FERROUS SULPHATE POISONING ITS INCIDENCE, SYMPTOMATOLOGY, TREATMENT, AND PREVENTION

BY

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In a pathological report on a case of ferrous sulphate poisoning admitted to my ward Prain (1949) describes the lesions, with their probable toxic significance, and the risk that these attractively coloured pills entail when young children have access to them. An annotation in the *British Medical Journal* (1949) emphasizes this risk and points out that all the recorded cases have occurred in Scotland and the northern half of England. Another case has in fact occurred in Surrey (*Surrey Comet*, 1949). It has accordingly seemed worth while to review the experience of this one hospital unit, which serves Dundee, with a population of 182,000. All the cases came from Dundee and no others are known to have been admitted elsewhere in the city. The first case occurred on May 3, 1944. This is the earliest case known to have been recorded in modern times. It was fatal, and along with the second case, which occurred on March 4, 1947, has already been fully reported (Thomson, 1947).

Six cases have occurred in the period from May 3, 1944, to October 2, 1949, and have all been under my care in Dundee Royal Infirmary. All took similar tablets containing ferrous sulphate exsic. 3 gr. (0.2 g.), copper sulphate 1/25 gr. (2.6 mg.), and manganese sulphate 1/25 gr. (tab. ferrous sulph. co., B.P.C.).

Case 1 (Summary of Report)

On May 3, 1944, a 16-months-old girl took 40 ferrous sulph. co. tablets from a paper packet and swallowed 39 of them at 10.30 a.m. She was given salt and water to drink and returned 13. Thus 26 were retained. She became hot and drowsy, and kept on coughing and vomiting. The vomit contained blood-stained material. On admission at 11.50 a.m. she was drowsy, pale, and still coughing and vomiting. The temperature was 96° F. (35.6° C.), pulse 140, and respiration 24. The pulse was of slightly diminished volume. The abdomen was slightly distended, but there was neither tenderness nor resistance on palpation. In the evening she was breathing heavily but was otherwise comfortable. No further vomiting occurred, but one loose stool containing mucus and dark blood was passed. At 7.30 a.m. on May 4 (21 hours after taking the tablets) her temperature rose suddenly, breathing became difficult, and the child became cyanosed. She appeared to choke on inspiration and died at once.

At post-mortem examination Dr. G. H. Smith found intense inflammatory change in the gastric mucosa and a marked degree of necrosis and sloughing limited to the crests of the longitudinal rugae. The necrosis extended down to muscle. In contrast to the stomach there were only a few patches of congestion in the upper jejunum. The intestine was otherwise healthy.

Treatment.—She received salt and water to drink before admission, and on admission gastric lavage with a sodium bicarbonate solution was carried out. Normal saline was left in the stomach, and 2½ gr. (0.16 g.) of bismuth carbonate was given four-hourly, and sodium bicarbonate 15 gr. (1 g.) at 8 p.m. She was also given glucose and orange juice, and later diluted milk.

This child died after retaining about 26 pills in spite of what, in view of subsequent investigations (Somers, 1947), seems to have been the correct treatment with bicarbonate solution to dilute the corrosive iron and also to reduce its solubility by altering it to the less irritant ferrous carbonate.

Case 2 (Summary)

On March 4, 1947, at about 9.30 a.m., a boy aged 2 swallowed about 10 tablets similar to those in Case 1. Approximately half an hour later he began to vomit, and two tablets were returned whole. There was no haematemesis. His appearance became "waxy," but improved before he was admitted at 2.5 p.m. the same day. On admission he was flushed and drowsy, and there was neither abdominal tenderness nor abnormal resistance on palpation. A stool passed later in the day gave a positive guaiac reaction. Vomiting ceased by March 6 and the stool was normal by the 9th with no blood. On the 13th the guaiac test was again positive; no meat had been given. Further recovery was uneventful.

Treatment.—He was given ¼ oz. (14 ml.) of mist. magnesii hydroxide on admission and bismuth bicarbonate 2½ gr. four-hourly along with glucose and water, later changed to milk and subsequently to milk diet.

