

POISONING BY "META FUEL" TABLETS (METACETALDEHYDE).

BY

REGINALD MILLER, M.D., F.R.C.P.

Physician to the Paddington Green Children's Hospital, London.

'Meta Fuel' is now extensively used to replace methylated spirit for such purposes as are fulfilled by small spirit lamps and stoves. It acts as an efficient substitute in such circumstances, and has the advantage of being a solid substance, and thus easily portable and specially convenient. It is sold in small lamps and stoves, and refills are dispensed in the form of white tablets or cakes. Judging from my experience in connection with the first case detailed below, it appears that many who sell this material are ignorant of its composition and nature. Its poisonous properties on ingestion can hardly be too widely known.

The two cases reported in the present paper show that 'Meta Fuel,' when chewed up and swallowed, is slowly absorbed from the intestine. Circulating in the blood, it acts as a poison to the central nervous system producing drowsiness and convulsions, and the severity of these symptoms in the first case suggests that, with a sufficiently large dose in a young child, a fatal issue is by no means an impossibility. Excretion takes place through the kidneys and in the process irritation or inflammation of these organs can be set up, though the convulsions are independent of the condition of the kidneys.

'Meta Fuel' agrees in its characteristics and reactions with metacetaldehyde, and it is remarkable that its activity should be so much greater than that of its isomer, paraldehyde.

CLINICAL CASES.

So far as I know the only case of poisoning by 'Meta Fuel' already reported in the English literature is that recorded by W. H. Willcox and C. Ainsworth Mitchell in *The Analyst* (September, 1927). As I had the opportunity of seeing this case for Sir William Willcox during the acute convulsive stage, I reproduce here the published report of the case with the authors' kind permission. The second case described below was that of a young child who was admitted under my care at the Paddington Green Children's Hospital.

Case 1. Willcox and Mitchell¹ give the following account:—On June 8th, 1927, at 8 p.m., a boy of 16 swallowed, in mistake for a sweet, a portion (about 5 grm.) of a double tablet of the solidified fuel used as a substitute for methylated spirits.

No ill effects occurred till 3 a.m. on June 9th, when the patient became flushed, restless and delirious. The temperature rose to 100° F. at 6 a.m. Convulsions occurred on June 9th at 8 a.m., and five further attacks of convulsions occurred during the following 14 hours. The patient was semi-comatose during the intervals between the convulsions.

The urine had sp. gr. 1.014, was very acid, and contained a trace of albumin. There was marked tenderness of the calves of the legs during this period. The temperature remained between 100° and 101° F. for 36 hours and then fell to 99° F., where it remained for 24 hours, afterwards becoming normal.

The treatment consisted in large doses of alkalies* (in the form of sodium citrate, 60 gr. ; sodium bicarbonate, 30 gr. ; water to 1 oz.) given every four hours by the mouth ; also normal saline containing 2 dr. of sodium bicarbonate to the pint was given rectally in amounts of 15 oz. every six hours.

Throughout the period during which the convulsions occurred chloral (10 gr.) and potassium bromide (30 gr.) were given every four hours. The urine remained very acid for three days, in spite of the large doses of alkali that were administered.

After the convulsions had ceased potassium bromide, in doses of 15 gr., was given three times a day for four days.

The patient made a good recovery, but the albuminuria persisted for four days. After recovery there was some loss of memory for several days.

November, 1928. The boy is said now to have recovered completely. The loss of memory was for a time very marked. His more recently acquired school work was forgotten, and even in September, 1927, his remembrance of the details of his August holiday was hazy. (R. M.)

Case 2. D. S., boy, aged 4 years, 11 months. At 1.30 p.m. on July 20th, 1928, he was given by another boy some 'Meta' bricks to play with. He ate one of these and soon after vomited. Vomiting was repeated at intervals, and at 6 p.m. he was seen by a doctor who sent him to hospital.

On admission to Paddington Green Children's Hospital he was found to be drowsy, and to show slight rigidity of the limbs. He answered questions with difficulty. Physical examination revealed nothing further. His stomach was immediately washed out, and clear, odourless, yellowish fluid was returned. During the night, July 20-21, the child retched frequently and vomited once.

At 6.15 a.m. on July 21st he had a slight fit, becoming stiff and cyanosed. His jaws were clenched. With this fit there was incontinence of urine. The fit passed off almost immediately, and at 11 a.m. he vomited again. He continued drowsy and it was noticed that while his left leg was rather rigid, the right foot was extended in the tetany position. He vomited twice more during the afternoon, and by the evening the drowsiness began to pass off. Some doses of bromide were given during the 21st. The urine contained no albumen.

By the 22nd the boy appeared well, and no further symptoms developing, he was discharged well on July 25th.

CHEMICAL CONSIDERATIONS.

From the authoritative statements of Willcox and Mitchell which I here reproduce below, it appears that 'Meta Fuel' consists of metacetaldehyde. Presumably it is this substance which when ingested acts as the nerve poison, but what the authors say as to the possible influence of various impurities should be noted.

