confirm the subjective assessment that SBK are larger than NSBK in both nuclear and cytoplasmic perimeters. The most relevant morphometric differential feature, however, is the CI. In keeping with subjective judgement, the cytoplasmic membrane profile of SBK was found to be much less regular than that of NSBK. This highly indented profile is fully compatible with the dermal–epidermal anchoring role reportedly played by SBK. On the other hand, NSBK have smoother borders and few desmosomes, strongly suggesting that these cells do not fulfil any fundamental function in dermal–epidermal anchoring mechanisms (1–6).

In conclusion, the present results indicate that NSBK and SBK are readily detectable in human palmar skin by electron microscopy, and that quantitative techniques can be useful in providing an objective means for the assessment of size and shape differences between these two keratinocyte subpopulations.

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Implantation of Orthopaedic Devices in Patients with Metal Allergy

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Å. Carlsson, H. Möller. Implantation of orthopaedic devices in patients with metal allergy. Acta Derm Venereol (Stockh) 1989; 69: 62–66.

Patients with a contact allergy to chromium, cobalt and/or nickel, patch test verified before implantation of a metallic orthopaedic device, were followed up years later by clinical and radiographic examination as well as with epicutaneous and intracutaneous tests. Eighteen patients had been exposed to an orthopaedic implant for several years (mean 6.3 years) containing a metal to which they were allergic. None had suffered any dermatologic or orthopaedic complications attributable to the contact allergy. *Key words: Contact allergy; Chromium; Cobalt; Nickel; Bio-implantation.* (Accepted June 9, 1988.)

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Metals are introduced into the human body in the form of dental alloys containing e.g. mercury, gold, and stainless-steel, as orthopaedic nails, screws, plates and joint prostheses containing e.g. chromium, nickel and cobalt, and as cardiac stainless-steel pacemakers and valves. There is thus a possibility that these haptenic foreign bodies may sensitize and in consequence give rise to local or distant skin reactions ('endogenous contact dermatitis') or result in an impaired function or even rejection of the implant.

Sensitization in connection with orthopaedic bio-implantation seems to be rare. Patch testing before and after elective surgery has shown a conversion of negative to positive metal tests in a few cases (1, 2), no conversion (3), or even a change to negativity (4). Experimental sensitization in guinea pigs, although successful in intramuscular chromium–nickel implantation (5), could not be achieved by intra-articular deposition of chromate (3).

In patients already sensitized to one or several metals, implantation of the metal in question may elicit an allergic reaction leading to postoperative or late skin disease as well as prosthetic loosening or other orthopaedic complications. Such an outcome would then be frequent, indeed, since contact allergy to metals, and that to nickel in particular, is so common even in healthy populations. As a matter of fact, there is rich anecdotal evidence of eczematous reactions in metal-implanted patients with a previous history of metal sensitivity, but systematic studies are lacking.

In the present study we wanted to follow patients with a preoperative, test-established metal allergy during the years following bio-implantation, to look for dermatologic and orthopaedic complications. For each individual, it was ascertained that the implant contained a metal agreeing with a positive skin test, and the test was repeated at follow-up including an intradermal confirmation.

MATERIAL AND METHODS

In order to reach patients with contact allergy to a metal, known prior to an orthopaedic bio-implantation, they were traced from two sources:

Group A

Patients found to have a contact allergy to nickel during the 15 years 1962–76 at the Department of Dermatology (n=680) were searched for in the records at the Department of Orthopaedics. We found 355 patients (52%) with nickel allergy and having received medical care at the Department of Orthopaedics. Of these, 37 had been operated upon with implantation of a metallic device; 18 were deceased, 19 still living. Among these 19 patients, 15 could be traced and examined. See Table I for this material including operated part, implanted metal, and evaluation time.

Group B

In a previously studied material (3) there were 9 patients with a positive patch test to nickel before their total hip replacement. Seven of these could be evaluated (Table I).

