

CHAPTER 30

POISONING

1. VOLATILE POISONS. BENZOL AND TOLUOL.

THE hazards associated with the use of volatile substances such as the aromatic naphthas, like benzol and toluol, are well known. Cases of blood dyscrasia due to this cause are occasionally reported in civil life, and in a few instances these occurred in the Services also. Deaths also occurred from aplasia of the bone marrow, in circumstances which apparently precluded the possibility of exposure to toxic substances. The cause of these was just as obscure as similar happenings in civil life, but the sensitiveness of the bone marrow to certain chemical substances and to some nutritional disturbances always suggests the propriety of looking for a toxic cause.

A soldier died from aplastic anaemia some time after an apparently brief exposure to benzol; this was accepted as due to benzol poisoning in a very susceptible person. In 1944 an airman died of acute thrombocytopaenia and aplastic anaemia. He had been working for some one and a half hours a day over a period of over two months in a workshop where engine parts were cleaned with a fluid of high benzol content. A special investigation was sponsored by the D.G.M.S., R.A.A.F., to determine whether men employed in such workshops were exposed to hazard, and whether any periodic check on their blood should be made. Conditions in painting and spraying shops were also investigated. Blood examinations were made of men making any contact with benzol. Counts were made of the red cells and platelets, total and differential counts of the white blood cells were made, haemoglobin and haematocrit estimations were carried out, and calculations of the mean corpuscular volume, haemoglobin content and concentration.

Owing to a lack of agreement in the literature, difficulty was found in setting a standard by which the early signs in the blood of benzol poisoning could be recognised. Standards were determined for healthy controls, who were members of the R.A.A.F. not exposed to any industrial hazard. These showed a striking difference between the blood pictures of 300 controls and those represented by the standard figures of Whitby and Britton. Full medical and occupational histories were taken of the contact groups and also of control groups drawn from non-flying units. These results were subjected to statistical analysis.

It seemed probable that individual susceptibility to benzol vapour varied considerably. The various fluids used in the R.A.A.F. under investigation were found to differ considerably in their content of aromatic hydrocarbons, ranging from 16 to 56 per cent. Estimation of the vapour content of the aromatic hydrocarbons in the atmosphere of workshops showed variations from 0 to 1,400 parts per million, according to the place and

circumstances of testing. For most of the time concentrations did not exceed 10 to 35 parts per million, and higher concentrations existed only for brief periods. This investigation did not reveal any need for routine blood examinations of members of the R.A.A.F. employed in cleaning and painting workshops, but emphasised the need for the establishment of Australian norms for blood pictures. In view of individual variations in susceptibility to benzol vapour strict attention was necessary to the safety precautions laid down for workshop practice. The published results of this enquiry by M. Hutchings, S. Drescher, F. B. McGovern and F. A. Coombs pointed out, too, that new processes involving the use of new solvents were constantly being introduced, making close cooperation imperative between technical and medical staffs.

2. METHYL ALCOHOL

Many minor forms of toxic gastritis or gastro-enteritis occurred as the result of drinking "home brews" of various kinds. Optimism and ignorance led men to drink fermented liquors which must have contained a mixture of alcohols and by-products of varying toxicity. This happened occasionally in the islands, where the difficulty in obtaining alcohol was the spur to experiments in brewing. The resultant disturbances were only temporary and seldom needed special treatment, but men were occasionally admitted to hospital. On the hospital ship *Manunda* Major Rosebery reported a state of confusion in men who admitted drinking "jungle juice"; they had sluggish deep reflexes, impaired memory, unsteadiness and delusions. These manifestations seemed to be out of proportion to the amounts consumed, but they cannot be classed as being due to any other cause than alcohol in general, except that there was clinical evidence of slow excretion.

Much more serious were the results following the ingestion of methyl alcohol or methanol. This substance is rapidly absorbed but very much more slowly excreted from the body, where it breaks down into other toxic substances like formic acid. The consumption of quantities less than the usually accepted lethal dose of 100 to 250 millilitres has been reported among Australian soldiers without harmful effect, but there is apparently considerable variation in the power of different individuals to withstand or detoxicate methyl alcohol.

A series of eight cases was reported by Major J. H. Colebatch in Balikpapan. The patients were treated under action conditions in a casualty clearing station, where full investigation was difficult. Methyl alcohol was obtained by three groups of men from drums captured from the Japanese, and consumed diluted with lime juice and water. Six men died. One man was apparently almost unaffected by some ten to twelve ounces of methanol drunk one and a half days before, though this amount was fatal to all but one other. Nausea and vomiting appeared after a latent period of sixteen hours, and amblyopia was then observed. The nervous system was seriously affected, as evidenced by stupor, coma and fits, and the optic discs were swollen in three instances. Treatment

given included continued gastric lavage, intravenous administration of alkalis, free glucose fluids and lumbar puncture. Post-mortem examination showed congestion of the digestive organs, kidneys and brain. One of the two patients who recovered still had optic atrophy of one eye five months later.

In June 1944 seven men from Keppel Harbour camp on Singapore Island were treated for methyl alcohol poisoning; five were Australians and two Dutch. One of the Dutch died soon after admission to hospital, all the others recovered. Most of these men had toxic amblyopia in varying degrees; one had some contraction of the visual fields some time later, but central vision was normal.

