconvertible by simple oxidation and reduction processes. He reported that the alkaloid content in argemone oil varies from 0.044% to 0.5%. While this variation may be due to the different techniques used for the estimation of alkaloids, further work needs to be done on the relationship between climatic and geographical factors on the toxin content of the plant.

Experimental studies suggest that the skin, liver, lungs, kidneys and heart are the target sites for argemone oil intoxication. The inhibition of pyruvate oxidation by sanguinarine has been speculated to increase the blood pyruvate concentration. However, this hypothesis is not yet established in dropsy patients. Sanguinarine...
inhibits the Na⁺, K⁺-ATPase activity of the heart by interacting with the cardiac glycoside receptor site of the enzyme.¹² In rats, the inhibition of enzyme activity probably causes degenerative changes in the cardiac muscle fibres of the auricular wall. A similar effect could be causing tachycardia and cardiac failure in patients with dropsy. Argemone oil causes a dilatation of the smaller arterioles and capillaries. ‘Capillaritis’ leads to the escape of serum albumin with a concomitant increase in globulin resulting in increased capillary permeability which may be responsible for oedema and serous effusions in the pericardium, lungs and pleural cavity.⁴⁵

Studies from ITRC suggest that argemone oil inactivates the hepatic cytochrome P450 protein.¹³ This is responsible for the biotransformation of a variety of xenobiotics, thus impairing the clearance of argemone alkaloids from the body¹⁴ resulting in cumulative toxicity. A green fluorescent metabolite, benzacridine, was detected in the urine and faeces of rats and guinea pigs even 96 hours after oral intubation of sanguinarine.¹⁴ This metabolite has also been detected in the milk of sheep grazing on argemone plants. Argemone oil has also been reported to enhance the production of reactive oxygen species (ROS).¹⁵¹⁶ In rats, these may result in increased fibrosis, hyperplasia of bile ducts and congestion in the portal tracts along with hepatomegaly, dilated blood vessels and proliferation of endothelial cells. Several bioantioxidants have a protective effect by scavenging the ROS in argemone oil-induced toxicity.¹⁵¹⁶ Based on these studies, a limited trial of a combination of bioantioxidants (riboflavin and L-tocopherol) was conducted in dropsy patients at Barabanki.³ This regimen was adopted in several hospitals of Delhi and other states during the August 1998 outbreak. Although steroid therapy has also been advocated in dropsy patients, it may be counter-effective in the haemorrhagic state. The line of treatment in argemone-intoxicated patients has so far been symptomatic, as the mechanism of toxicity of argemone oil is still not clear.

REFERENCES