

held by loose connective tissue makes it mobile and, in children, the mucous membrane may have developed more strongly than the muscularis mucosae. They concluded that two factors might operate: first, a congenital weakness of tissue with an unduly wide urethra and, secondly, an acquired factor such as debility or inflammation. Other theories frequently mentioned are redundancy of the urethral mucosa, stress from cough or straining at stool, straddle injury, foreign body, or a true urethral hernia. Keefe (1917) favoured a neuromuscular cause, whereby the constrictor muscle is too weak to oppose a strong detrusor.

Many different methods of treatment have been used. Conservative treatment with replacement of the prolapsed mucosa, followed by continuous pressure, has been advocated but the tendency to relapse is high. A variation of this method is to insert a large catheter after replacing the mass. Catheter drainage is instituted for two to three weeks but relapses still occur after this procedure. Perhaps the most commonly used surgical treatment is to pass a catheter without making any attempt to reduce the mass. The redundant mucosa is then ligated at the base, over the catheter, and allowed to separate. Alternatively, it may be amputated with diathermy. Peters (1962) favoured fulguration at the 'four points of the compass' to induce submucosal fibrosis. Hepburn (1927) used an ingenious method whereby the prolapse was reduced by pulling it up the urethra by a suprapubic approach and stitching the bladder neck to the pubic bone. However, this method has only been considered for elderly patients, and the other surgical measures seem to have given good results with infrequent relapses. Conservative treatment with the local application of steroid and an antibiotic has shown promise in two of the cases, but the time is too short and the number too few to draw any conclusions.

Summary

Three examples of urethral prolapse in West Indian girls are described. This condition should be suspected when haematuria or vulval bleeding occurs in a West Indian girl.

REFERENCES

- Barnes, H. H. F. (1953). Prolapse of the urethra in young girls. *British Medical Journal*, **2**, 765.
 Epsteen, A., and Strauss, B. (1937). Prolapse of the female urethra with gangrene. *American Journal of Surgery*, **35**, 563.
 Hepburn, T. N. (1927). Prolapse of the urethra in female children. *Surgery, Gynaecology and Obstetrics*, **44**, 400.
 Keefe, J. W. (1917). Prolapse of the female urethra. *Journal of American Medical Association*, **69**, 1935.
 Owens, S. B., and Morse, W. H. (1968). Prolapse of the female urethra in children. *Journal of Urology*, **100**, 171.

- Peters, W. A., Jr. (1962). Prolapse of the urethral mucosa. *American Journal of Obstetrics and Gynaecology*, **84**, 862.
 Säufferlin, H. (1929). Über den Vorfall Der Hahnrröhre bei der Frau. *Zeitschrift für Geburtshilfe und Gynäkologie*, **94**, 630.

H. EVERLEY JONES and H. J. FISHER
The Royal Hospital, Wolverhampton.

Chronic Copper Poisoning Presenting as Pink Disease

Copper toxicity is extremely rare, and Sternlieb and Scheinberg (1964) suggest that this is due to excretion or incomplete absorption of the metal rather than to an inherent lack of toxicity in copper. It is only in Kinnier-Wilson's disease (hepato-lenticular degeneration) that progressive copper toxicity is likely to occur due to defective copper balance from deficiency of copper-binding caeruloplamin. Acute copper poisoning (usually copper sulphate in weed-killers) is not infrequently encountered but, as far as we are aware, no case of poisoning due to chronic ingestion of copper has so far been reported. With increased use of copper for hot-water pipes, further examples of copper poisoning must be anticipated.

Case Report

A 15-month-old infant was admitted to the Children's Unit after a 5-week history of behaviour change, diarrhoea, and progressive marasmus. Before admission developmental progress had been entirely satisfactory and there was nothing of significance in the birth or family history. When first seen the clinical picture was that of pink disease with prostration, misery, red extremities, hypotonia, photophobia, and peripheral oedema (Fig. 1). The body weight was only 7.48 kg (weight at 1 year 10.09 kg). The liver was palpable 2 cm below the costal margin.

Investigations. The outstanding finding was a raised serum copper level of 286 $\mu\text{g}/100\text{ ml}$ (normal range taken as 164 \pm 70 $\mu\text{g}/100\text{ ml}$ (Zak, 1958)), with a urinary copper level of zero (normal range 48 \pm 16.3 $\mu\text{g}/100\text{ ml}$ (Eden and Green, 1940)). The serum and urinary copper levels were measured in a laboratory where these estimations are routinely performed, and where a high level of accuracy can be expected. All tests for mercury were negative. Other investigations which gave abnormal values were: serum aspartate aminotransferase (SGOT) and alanine aminotransferase (SGPT) both 180 Karmen units/100 ml. Alkaline phosphatase 33 KA units. Lactic dehydrogenase, γ -glutamyl transpeptidase, and pseudocholinesterase activity were not increased. Total plasma proteins were 4.0 g/100 ml with an albumin level of 2.2 g/100 ml.