Another outbreak of methyl alcohol poisoning was observed in a working camp at Singapore in February 1945. Cotter Harvey reported that over 150 men, Australian and Dutch, were affected on one occasion after taking the alcohol in tea. The latent period here was twenty-four hours, when gastro-intestinal disturbances were noticed, and next morning one man died suddenly. It was then found that over 150 men were affected with gastro-intestinal upset or blurred vision. Nine were seriously ill and were admitted to hospital. Two died within a few hours. The remainder were treated with gastric lavage and alkalis; their urine contained formic acid, as did also the cerebro-spinal fluid, which was under increased pressure. All these made good recoveries with full restoration of eyesight. The amount of methyl alcohol taken was small; in no instance did it exceed two ounces and the average appeared to be about half an ounce. It is probable that some of the men were unduly susceptible and in all the men and particularly in those most affected it seems probable that lowered nutrition decreased their tolerance.

A warning was issued in the Routine Orders of the 2/14th Australian General Hospital for 24th/25th October 1945, of the danger of drinking local spirits on Singapore Island. Up to 15th October, sixty-four men had been admitted to hospitals in the area suffering from the effects of drinking spirits which contained methyl alcohol. Twenty-eight deaths of servicemen of various nationalities were reported and two among civilians. Permanent blindness was caused in two instances. Tests of the liquor consumed showed that one drink might cause blindness and two might be fatal.

3. ETHYLENE GLYCOL

S. F. McDonald reported seven cases of poisoning by ethylene glycol, with four deaths, in members of the R.A.A.F. This liquid is the chief constituent of an anti-freeze mixture used in liquid-cooled aero engines, and has neither colour nor odour, but a warm bitter-sweet taste. The lethal dose is said to be about 100 millilitres. Like methyl alcohol, it has a predilection for the nervous system. In this series the liquid was drunk as part of a New Year's Eve celebration, and was mixed with lemon powder in water. One man was unaffected till the next day, when he had vomiting, and the following day the signs of a severe glomerular

nephritis appeared, from which he later recovered. Two others recovered after severe vomiting and considerable general disturbance but no focal signs. In the four fatal cases, congestion of the digestive and respiratory organs and the kidneys was noted. Choking of the renal tubules with oxalate crystals has been described, but was not found in this series. All the men who died lost consciousness early.

4. TRI-ORTHO-CRESYL PHOSPHATE

Perhaps the most curious neurological condition seen in the Australian armed forces was due to the effects of tri-ortho-cresyl phosphate. This substance attained some notoriety in the United States of America during the prohibition of alcohol, when it was used as an adulterant in ginger drinks. It caused severe symptoms of motor paralysis, known as "jake" paralysis, which was characterised by early selection of the neurons of the lower limbs, followed by wider involvement, sometimes including the pyramidal tracts. The paralysis was symmetrical and improvement was slow. Residual damage in the severer grades caused muscular atrophy affecting both upper and lower extremities, with some spasticity of the gait.

Three patients were admitted to the 113th Military General Hospital, Concord, Sydney. Subjective symptoms in the legs were followed by foot drop, weakness and fibrillation of the calf muscles and loss of power in both hands. No definite objective sensory phenomena were noted. The symmetrical distribution of this motor neuron lesion suggested a toxic cause to Lieut-Colonel Noad and Captain Helen Taylor, and its strong resemblance to "jake" paralysis led to careful enquiry into possible sources of such a poison. A common feature was that each patient was under treatment for gastric or duodenal ulcer and was taking magnesium trisilicate. Each stated that he had noticed an unpleasant taste in the powder: one thought it resembled carbolic. Enquiry revealed that a fourth man noticed identical symptoms a week after his discharge for duodenal ulcer and had been admitted to a Repatriation Hospital, where similar findings were noted. All the magnesium trisilicate held by the hospital was examined, and in portion of this Dr Adrien Albert found 2.6 per cent tri-ortho-cresyl phosphate. The taste and smell described were not due to the substance itself but to other cresyls formed by hydrolysis. No contamination with other drugs of the cresylic acid type could have produced tri-ortho-cresylic acid in this way. No further samples of the magnesium powder were found to be contaminated, and with one exception no further cases were discovered. This occurred in an officer of one of the women's services, who unofficially obtained magnesium trisilicate from the hospital and took it for indigestion. She suffered a slight motor weakness in the lower parts of both legs which later disappeared. The clinical progress of the condition was slow, particularly in the patient first and most severely affected, but gradual improvement took place with some residual weakness.

Full enquiry failed to prove how the tri-ortho-cresyl phosphate contaminated the trisilicate powder. The admixture was observed on analysis

to be patchy and it was found that wartime stringency obliged large quantities of the trisilicate to be placed in a rather permeable container made of loose-meshed sacking. Lorries carrying such packages also carried many other commercial chemical products, including tri-ortho-cresyl phosphate, which is largely used as a plasticising agent in industry. It seems likely that contamination occurred in this way. The particular interest of this curious accidental happening lies in the value of careful clinical examination allied to a keen appreciation of the possibility of a common cause for a distinctive and unexplained syndrome.

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