A total of 22 patients were thus examined, which implied dermatologic history and examination, epicutaneous and intracutaneous tests for delayed metal allergy, as well as clinical and radiographic orthopaedic examination. Patch tests were performed with potassium dichromate 0.5%, cobalt chloride 0.5%, and nickel sulfate 5.0% in petrolatum, using Finn chambers® on Scanpor® applied for 48 h and read according to ICDRG after a further 24 h. Intracutaneous tests were performed on the volar aspect of the right forearm with 1 mM saline solutions of the same metal salts and evaluated as a tuberculin reaction after 72 h.

RESULTS

Among the 15 patients in group A two were excluded from the final evaluation, one because he had been implanted with a stainless-steel (Cr-Ni) prosthesis but at re-examination reacted only to cobalt, and one because she did not react positively at present to the metal test.

Among the 7 patients in group B, 2 were excluded, one because she had at present no posi-

tive metal test, and one because he had been implanted with a vitallium (Cr-Co) prosthesis and was allergic to nickel.

Thus there remained 18 patients who had been exposed to an orthopaedic implant for several years (mean 6.3 years) containing a metal to which they were allergic (Table I).

From the orthopaedic point of view, no complications were observed that could be attributed to metal allergy. All fractures healed, in case no. 13 (Table I) after revision and a more rigid fixation. One elbow arthroplasty (case no. 4) was converted to an arthrodesis because of mechanical loosening of the components, a common complication. Also the loosening of a knee prosthesis (case 6) could be explained by mechanical factors.

In dermatologic anamnesis, very little was disclosed. Only one of the 18 patients acquired an eczematous dermatitis (leg once, face later) after the operation, while 3 patients saw an eczema disappear. Seven patients had an eczema to about the same degree both before and after surgery. Fifteen patients had a history of metal sensitivity before as well as after the operation; 3 of these thought that the sensitivity had diminished. Only one patient had had an eczematous reaction at the site and time of the surgical procedure. Eight of the 15 patients had had a periodic hand eczema, in most cases, before as well as after the operation. In no case had an old eczema worsened, or a new one appeared.

Patient no. 9 had a particularly strong test reaction to cobalt, and patient 12 to nickel; at

Table I. *Findings in the 18 patients with contact allergy to metals before bio-implantation*

Numbers in brackets refer to reference 3, Table 4

Patients	Operation	Part of body	Prosthetic metal	Duration (years)	Contact allergy	Complications		
							New eczema after surgery	Orthopaedic
Group A								
1	Nails, plate	Hip	Cr Ni	1	Ni	×	–	–
2	Arthroplasty	Knee	Co Cr	5	Cr Ni	×	Plantar eczema	–
3	Screw	Knee	Cr Ni	1	Co Ni	×	–	–
4	Arthroplasty plates, screw	Arm	Cr Ni	11	Ni		Leg and face eczema	Mech. failure
5	Cerclage	Arm	Cr Ni	2	Ni	×	–	–
6	Arthroplasty	Knee	Cr Co Ni	3	Ni	××	–	Mech. failure
7	Cerclage	Arm	Cr Ni	1	Ni	××	Eczema at wound	–
8	Nails	Hip	Cr Ni	5	Ni	×	–	–
9	Nail	Hip	Cr Ni	16	Co Ni	××	–	–
10	Arthropl. ×3	Knee, ankles	Cr Co Ni	8	Co Ni	××	–	–
11	Nails	Hip	Cr Ni	3	Ni		–	–
12	Screw	Knee	Cr Ni	3	Co Ni		–	–
13	Plates, nail	Femur	Cr Co Ni	3	Ni	×	–	–
Group B								
14 (4)	Arthroplasty	Hip	Cr Ni	11	Ni		–	–
15 (6)	Arthroplasty	Hip	Cr Ni	10	Ni		–	–
16 (7)	Arthroplasty	Hip	Cr Ni	10	Ni		–	–
17 (9)	Arthroplasty	Hip	Cr Ni	10	Ni	×	–	–
18 (10)	Arthroplasty	Hip	Cr Ni	11	Ni		–	–

× Eczema before as well as after surgery.
×× Eczema healed after surgery.

least the latter patient had an equivalent antigen-containing prosthesis but neither of the 2 sustained cutaneous or orthopaedic complications.

