COMMENTARY

This type of bone tumour starts as an enchondroma,¹ which ossifies later, near the extremities of the long bones of the limbs. According to Thompson and Miles,² it occurs neither in membrane bones nor in bones entirely formed from cartilage; this is borne out in this case. These authors mention involvement of the iliac crest, and Chaumet³ also refers to a case in which a mass had formed on the anterior superior iliac spine, but no mention is made by them of the os pubis as a site. Roughly, as has been observed in other cases, there was a tendency to symmetry of the outgrowths in this particular patient. Heredity⁴ is stated to play a part in the production of the condition. This patient's parents died "many years ago," and no cause of death is known. She has two brothers and a married sister, who is childless, but it was impossible to get them to come for examination; however, as far as can be ascertained, they have no deformity. The child was examined in November, 1930, and showed no signs of juxta-articular tumours.

My thanks are due to Dr. Coureas of Nicosia for taking the radiograms which are published as illustrations of this case.

REFERENCES

- ¹ Tubby: *Deformities, including Diseases of Bones and Joints*, Section IX, Chapter 2.
- ² Thompson and Miles: *Manual of Surgery*, p. 483.
- ³ Chaumet: *Traité de Radiodiagnostic*, p. 40.
- ⁴ Choyce: *System of Surgery*, vol. iii, p. 777.

THE HEALTH OF THE WORKER IN CHROMIUM PLATING

BY

HUBERT B. TRUMPER, B.A., B.CHIR.CANTAB.

MEDICAL OFFICER TO THE ASSOCIATION OF BRITISH
CHROMIUM DEPOSITORS

Workers in this industry suffer disablement, usually temporary, from one or more of the following effects of exposure to chromic acid or its salts: (1) dermatitis; (2) ulceration of the hands, arms, or feet; (3) ulceration of the cartilaginous part of the septum of the nose; (4) vomiting after food.

The process of chromium plating consists in wiring the articles on to a frame ready for the plating vat, the actual plating, which lasts anything up to fifteen minutes, the unwiring, swilling, and polishing of the plated articles. A relatively large current is used in the plating tank, from 500 to 1,000 amperes and 4 to 10 volts. The solution contains 50 per cent. of chromic acid, and during the working of the tank reddish-brown fumes rise up into the air, to be sucked off by exhaust fans. Analysis reveals that these fumes contain upwards of 60 per cent. chromic acid, forced up in the form of a spray by the evolution of hydrogen at the cathode. The polishing of the work is done on a calico mop impregnated with either white or green "compo." The abrasive in the white compo is fused alumina; in the green it is a green chrome oxide (Cr_2O_3). Both these are held as a bond by high-class stearine. Here also the dust from the polishing is sucked off by exhaust fans. Employees actually working on the plating tanks are, as might be supposed, most liable to trouble, but any or all of the conditions mentioned above may occur at any stage of the plating process, or even in persons working in the same shop.

There are at least four main factors in the production of these conditions: first, a septic process in the body of the worker; secondly, inefficient exhaust apparatus;

thirdly, a moisture-laden atmosphere, a sweat-laden skin, or both; and, finally, carelessness on the part of the operator.

PREVENTION OF DISABLEMENT

Persons to be employed in this industry should be medically examined before commencing on this process to prevent those with such obvious septic foci as foul teeth or tonsils from undertaking work which will inevitably lead to disablement. Sepsis of the nose, mouth, and pharynx is the commonest predisposing factor. The exhaust system of the tank should be sufficiently powerful to draw the smoke from the cigarette at the lips of a man standing by the tank. Scrupulous cleanliness on the part of the operator is, happily, as unnecessary as it is difficult to obtain. It is important, however, that wash basins, with a good supply of really dry towels, should be provided. In addition, the skin must be protected with some form of grease. This is of great assistance in preserving the health of the horn cells. The most satisfactory is a modified Lassar's paste with a preponderant base of pure vaseline. This should be smeared on the hands and arms before work is commenced, and a small piece inserted into each nostril, which quickly spreads over the exposed mucosa. In one large plant the operators use a specially prepared soap free of alkali and containing a proportion of free lanoline. This extra lanoline is left as a thin deposit on the skin after the hands and arms have been washed. Rubber gauntlets are compulsory, and are worn where contamination with the solution is inevitable. If they are worn continuously the additional perspiration produced more than counteracts the beneficial effect of the protection. Respirators are not of proved value. In a large plant the floor quickly becomes awash with drippings from the tanks and swills. This is a potent factor in the causation of trouble, and can be obviated by covering the floor with fresh sawdust each morning and sweeping clear at the conclusion of the day's work. Carelessness on the part of the operator can be avoided only by intelligent supervision.

TREATMENT

Dermatitis.—The usual positions for this form of dermatitis are the hands, arms, face, and occasionally the chest. The onset is sudden, but it is very unusual for an attack to occur until the operator has been in contact with the plating plant for at least six months. A severe case presents a horrifying appearance. The face is intensely red, and swollen out of all recognition. I have seen four cases in which oedema was so severe as to cause temporary blindness. Where the arms are affected they, too, are red and swollen, and the affected parts itch intensely, or may even be excruciatingly painful. The conjunctivae are injected, but the mucosa of the mouth seems to be unaffected, save that some patients complain of intense tingling of the tongue. At this stage the patient should be put to bed and the affected parts covered with lint soaked in double strength calamine lotion. The dressing should be changed frequently. Morphine is sometimes necessary to allay the irritation. Twenty-four hours later the oedema has subsided; and the affected skin is dusky in colour, with clusters of brick-red spots separated by crusted effusion from the contracting corium. The skin should now be scrubbed with gauze soaked in spirit, carefully dried, and swathed in lint plentifully spread with Lassar's paste. This procedure should be carried out twice daily. As soon as all irritation has ceased, usually in two days, the patient should resume work in the plating shop, being dressed by the first-aid official night and morning. The majority are clear of the dermatitis in a week. If patients remain

away from work until the cure is complete, they render themselves very liable to a recurrence on resuming work. When efficient treatment is lacking at the commencement of the attack the skin suffers permanent damage, and often becomes thin and papery after prolonged absence from work. In such cases recurrence is almost inevitable. The ultra-violet ray is of no use in the treatment of this condition.

