The cardiovascular effects of methylmethacrylic bone cement include both cardiac arrest (Powell *et al.*, 1970) and hypotension (Peebles *et al.*, 1972). The former tends to produce diffuse neuronal necrosis (Brierley *et al.*, 1971), while the latter is associated with focal ischaemic damage in cerebral arterial boundary zones in both man (Adams *et al.*, 1966) and primates (Meldrum and Brierley, 1971). The neuropathological findings in the present case—circumscribed infarcts affecting all of the major arterial boundary zones in the cerebral and cerebellar hemispheres in the absence of diffuse neuronal necrosis—are characteristic of a severe and precipitate fall in systemic blood pressure. From the observations that have been made previously on the cardiovascular effects of methylmethacrylic bone cement (Peebles *et al.*, 1972), and as the patient failed to recover consciousness postoperatively, there seems little doubt that an abrupt fall in blood pressure occurred at the time of insertion of the prosthesis. The focal nature and distribution of the infarction indicated that the postoperative hypoxaemia, which can be ascribed to pulmonary fat embolism, was not the primary cause of brain damage.

There is an increasing awareness of the significance of arterial boundary zone infarcts, as these lesions have been described not only in patients with systemic hypotension, but also in fatal head injuries (Graham and Adams, 1971). The significance of this case is that it highlights possible damage attendant on the use of methylmethacrylic bone

cement in various orthopaedic procedures in the genesis of permanent brain damage.

Addendum

Since this paper was submitted for publication Sevitt (1972) has reported a detailed account of the occurrence of fat embolism in patients with fractured hips, some of whom were treated by arthroplasty utilizing acrylic cement.

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Erythropoietic Protoporphyria: First Report in an Indian

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British Medical Journal, 1972, **3**, 741-742

Erythropoietic protoporphyria, a recently recognized disorder of porphyrin metabolism, was first described by Magnus *et al.* in 1961. It is characterized by mild to moderate photosensitivity and an excess of protoporphyrins in the erythrocytes and the stools. The condition is alleged to be inherited as an autosomal dominant character (Schmid, 1966). A large number of cases have by now been reported from different parts of the world. To our knowledge, however, there has been no previous report of erythropoietic protoporphyria from India. In reporting such a case we also wish to draw attention to certain unusual features which were present.

Case Report

A 7-year-old Sikh boy, the product of a consanguineous marriage, presented with a history of recurrent asymptomatic vesiculobullous lesions on the arms, face, and uncovered portions of both legs since the age of 1 year. The lesions healed within two or three days, leaving atrophic and hyperpigmented spots. There was no history of preceding erythema, oedema, or any particular relation to exposure to sunlight. "Peeling-off" of the skin was reported to occur on minor mechanical trauma, though vesicular lesions would appear spontaneously on exposed parts. The urine was reported to be of normal colour. No other mem-

ber of the family was reported as suffering from a similar condition.

On examination the most striking clinical features were hyperpigmented macular and atrophic hyperpigmented scarred lesions confined to the face, ears, hands, arms, and feet (Fig. 1). The fingers were stunted and showed thickening of the skin over the

FIG. 1—Hypertrichosis and macular hypopigmented and hyperpigmented lesions.

knuckles (Fig. 2). There was a moderately dense crop of lanugo on the upper lip and chin and on the forehead, where it covered almost the entire area from the eyebrows to the hairline. The forearms and legs were also covered by dense hair. The spleen and liver were not palpable and systemic examination did not show anything abnormal. The teeth, which were normal in colour, showed fluorescence under Wood's light.

The haemoglobin level was 10.8 g/100 ml and the packed cell volume 35%. A peripheral blood smear showed normal erythrocyte morphology with little anisocytosis. The total white cell count was 11,400/mm³ (polymorphs 46%, lymphocytes 52%, eosinophils 2%) and the reticulocyte count 0.1%. The serum proteins were 6.4 g/100 ml, serum cholesterol was 200 mg/100

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ml, serum alkaline phosphatase 13.8 King-Armstrong units/100 ml, thymol turbidity 2 units, serum bilirubin 0.6 mg/100 ml, and serum iron 112 µg.