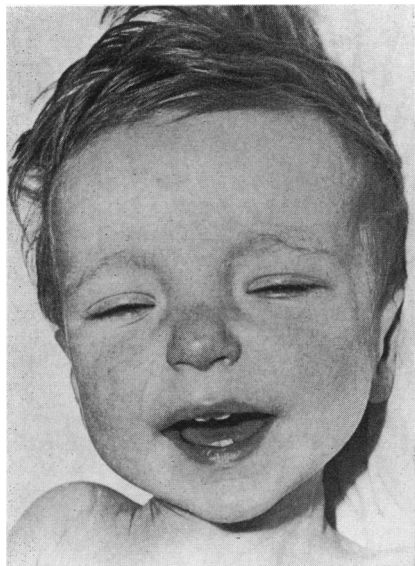


FIG. 1.—Photophobia, misery, and flushed facies.

The peripheral blood picture, bleeding and clotting times, urea, cholesterol, total serum lipids, uric acid, faecal porphyrins, urinary coproporphyrins, urine chromatography for aminoaciduria and skeletal survey were all within accepted normal limits. Copper oxidase activity was 0.10 units (normal range 0.14–0.57 units (Ravin, 1961)).

Treatment. From the data available it was thought that this infant showed signs of copper poisoning

simulating classical pink disease. Walshe (1956) first showed the cupruritic effect of D-penicillamine which renders protein-bound copper filtrable by the renal glomeruli, and this was prescribed in a daily schedule of 150 mg t.d.s. Almost immediately there was a deterioration in his clinical status which became critical. Oedema became massive and there was apathy and early signs of bronchopneumonia. The dosage of D-penicillamine was reduced to 75 mg t.d.s. for 5 weeks, and he improved. Serial estimations of serum and urinary copper are shown in Fig. 2; on clearing the excess copper his body-weight immediately increased and recovery began. Generalized purpura in the presence of a normal platelet count and coagulogram occurred during the phase of recovery. It was thought to be a side effect of D-penicillamine therapy (Corcos *et al.*, 1964; Conway and Walker, 1962; Cramér and Selander, 1965; Sternlieb and Scheinberg, 1964), and this, together with probable liver involvement in the primary illness, prompted the use of prednisolone in small doses over a 3-week period.

Discussion

Three months before this patient's admission, the family moved to a new house in which the hot-water system was entirely composed of copper. The hot water was stored in a 40-gallon 'Primatic' tank made of copper and at night the temperature in the tank reached about 93 °C. An idiosyncrasy of this family was that all water for cooking or beverages invariably came from the hot-water tap, and after only two months the electric kettle was coated inside with a thick green film of a copper complex. Estimations of the copper content of the tap water, both hot and cold, were made on samples

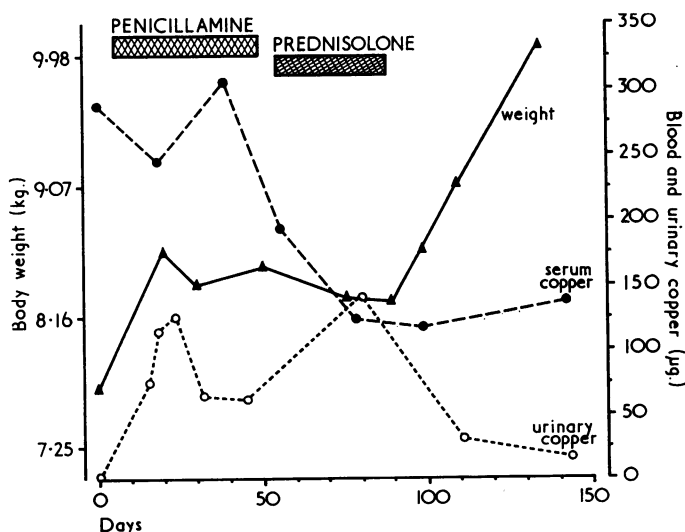


FIG. 2.—Effect of penicillamine and prednisolone on patient's weight, serum copper, and urinary copper concentrations ($\mu\text{g}/100\text{ ml}$).

from the patient's home and that of a neighbour whose hot water system also used copper piping. The results were compared with samples from the hospital (mixed copper and other piping) and North London (no copper piping) (Table).

