

Rejection of metal to metal prosthesis and skin sensitivity to cobalt

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Metal to metal prostheses give satisfactory results in 90 % of patients. About half of the failure rate may be due to allergic reaction to the metals involved, particularly cobalt. A total of 35 patients in this unsatisfactory group have been patch-tested; 16 were positive to metals, 13 to cobalt, 4 to nickel and 2 to chromate. Only two patients showed any skin lesions - one a localized dermatitis round the knee joint from nickel sensitivity, and one to cobalt who had a widespread scattered circular erythematous lesion suggestive of a generalized allergic vasculitis. Patients requiring a metal/metal prosthesis should have a careful history taken for metal sensitivity and be patch-tested with the metals. All the patients in this investigation had metal/metal prostheses and no reaction was seen after metal/high density polyethylene implants. Titanium 318 may be a satisfactory substitute for cobalt chrome alloy if reactions are encountered.

Key words: allergy - cobalt - dermatitis - prosthesis rejection.

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The treatment of osteo-arthritis of the hip by a metal to metal prosthesis gives satisfactory results in over 90 % of patients. The remainder do not do well, developing loosening of the prosthesis which, in many cases, has to be removed owing to pain.

The metal alloy used in metal to metal prosthesis contains 60-65 % cobalt, 27 % chromate and 2.5 % nickel and traces of molybdenum, iron, carbon, silicon and manganese.

Nine patients who developed a fracture of the acetabulum one to four years after arthroplasty were investigated by Miller (1972).

Removal of the prosthesis was required in all patients because of pain and loosening of the prosthesis. Three patients had evidence of infection and in one case trauma

could have been a factor, but no cause was found in the remainder.

The possibility of this failure being due to a delayed type (Gell and Coombs type IV) hyper-sensitivity was then considered.

In order to investigate this possibility, 34 patients who presented with pain and loosening of the prosthesis were investigated for sensitivity by patch tests applied to the skin of the back.

Method

Patches were used with the salts of metals used in the prostheses, chromium, cobalt and nickel, and with the constituents of the acrylic cement which binds the metal to the bone, using circular pads of lint 5mm in diameter on aluminium foil (A1-test). The

patches were fastened to the back with Micropore tape. The patch tests were removed after 48 hours and any reaction was noted. The tests were read again after a further 48 hours. The test material for the metal sensitivity was obtained from Trolle Lassen Laboratories of Copenhagen: potassium dichromate 0.5 %, cobalt chloride 1 % and nickel sulphate 2.5 %, all in petrolatum, as used in the European Battery of patch tests. For investigation of the acrylic cement, 25 % acrylic monomer in olive oil, benzoyl peroxide 10 % in pet., dimethyl phthalate (as is), epoxy resin 1 % in petrolatum from the European Battery and hydroquinone 1 % in water were used.

Results

A total of 35 patients with unsatisfactory prostheses have now been patch-tested and 16 have had positive results, 13 to cobalt, 4 to nickel and 2 to chromate.

At a patch test clinic in the same hospital, out of 490 patients patch-tested for cobalt, only 9 (1.8 %) were positive. Fregert (1974) in a larger series has found an even lower figure.

The high incidence of reaction in these patients may well be significant, but it must be emphasized that this is a highly selective group of patients and no control studies of normal joint replacements have been undertaken. Evans et al. (1974) refer to 21 patients with normal replacements with negative reactions to metals.

Discussion

Skin reactions to implanted metals are well-known. Laugier and Fousereau (1966) described four cases of dermatitis in patients in whom stainless steel plates had been inserted. Brendlinger and Tarsitano (1970) reported a case of dermatitis due to sensitivity to a cobalt/chrome denture. McKenzie,

Atkin and Ridsdill-Smith (1967) described a case of urticaria following the insertion of a cobalt/chrome nail.

As far as we are aware there has been no previous attempt to correlate the failure of joint replacements with the possibility of allergic reactions to the metals used.

As a large number of metal to metal prostheses operations are now performed in which a steady liberation of cobalt (and nickel) has been demonstrated (Coleman et al. 1973), it might have been suspected that patients would appear in dermatological clinics. The incidence of dermatitis, however, is very low. Only two of the 34 patients investigated developed dermatitis. The first of these was a lady aged 40 years who developed severe localized dermatitis with bullae around a metal to metal knee prosthesis; this extended 6 inches above and below the knee joint. Ten years previously a similar prosthesis had been inserted in the other knee but required removal because of pain and sinus formation. She had a positive patch test to nickel.

The second patient was a man aged 68 who had had a good functioning metal to metal hip replacement for ten years. About two years after his second hip was replaced by a similar prosthesis he developed pain and loosening and the second prosthesis had to be removed. He then developed diffuse but scattered circular erythematous lesions suggestive of a generalized allergic vasculitis. His patch test reaction to cobalt was positive.

Four patients who were strongly sensitive to nickel, one also to cobalt, gave a history of metal sensitivity from costume jewellery, watch straps or suspenders, but only one developed any dermatitis associated with the prosthesis.

Cobalt is found in tattoos, pottery manufacture, adhesives, hair dyes, fly-paper and pigments (Fisher 1973). It is a rare contact allergen in a working environment and

hardly ever occurs in elderly sedentary patients. It might be for this reason that skin lesions are so few. Elderly patients may also have a diminished immune response and, although it has been found that cobalt is present deep in the tissue around the prosthesis (Evans et al. 1974), it may be more difficult for the necessary carrier hapten to reach the lymph nodes of the skin and so produce a skin reaction. It is postulated that the immune reaction occurs in the local tissues adjacent to the prosthesis leading to endarteritis and ischaemic necrosis of bone. This leads to loosening of the prosthesis.

Conclusion

The incidence of dermatitis from metal prostheses is very low. Two cases only are described, one sensitive to cobalt and one to nickel.

Cobalt which is shed from a metal to metal prosthesis may cause an immune rejection reaction.

Prior to operation it is important for the Orthopaedic Surgeon to be aware of this possibility and to patch test the patient with the constituent metals of the prosthesis.

So far no reactions have been encountered with articulations between metal and high density polyethylene; this type of prosthesis might be preferred if all other considerations are equal.

Titanium 318 may be a satisfactory substitute for cobalt chrome alloy if reactions are encountered.

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