Clearance studies were carried out with ^{59}Fe -labelled ferric citrate of high specific activity ($> 2 \mu\text{Ci}/\mu\text{g}$). The plasma iron clearance ($T_{1/2}$) was 62 minutes. Incorporation of ^{59}Fe into the red cells was determined on blood samples taken at intervals up to the 17th day. The maximum iron utilization was 72%, the plateau being reached on the seventh day. The plasma iron turnover was 1.0 mg/100 ml/day. These findings suggested a slightly fast clearance of ^{59}Fe and a somewhat increased turnover, with a

FIG. 2—Hypertrichosis on forearms and stunted fingers.

normal utilization of iron. This was in keeping with the microscopical appearance of the bone marrow, which showed a mild erythroid hyperplasia (normoblastic type) with a myeloblast: erythroblast ratio of 1:1. No abnormality of leucopoiesis or thrombopoiesis was seen.

Porphyrin values, determined on two occasions by the methods suggested by Rimington (1961) and Rimington *et al.* (1963) are shown in the Table.

Levels of Coproporphyrin, Uroporphyrin, and Protoporphyrin found on Two Occasions

Urine Values (µg/24 hr)		Stool Values (µg/g dry weight)		Blood Values (µg/100 ml R.B.C.s)		
Copro.	Uro.	Copro.	Proto.	Copro.	Uro.	Proto.
99.1	43.7	15.2	312.2	2.9	1.9	614.8
97.2	49.5	18.3	278.6	1.3	2.9	691.6

Isomer studies of the porphyrins showed that isomer III made up 67-69% of the coproporphyrins.

On fluorescence microscopy with a high-pressure mercury arc lamp and appropriate primary and secondary filters a transient fluorescence was seen in some of the red blood cells.

Irradiation of the skin with a Kromayer lamp and a Schott GG 360 filter for 10 minutes resulted in a faint immediate erythema without any oedema or burning sensation.

Histological examination of a biopsy specimen of apparently normal skin taken from the dorsum of the hand showed mild hyperkeratosis, acanthosis, and an increased vascularity in the papillary portion of the dermis. P.A.S.-positive material was present around the blood vessels. No split or bullous lesion was seen.

The patient's mother's stools contained 6.4 µg of coproporphyrin and 59.1 µg of protoporphyrin/g dry weight and her blood contained 12.1 µg of protoporphyrin and 1.5 µg of uroporphyrin/

100 ml R.B.C.s. Qualitative tests for porphyrins in the urine and stools of the patient's sibs, father, and maternal aunt and grandmother were negative. Qualitative tests for porphyrins in the blood of the grandmother were negative.

Comment

Erythropoietic protoporphyria usually presents in the form of a mild photosensitivity, such as solar urticaria or pruritus, though many patients diagnosed in the past as having hydroa aestivale have also been found to be protoporphyric. Unusual clinical presentations have included purpuric lesions and a picture simulating that of lipoid proteinosis (Rimington *et al.*, 1967). Our patient presented with evidence of moderately severe skin photosensitivity. He also showed increased susceptibility to mechanical trauma, which, though regarded as a common finding in other porphyrias, is usually absent in erythropoietic protoporphyria (Magnus, 1968).

Only one patient with a similar combination of complaints seems to have been reported hitherto (Sweeny *et al.*, 1963). Our patient's increased susceptibility to mechanical trauma was initially interpreted as epidermolysis bullosa by competent dermatologists. The presence of hypertrichosis and fluorescent teeth, however, led to a clinical diagnosis of porphyria, which was later confirmed biochemically. Hypertrichosis has frequently been reported in Gunther's disease and porphyria cutanea tarda (Schmid, 1966; Bhutani and Deshpande, unpublished observations) but has, to our knowledge, not been reported in erythropoietic protoporphyria. Again fluorescence of the teeth, though frequently met with in Gunther's disease, has not been reported in porphyria cutanea tarda (Magnus, 1968) or erythropoietic protoporphyria, and for some time this led to the suspicion of Gunther's disease in the present case. The transient fluorescence in the erythrocytes and the porphyrin values in the erythrocytes, urine, and stools discounted this possibility. The final clue, however, came from the isomer studies, which showed that most of the coproporphyrins excreted in the urine and stools were in the form of isomer III.

The haematological disturbances in erythropoietic protoporphyria have been reported to be mild (Turnbull, 1971). In this patient there was mild anaemia, with slight erythroid hyperplasia of the bone marrow and normal serum iron levels. The results of the ferrokinetic studies were essentially within the normal range, which is in agreement with the findings of other investigators (Magnus *et al.*, 1961).

We are grateful to Dr. Sydney G. Smith, of the Welsh National School of Medicine, Cardiff, and Dr. I. A. Magnus, of the Institute of Dermatology, London, for determining the isomer pattern of the porphyrins.

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