Iron Intoxication in an Adult

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Chelation of absorbed iron by desferrioxamine has been claimed to be an effective treatment of iron intoxication (Westlin, 1966). The amounts of iron excreted in the urine after chelation therapy, however, are minute in relation to the ingested dose. The presence of oliguria in an intoxicated patient poses a special problem; this is pertinent because most fatal cases in the literature have become oliguric. As the toxicity of chelated ferrioxamine appears to be similar to that of elemental iron (Whitten *et al.*, 1965), an alternative route has been sought for the removal of the chelate in the presence of oliguria. Peritoneal dialysis is often quoted in this context but has only once been described in acute iron poisoning (Covey, 1964).

We recently had the chance of studying the removal of iron by peritoneal dialysis in a case of iron intoxication treated with desferrioxamine both intravenously and in the dialysate.

Case Report

The patient, a 20-year-old woman, was admitted to hospital 24 hours after the suicidal ingestion of 50 tablets of ferrous sulphate (10 g.). At the age of 5 she had a haematemesis. This was due to oesophageal varices from portal vein atresia and was successfully treated by gastric transection.

On admission she was conscious but confused and deeply jaundiced. She was tachypnoeic; the heart rate was 110, blood pressure 90/50 mm. Hg, and the extremities were warm. There was generalized abdominal tenderness, but neither liver nor spleen was palpable. A urethral catheter was passed and no urine was found in the bladder, though she had last passed urine six hours previously.

Laboratory investigations resulted as follows: haemoglobin 13·9 g./100 ml.; W.B.C. 28,000/cu. mm.; platelets 310,000/cu. mm.; plasma sodium 138 mEq/l., potassium 5·5 mEq/l., bicarbonate 6 mEq/l., and urea 33 mg./100 ml.; bilirubin 13 mg./100 ml., alkaline phosphatase 26 K.A. units, serum aspartate aminotransferase over 500 i.u.; prothrombin ratio 6·6; serum iron 640 μg./100 ml. Straight *x*-ray examination of the abdomen showed no opacities.

The patient was transfused with 500 ml. of plasma, 200 ml. of 8·4% $NaHCO_3$, and 100 ml. of 25% mannitol and given oxygen through an M.C. mask. Her clinical condition did not improve and she remained anuric. Arterial blood gas analysis showed: Pao_2 200 mm. Hg. $Paco_2$ 19·5 mm. Hg, and *p*H 7·02, giving a base deficit of 27 mEq/l. even after the administration of 200 mEq of sodium bicarbonate.

It was decided to start peritoneal dialysis and to give desferrioxamine intravenously and in the dialysate. Details of this treatment are given in Table I. Desferrioxamine was not given orally as the patient would not swallow, and in view of the history of oesophageal varices a nasogastric tube was not passed. A further 1,000 mEq of $NaHCO_3$ was given over the next 12 hours. The patient continued to be hypotensive and anuric, despite the maintenance of a normal jugular venous pressure. Isoprenaline had no effect on her circulation, and her clotting deficiencies were only partly corrected with 2 pints (1,140 ml.) of fresh frozen plasma. She remained acidotic, became progressively hypothermic, and died 24 hours after admission.

Results of Peritoneal Dialysis.—The total iron removed and the total iron clearance in the dialysate for five separate periods are given in Table I. The serum iron levels during dialysis are given in Table II. Serum and dialysate iron levels were measured by the method of Singh (1967), estimating total iron, including ferrioxamine.

TABLE II.—*Serum Iron Levels during Dialysis*

Time (hours and minutes) after ingestion of iron	24·00	26·40	32·35	40·30	44·45
Serum iron (as total iron) (μg./100 ml.)	640	630	950	1,400	1,400

Comment

Acute iron poisoning appears to be almost entirely confined to children; but two cases in adults have been reported (Dugdale and Powell, 1964; Westlin, 1966). No fatalities have been recorded in adults from this cause.

The presence of shock, coma, anuria, and severe metabolic acidosis in our patient made her survival extremely unlikely. The gross rise in the serum transaminase levels, hyperbilirubinaemia, uncorrectable metabolic acidosis, and the abnormalities in the clotting factors all seem to indicate widespread disruption of intracellular enzyme systems. In view of the patient's known portal atresia and porto-systemic anastomosis, it might be anticipated that systemic effects could be expected early in this patient; the nature of her illness, however, was similar to other fatal cases described in the literature (Barr and Fraser, 1968).

Anuria after iron poisoning carries a very bad prognosis (Dugdale and Powell, 1964; Barr and Fraser, 1968). In these circumstances the use of dialysis would seem reasonable. Haemodialysis has been reported only in dogs (Whitten *et al.*, 1966). The results were unimpressive, between 4·8% and 1·4% of the administered dose being recovered in the dialysate in five hours. Peritoneal dialysis has been described only once (Covey, 1964). The patient, a child aged 23 months, was shocked and oliguric and had an initial serum iron level of 1,166 μg./100 ml. Control iron clearances in the dialysate were of the order of 0.3 ml./min., rising to 0.36 ml./min. after the administration of intramuscular calcium disodium edetic acid. Though the child survived, only about 1.9 mg. of iron was removed in the dialysate in four days.

In our patient the results of peritoneal dialysis were disappointing and it seems that even in oliguric patients the low rate at which iron is removed by dialysis makes the procedure of doubtful value.

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TABLE I.—*Results of Peritoneal Dialysis*

Periods	1 Control	2 Dialysis and Intravenous Desferrioxamine	3 Control	4 Desferrioxamine in Dialysate	5 Control
Time (hours and minutes) after ingestion of iron	24·00 – 27·25	27·25 – 32·35	32·35 – 40·30	40·30 – 44·45	44·45 – 46·30
Dose of desferrioxamine and route		3 g. (over 5 hours). Intravenous		0·5 g./l. (total 3 g.) in dialysate	
No. of 1-litre peritoneal exchanges	8	10	9	6	4
Total iron removed (mg.)	3·59	6·30	8·17	5·44	3·36
Iron clearance in dialysate. (ml./min.)	2·76	2·57	1·71	1·54	2·24