Case 3

On July 6, 1947, a girl aged 4½ years swallowed about 24 tablets. An hour later, according to her mother, she vomited about 20 of them. On admission she was slightly pale. Her abdomen was normal on palpation. She received 2½ gr. of bismuth carbonate four-hourly, but never exhibited any symptoms of illness except the vomiting before admission. According to the history she returned 20 tablets in recognizable shape one hour after swallowing them.

Case 4

On February 8, 1948, a girl aged 11 months was admitted under my care. A full report of this case has been published by Prain (1949). A summary of the case is given here.

At 7.30 p.m., while playing with a box of these tablets prescribed for her mother, she swallowed an unknown quantity of them and became drowsy and vomited. On admission at 9.30 p.m. she was pale and drowsy; the abdomen was soft and not tender. She vomited altered and bright-red blood until 10 p.m., when vomiting ceased. Next day she seemed well and played with her toys. She passed two tarry stools. But on the morning of the 10th she became cyanosed and had moist accompaniments at both bases. She died 39 hours after taking the pills.

On post-mortem examination extreme congestion of the mucous membrane was found; but the necrosis, though locally severe, was not so striking as in Case 1. The small intestine shows a few areas of congestion less marked than in the stomach.

Treatment.—This consisted of gastric lavage with sodium bicarbonate in water, also bismuth bicarbonate 2½ gr. in mist. cretae four-hourly.

Case 5

On July 14, 1949, a boy aged 19 months took some tablets off a shelf and was found eating them. He probably ate about 10. Before admission he was given syrup of figs and then salt and water, after which he vomited brown fluid several times. There was no red blood in his vomit. He then went to sleep, and was admitted 1½ hours after taking the tablets. A stool examined on the 16th gave positive reactions to Kastle-Meyer and benzdine tests for blood. Recovery was uneventful.

Treatment.—Gastric lavage with sodium bicarbonate produced clear fluid with streaks of blood-stained mucus in it. On the 14th dimercaprol, 0.5 ml., was given four-hourly for a few doses, but was stopped on the 15th.

Case 6

On October 2, 1949, a boy aged 2½ years was discovered at 8 p.m. with his mouth full of tablets which had been supplied to his mother. The quantity he ate is not accurately known, but was probably between 10 and 20. He was given syrup of figs at home, and vomited at 8.15 p.m.; subsequently he vomited five more times. The first five vomits contained "white bits and green stain." The last vomit contained only "water." He complained of a sore stomach after swallowing the pills, and was drowsy at 9.30 p.m. He was admitted at 11 p.m. awake but sleepy. His abdomen was soft and not tender. Gastric

Age and Sex	Tablets Taken	Tablets Returned After Interval of	Tablets Retained	Treatment Before Admission	Time Before Admission	Treatment After Admission	Early Pallor	Drowsiness	Vomiting	Abdominal Pain	Haematemesis	Guaiac or Kastle-Meyer or Benzidine Test	Sudden Collapse	Result
1 16/12 M	39	13; less than 1 hour	26	Salt and water	1 hr.	Soda bicarb. lavage, bismuth carb.	+	+	+	-	+	+	+	Died
2 2 yrs. M	10	2; $\frac{1}{2}$ hour	8	Water freely	20 mins. 4 $\frac{1}{2}$ hrs.	Mist. magnes. hydrox. and bismuth carb.	+	+	+	-	-	+	-	Recovered
3 4 $\frac{1}{2}$ yrs. F	24 $\pm$	20; 1 hour	4	None	?	Bismuth carb.	+	+	+	-	+	-	-	Died
4 11/12 F	?	None	?	None	2 hrs.	Soda bicarb. lavage, bismuth bicarb., mist. cretae	+	+	+	-	+	+	+	Died
5 19/12 M	10 $\pm$	None	10 $\pm$	Syrup of figs; salt and water emesis	1 $\frac{1}{2}$ hrs.	Soda bicarb. lavage, dimercaprol	-	+	+	-	+	+	-	Recovered
6 2 $\frac{1}{2}$ yrs. M	10-20	Fragments, less than 3 hours	?	Syrup of figs	3 hrs.	Gastric lavage $\frac{1}{2}$ oz. mag. sulph.	-	+	+	+	-	-	-	"

lavage was carried out with saline, and $\frac{1}{2}$ oz. (15 g.) of magnesium sulphate in solution was left in the stomach. On the 3rd and 4th he passed two loose dark stools each day. The guaiac and Kastle-Meyer tests were negative. His further recovery was uneventful.