TABLE

Source of Water	Cold Water Tap (Cu μ g/100 ml)	Hot Water Tap (Cu μ g/100 ml)
Patient's home	35	79
Neighbour's home .. .	30	68
Hospital	4	30
North London .. .	8	16

From these results it is seen that the copper content of 'hot' water is significantly higher than water from the cold tap. The presence of copper piping apparently leads to a significant increase in the copper content of the water.

As was mentioned earlier the copper oxidase activity was only 0.10 units, and because of this the caeruloplasmin (α -copper binding protein) level was estimated at 22.5 mg/100 ml (Dr. J. Walshe). The determination was based on the enzyme assay on whole plasma and compared with results obtained from similar assays using purified caeruloplasmin. This result effectively eliminates hepato-lenticular degeneration from the differential diagnosis. Low levels of caeruloplasmin have also been reported in portal cirrhosis (Gubler *et al.*, 1957) and in nephrosis (Cartwright, Gubler, and Wintrobe, 1954), but in this case these conditions can be ignored. During the convalescent phase liver biopsy was performed and histology revealed a normal architecture. Copper assay on biopsy material gave levels of 4.7 and 5.1 μ g/g wet weight, which are at the lower end of the normal range. It thus appears that he had cleared his stored copper very well. It is disappointing not to have the results of liver biopsy before treatment was started as this would have made the diagnosis of copper poisoning wholly tenable. The infant's condition on first admission was such that biopsy was never considered. The critical change in the clinical status after starting D-penicillamine was thought to be due to mobilization and excretion of stored copper. In fact it constituted acute copper toxicity superimposed on a more chronic picture.

In conclusion it is suggested that this child was subjected to a high copper intake over a period of three months and showed abnormal sensitivity to the metal. The clinical picture was that of pink disease. From the progress following chelation with D-penicillamine and the fact that mercury was

not found, we put forward the suggestion that in some children excess copper can cause a clinical picture that cannot be distinguished from pink disease. The long-term prognosis for this child is probably good.

Summary

A case of chronic copper poisoning in a male infant of 15 months is reported. It is believed to be the first case report. The infant presented with a picture indistinguishable from that of classical pink disease (acrodynia). The copper had been ingested over a period of 3 months from contaminated water. Treatment consisted of D-penicillamine and prednisolone. Recovery was slow and at one time the patient's condition became critical.

We thank our Ward Sister, Miss B. M. Barchard.

REFERENCES

- Cartwright, C. E., Gubler, C. J., and Wintrobe, M. M. (1954). Studies on copper metabolism; hepatolenticular degeneration. *Journal of Clinical Investigation*, **33**, 1487.
- Conway, N., and Walker, J. M. (1962). Treatment of macroglobulinaemia. *British Medical Journal*, **2**, 1296.
- Corcos, J. M., Soler-Bechara, J., Mayer, K., Freyberg, R. H., Goldstein, R., and Jaffe, I. (1964). Neutrophilic agranulocytosis during administration of penicillamine. *Journal of the American Medical Association*, **189**, 265.
- Cramér, K., and Selander, S. (1965). Agranulocytosis treated with penicillamine and antazoline. (Swedish.) *Lakartidningen*, **62**, 449.
- Eden, A. A., and Green, H. H. (1940). Micro-determination of copper in biological material. *Biochemical Journal*, **34**, 1202.
- Gubler, C. J., Brown, H., Markowitz, H., Cartwright, G. E., and Wintrobe, M. M. (1957). Studies on copper metabolism. XXIII. Portal (Laennec's) cirrhosis of liver. *Journal of Clinical Investigation*, **36**, 1208.
- Ravin, H. A. (1961). An improved colorimetric enzymatic assay of ceruloplasmin. *Journal of Laboratory and Clinical Medicine*, **58**, 161.
- Sternlieb, I., and Scheinberg, I. H. (1964). Penicillamine therapy for hepatolenticular degeneration. *Journal of the American Medical Association*, **189**, 748.
- Walshe, J. M. (1956). Wilson's disease: new oral therapy. *Lancet*, **1**, 25.
- Zak, B. (1958). Simple procedure for the single sample determination of serum copper and iron. *Clinica Chimica Acta*, **3**, 328.

MICHAEL A. SALMON and TREVOR WRIGHT
Park Hospital for Children, Oxford, and the Children's Hospital, Sheffield.

Some Problems of Gastrointestinal Bleeding in Children

Gastrointestinal haemorrhage is not an uncommon condition in children, yet little has been written about it from Britain. This is surprising since assessment of the severity of the bleed, its site of origin, and the subsequent management may be difficult, especially when no obvious cause is found.

A retrospective study was therefore, made of all