In group A, one of the 18 deceased patients had had a skin reaction that could be attributed to a metallic implant. This female, with a previous contact allergy to chromate, cobalt, nickel and neomycin unknown to the orthopaedic surgeon sustained an ankle fracture at the age of 75 and was treated with open reduction and internal fixation. Later on she developed an eczematous dermatitis on the foot as well as a symmetric papular itching eruption on the trunk. The eczema did not subside until the osteosynthetic material had been removed.

DISCUSSION

This is the first long-term follow-up study of orthopaedic patients in which the outcome has been correlated to a skin test preceding the operation. This is not surprising, since skin tests are not routinely carried out before elective surgery and, of course, never in acute surgery.

Even if originally not of a prospective nature, this study can, however, be characterized as such, since the result of preoperative patch testing could be secured from dermatologic records. Similarly, the type of operation and the composition of the implanted material were obtained from the orthopaedic records. Finally, the presence of metal allergy was ascertained by renewed skin testing at the time of follow-up. Since metal allergy is notoriously difficult to diagnose by patch testing (6) all reactions were confirmed by intradermal testing (7). Only those patients with established contact allergy—which furthermore should agree with the material implanted—were accepted for this study.

With these firm prerequisites, it is no wonder that only 18 patients could be traced and examined. A further reason for the eventually small material is that more than half of the patients had been operated on because of a fracture of the femoral neck and the majority of these latter patients had since died. Mortality following such fractures is known to be high—in men 34% and in women 20% within one year (8).

On the whole, postoperative cutaneous complications after orthopaedic bio-implantations seem to be rare. Among 1600 consecutive operations, Kubba et al. (9) observed 19 patients with skin reactions; only 1 or 2 of these were considered causally connected with the metallic implant. The one patient in our material with a local eczema close to a static implant, a secondary symmetric eruption, and clearing after removal of the implant is a typical example of the anecdotal experience which now and then is occasionally found in the literature (10).

In a prospective study, Rooker & Wilkinson (4) found 6 patients patch test positive to metals before hip replacement; 3 of these were implanted with the metal(s) to which they were allergic (chromium/nickel). At follow-up 4, 13, and 18 months, respectively, after surgery, all 3 had lost their contact allergy. None had cutaneous or orthopaedic complications.

Also in our material patients (2 in group A, one in group B) had lost their metal allergy at re-examination. This may of course be attributable to false-positive test reactions at the preoperative test. Another explanation is a change in the immunity state.

Thus, it has been suggested that minute amounts of antigen leaking from implanted sites might induce hyposensitization, leading to a low incidence of cutaneous complications (9) or to disappearance of contact allergy (4). This would agree with recent experimental findings from our laboratory (11) where repeated oral administration of nickel sulfate to patients with nickel allergy resulted in a diminished degree of contact allergy.

To conclude, implantation of cemented metal-to-plastic joint prostheses is safe, even in the case of a pre-existing metal allergy, from both an orthopaedic and a dermatologic point of view. Metal devices used for fixation of fractures may, however, occasionally result in a local eczematous dermatitis, especially when placed immediately beneath the skin. In such

cases it should be possible to control the dermatitis until the fractures are healed and thereafter extract the foreign material.

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Serum Aminoterminal Propeptide of Type III Procollagen in Progressive Systemic Sclerosis and Localized Scleroderma

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Sera from 31 patients with progressive systemic sclerosis (PSS), 5 patients with widespread localized scleroderma (LS), and 3 patients with lichen sclerosus et atrophicus were analyzed for aminoterminal propeptide of type III procollagen (PIIINP) using a radioimmunoassay based on human propeptide. Thirty-eight per cent of the patients with PSS had levels above normal range, including all of the 3 patients with diffuse scleroderma. The same applies to 4 of 5 patients with widespread localized LS, while PIIINP in all 3 patients with lichen sclerosus et atrophicus were within normal levels. In patients with acrosclerosis, elevated PIIINP seems to be correlated to rapid progression and extension of lesions. A significant increase in PIIINP was found in a patient following discontinuation of prednisone and cyclophosphamide, while the present investigation did not allow judgement of effects of treatment with either penicillamine or cyclosporin A. (Accepted August 10, 1988.)

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