Discussion

Textbooks differ in their statements about tests to distinguish iron from haemoglobin. Tests showed that the Kastle-Meyer and benzidine tests give a brown deposit with iron solutions quite distinct from the colour reactions with haemoglobin. The guaiac test, while distinguishing between the two, does not give such obviously contrasting reactions.

So far as is known no other cases have occurred in Dundee in this period of 5 years and 5 months.

It thus appears that the condition is not rare. No explanation for the known cases occurring in the more northern parts of Britain can be offered except the accident of reporting.

The clinical picture of these cases is pallor at an early stage, followed by drowsiness, and vomiting early but ceasing after a few hours. Abdominal pain was noted in only one case, while none had abdominal tenderness or abnormal abdominal resistance. Haematemesis may be severe and early or not be clinically evident. Blood is probably present in the stools in most cases. A most misleading period of well-being, even playfulness, was seen in Cases 1 and 4 and in Forbes's (1947) first case. This was followed by fatal collapse. An important point is that whole tablets or fragments of them may persist in the stomach for at least one hour. Emesis in addition to lavage is therefore important for prompt elimination of any iron still in pill form.

The treatment given to Case 1, and subsequently experimentally justified by Somers, seems to have been appropriate—namely, gastric lavage with an aqueous bicarbonate solution to convert as much as possible of the corrosive ferrous sulphate to the much less irritant ferrous carbonate and to dilute it. Also to get rid of pills by emesis, which has been successfully done half an hour to one hour after ingestion; then to protect the mucosal lesions by bismuth. This seems to be the rational method of attempting to prevent the delayed sudden fatal collapse occurring after a deceptive period of improvement. This collapse is possibly due to toxic absorption from damaged mucous membrane affecting the liver (Prain, 1949). Dimercaprol, although tried, did not appear to help, and it is now suggested that it may be harmful (Edge and Somers, 1948).

It is abundantly clear that prevention of this accidental poisoning is important and urgent. The makers of

"fersolate" tablets have now added a warning: "Excessive doses of iron can be dangerous. Do not leave these tablets within reach of young children, who may eat them as sweets with harmful results." They also supply the tablets in a screw-topped container which would baffle the younger children. Welfare and antenatal clinics in particular should review their methods of issuing the useful ferrous sulphate tablets to adults. They should never be issued in paper packets or a carton with a loosely fitting lid. However, children on occasion will exercise much perverse ingenuity. One boy, aged 6 $\frac{1}{2}$, obtained and swallowed a poisonous quantity of pills containing iron, arsenic, aloin, strychnine, and capsicum by raiding a drawer in his friend's aunt's house.

The hope expressed in an annotation in the *British Medical Journal* (1947) that recognition of the danger would secure adequate precautions has not been realized. It would seem to be urgent that administrative action should be taken now to prevent these useful tablets being dispensed in unsafe containers, and that adequate warning be given on the containers of their potential danger to children when ingested in excessive quantity, as happens when children regard them as sweets. They should also be stored in a really safe place. It is considered insufficient to make them a less attractive colour, as the pleasant taste of the coating would still appeal to children and cause them to continue to suck and swallow more pills. I wish to oppose the suggestion (*Lancet*, 1949) that these very useful pills should be withheld from adults where there is a young family.

Summary

Six cases of ferrous sulphate poisoning are reported occurring in 5 years and 5 months in a town with a population of 182,000. Two patients died and four recovered. Early pallor, drowsiness, vomiting, haematemesis, and later melaena were the main symptoms. Fatal collapse may follow apparent recovery. The treatment given is described and discussed. An urgent plea is made for administrative action to secure really safe packing and storing of these pills when dispensed. Ferrous sulphate is so valuable when properly employed that it is important to prevent undeserved unpopularity due to the gross abuse of it. Gross abuse is a fair description of its use in the present series of cases.

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