Chromium Ulcers.—These ulcers may occur anywhere on the body, but are most common on the knuckles of the hands or the dorsum of the foot. They are always produced by an abrasion of the skin contaminated by chromic acid. They are circular in shape, with heaped-up edges, and a central clean-cut hole leading down to a base covered with exudate. These ulcers have a strong tendency to heal, but may penetrate very deeply, even to the bone. They vary in size from a match-head to a threepenny piece, but I have seen one the central hole of which would just take a half-crown. They are sterile, and the ulceration is due to a ferment, trypsin (Prosser-White). Although painless, they itch intolerably at night. The first essential in treatment is to splint the part. The splint must be maintained until the ulcer is completely healed. The ulcer should be cleaned out with gauze and dressed with equal parts of zinc oxide and vaseline. It takes about a week to heal if treated early.

Chromium Ulceration of the Nose.—This may be either anterior or posterior; where ulceration has once commenced, perforation is inevitable. First the area of the mucosa becomes pale and atrophic; later a greyish slough appears in the centre of the affected area. Usually such ulcers cause no inconvenience and are discovered accidentally, but the patient may complain of "whistling at night." Occasionally the ulceration completely destroys the cartilaginous part, and attacks the bony septum. The patient may have periodic moderate epistaxis, and a continued profuse discharge of pus from the nostrils. In these cases he should be put to bed, and the nostrils packed alternately daily with gauze soaked in flavine 1 in 1,000. The treatment may be necessary for several weeks.

Vomiting.—This is a rare manifestation of chromium trouble, and is always associated with dermatitis, though it does not occur in the acute stage of the inflammation. I have seen only four cases of vomiting in over a hundred patients suffering from the effects of chromic acid. Three of them were girls in a polishing shop, and one a man employed on a plating tank. The three girls were all very mild cases, and cleared up after being away from work for a week. The man was profoundly ill. In all four cases the signs and symptoms were identical. The vomiting was almost effortless, and happened immediately after taking food. It was preceded by profuse salivation. It occurred most violently after exertion, and increased in severity during the day. No signs could be elicited, and the abdomen was normal in every case. There was mild constipation. All the usual gastric sedatives were useless, and were, as a rule, returned within a few moments of swallowing.

THE PHARMACOLOGY OF CHROMIUM

It is probable that chromic acid is converted into chromous oxide when taken by the mouth, a part being deposited as such in various organs, and the balance being excreted in the urine. Ammonium sulphide precipitates from a solution of chromium compounds green chromic hydroxide; lead acetate solution precipitates solutions of chromium compounds in the form of a yellow lead chromate. I have never been able to demonstrate the presence of chromium compounds in the urine of any of my patients.

With a view to demonstrating the systemic effects from the exposure of the operator to chronic acid, four men were selected for examination. These men were all between 30 and 40 years of age, and all had worked continuously over a chromium plating tank for more than two years. A general clinical examination revealed a mild chronic catarrhal condition of the nose and throat in all the patients. One had a perforation of the septum of the nose of which he was ignorant. A complete blood examination showed a relative small lymphocytosis in all the patients, otherwise there was nothing abnormal. The day and night urine of each patient was tested, but failed to disclose the presence of chromium compounds. There was no albuminuria.

In spite of the fact that no evidence of absorption of chromium can be produced, it seems that a certain sensitization point is reached in the majority of patients, beyond which trouble ensues. Though a well-marked case of dermatitis or ulceration can definitely be recognized as due to chromium, I have been loath to use the term chromium poisoning, as all the conditions described above appear in a variety of other trades.

In a recent series of fifty cases, fifteen were women. This is a high proportion, as very few firms employ women on the most hazardous part of the process—namely, the plating tanks. Women are undoubtedly more susceptible to trouble.

The following table shows the number disabled from each condition, where the condition mentioned is the predominant factor.

Dermatitis	...	...	...	...	...	...	...	33
Ulceration of the nasal septum	...	...	...	...	...	...	...	4
Vomiting	...	...	...	...	...	...	...	4
Ulceration of the hands or feet	...	...	...	...	...	...	...	9
Total	...	...	...	...	...	...	...	50

None of these patients had received suitable first-aid treatment, with the result that their condition took a considerable period to clear up, the average time lost being nine weeks. Where adequate treatment and supervision are immediately available the average time lost is under a week.

The preventive measures outlined above are now being carried out by several large firms locally, and are proving successful. Prior to these methods being used there were always at least 10 per cent. of the personnel of the chromium plant suffering from one or other of these conditions. For the last three months there have been no cases in these works.

SUMMARY

1. Disablement among the operators on a chromium plating plant can be prevented.
2. The essentials of prevention are the elimination of septic foci and the protection of the skin by a film of ointment. The floors of the plating shop must be dry, and the exhaust apparatus efficient.
3. Persons suffering from any trouble due to chromic acid should have efficient first-aid treatment, and should cease work only in exceptional circumstances.
4. Women should not be employed except in the polishing shops.
5. There is no evidence of absorption of chromium by the workers in this industry.

I am indebted to Major A. J. Round, of B. J. Round and Sons, Birmingham, for his help in the prevention of disablement in this industry.

The soap and ointments mentioned above can be obtained in a satisfactory form from Philip Harris and Co. of Edmund Street, Birmingham.