An examination of this Meta Fuel, which was confirmed by Dr. H. E. Cox, showed that it agreed in its characteristics and reactions with metacetaldehyde. It sublimed, without melting, at 112° C., forming feathery needle-shaped crystals, and, when heated, in a sealed tube at 120° C., yielded ordinary aldehyde. It was insoluble in water, but dissolved in chloroform and carbon tetrachloride. When heated with strong sodium hydroxide solution it was converted into the brownish so-called aldehyde resin.

The presence of paraformaldehyde had at first been suspected, but no indication of a pink coloration could be obtained by Schryver's test. The original substance, when boiled with water and filtered, yielded a solution which gave a faint yellow coloration with Nessler's reagent, whereas formaldehyde would have given a brown precipitate changing to grey.

In view of the fact that relatively large doses of paraldehyde can be taken, and that cases are on record of recovery after a dose of 1 oz. or more, it is remarkable that metacetaldehyde

*These doses of alkali were prescribed by the present author under the mistaken impression that 'Meta Fuel' consisted of hexamine.

should be so much more active than its isomer. It is possible, however, that traces of the condensing agents used in the preparation of metacetaldehyde may be left in the final product and have some influence on its physiological action, since no particular care would be taken to make an absolutely pure product. The list of substances claimed in the patents for the preparation of metaldehyde fuel is a very long one, and includes such substances as sulphuric acid, hydrochloric acid, zinc chloride, phosgene, etc., so that the range of possible impurities is very wide.

CASES PREVIOUSLY REPORTED.

From an examination of the *Index Medicus* I have under the heading "Metaldehyde" been able to trace reports of four cases occurring on the Continent.

The first case ever recorded is that of P. Gautier and R. Colomb² who reported an instance of poisoning from swallowing one 'Meta' tablet in a child of two and a half years. He complained of pain in the stomach one and a half hours later, and vomited. When first seen three hours after the dose, he was semi-comatose, and later was convulsed.

In 1927 two cases were reported. One by H. Belfrage³ in a child of three years, and another by P. Wolfer⁴ in a boy of four years old. In both cases nervous symptoms similar to those already detailed were observed. A fourth case is also mentioned as published in the *Neue Zürcher Zeitung* in June, 1927, but I have not been able to consult this communication, nor have I been able to trace the name of its author.

DISCUSSION.

'Meta Fuel' is sold in white tablets or blocks, and is by no means unattractive in appearance. Left within reach of small children it is, one would think, not unlikely to be tasted or eaten. Its taste is apparently uninteresting but not prohibitive. In the case of the boy of 16 (Case 1) who ate such a comparatively large amount of it, he said at the time that 'he did not think much of it.' In this instance the boy ate the 'Meta Fuel' thinking that it was a special sweetmeat brought from abroad for him, and would certainly not have taken it except for this particular misapprehension. In the case of the younger child, he was playing at bricks with it, and it would seem that for children of about five years old, the 'Meta Fuel' might have a dangerous fascination.

When swallowed, the 'Meta Fuel' is absorbed slowly, a point of importance in relation to treatment. In the boy of 16 no symptoms appeared for seven hours, and it was twelve hours before the first convulsion. Bouts of convulsions continued during the ensuing fourteen hours. In the little boy of 5, who had probably vomited some of the dose taken, drowsiness appeared in 4½ hours, and his one convulsion after 16¾ hours.

Most of the younger children in the cases quoted suffered from vomiting and abdominal pain after swallowing the 'Meta Fuel.' We may conclude that it acts as a gastric irritant. One case showed albuminuria lasting for several days, and as the metacetaldehyde is excreted *via* the kidneys and can be recognized in the urine, it is probable that it acts as a renal irritant.

With regard to treatment, gastric lavage is obviously indicated, and the slow rate of absorption from the intestine suggests the advisability of administering an immediate purge. There seems to be no direct antidote to the poison known. The administration of alkalies probably prevents the formation of acetic acid in the alimentary tract. The convulsions are amenable to the ordinary symptomatic treatment.

CONCLUSIONS.

1. 'Meta Fuel' tablets when swallowed are slowly absorbed. They consist of metacetaldehyde which acts as a nerve poison, producing coma and convulsions.

2. As 'Meta' tablets are rather attractive in appearance and may easily be left within the reach of small children, the public should be made aware of their poisonous properties.

REFERENCES.

1. Willcox, W. H. & Mitchell, C. A., *Analyst*, Camb., 1927, LII, 528.
2. Gautier, P. & Colomb, R., *Rév. méd. Suisse rom.*, Geneva, 1926, XLVI, 811.
3. Belfrage, H., *Acta Pædiat.*, Stockholm, 1927, VI, 481.
4. Wolfer, P., *Schweiz. med. Wchnschr.*, Basel, 1927, LVII, 1144.