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Loosening of a Total Hip Prosthesis at Contact Allergy Due to Benzoyl Peroxide*

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Summary. It is reported that a 62-year-old man with total hip prosthesis developed a recurrent sterile fistula and loosening of his prosthesis due to allergy to the bone cement component benzoyl peroxide.

Zusammenfassung. Es wird über einen 62jährigen Mann mit Hüfttotalendoprothese berichtet, bei dem es zu einer rezidivierenden sterilen Fistelung und Prothesenlockerung bei Kontaktallergie gegenüber Benzoylperoxid kam, einem Bestandteil des Knochenzements.

One of the main problems in total hip prostheses is the late loosening of part of or the whole prosthesis. The percentage of loosening ranges from 1.5 to 17.8 (3.6). It may be due to deficiencies in the prosthesis itself (high friction, asymmetry in the prosthetic model, defective material), faulty implantation (varus position of the stem, poor cementing), preexisting diseases such as rheumatoid polyarthritis with consequent osteoporosis or protrusio acetabuli resulting from other diseases and finally early and late infection plus abacterial loosening of undetermined origin.

Recently, loosening due to contact allergy has been suggested [4, 5, 11, 13], so far seen exclusively in allergic reactions to components of the metal alloys used (chrome, cobalt, and nickel). As yet it has not been demonstrated that components of bone cement can bring about an allergy resulting in loosening of the prosthesis. Gschwend et al. go so far as to emphasize in their comprehensive 1977 study [5] that current opinion maintains that there is no immunological potential in polymethylmethacrylate nor in polyethylene.

We would therefore like to report on a patient who showed aseptic loosening of a total hip prosthesis (Weber-Huggler) with confirmed allergy to benzoyl

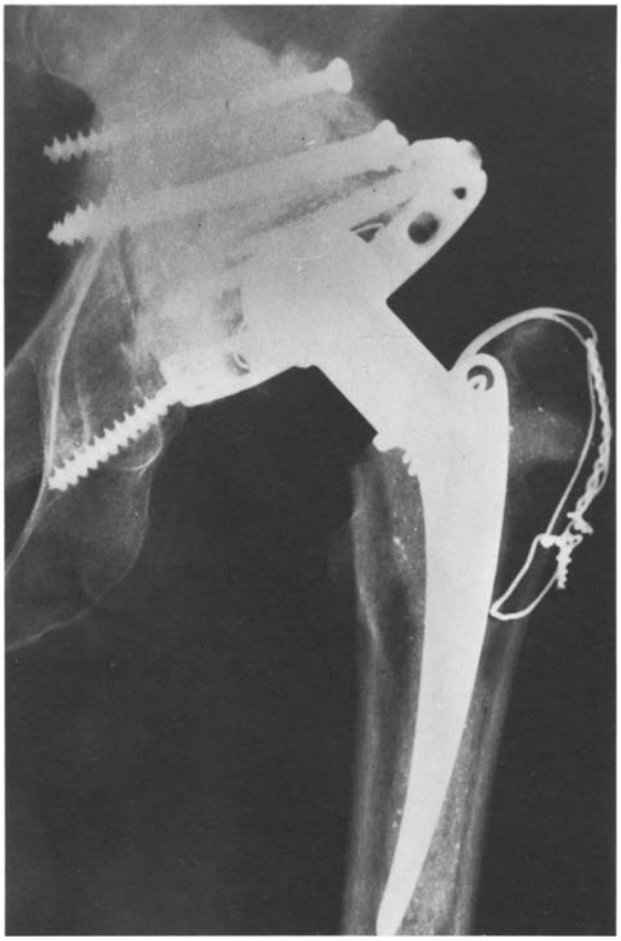

Fig. 1. Condition after previously performed operation with total prosthesis due to post-traumatic coxarthrosis on the left side

* Dedicated Professor Dr. A. N. Witt on his 65th birthday

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Fig. 2a. Loosening of total prosthesis in socket area; questionable loosening in the shaft area

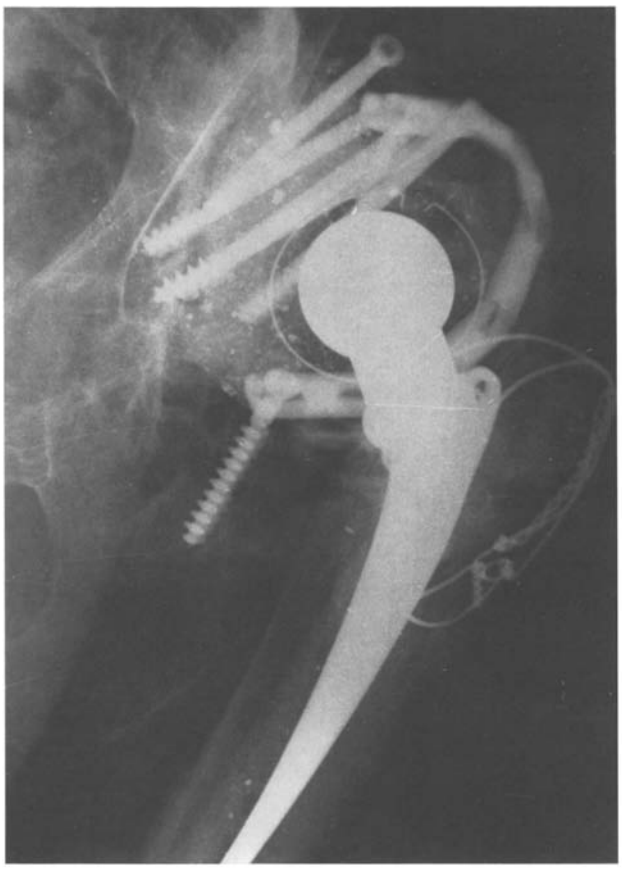

Fig. 2b. The so-called obturator X-ray examination reveals the extent of the loosening

peroxide, a compound to initiate polymerization present in all bone cements known to us (the so-called starter).

Case Report

A 62-year-old man was seriously injured in a traffic accident in 1959, and suffered a fracture of the upper left arm, an open fracture of the left tibia, fractures of the left radius and clavicle, as well as fractures of the left metatarsals, and fracture dislocation of the left hip joint. In 1973 in another clinic alloarthroplasty of the left hip joint was performed because of severe posttraumatic coxarthrosis. In order to improve the acetabulum, screws and a curved osteosynthetic plate were used for fixation in addition to bone cement (Fig. 1). In 1976 the prosthesis became loose with subsequent fistula development, but without the typical pain of such loosening. The fistula swab was either abacterial or apathogenic staphylococci only were found in the outer parts of the fistula. Deeper lying areas were always sterile. Examination of the fistula in 1978 showed a canal up to the wire fixation of the great trochanter (Fig. 2), requiring an operative revision with removal of the wire. Once more the swab, performed during the surgical intervention, produced no bac-

Table 1. Patch tests results. Listed are only problem-oriented compounds from groups tested, such as "Standard", "Plastics", and "Acrylics" [2] as well as materials brought in by the patient

Substance		Reaction[a] (days)		
		2	3	8
Peruvian Balsam	25 %	–	+	
Potassium Dichromate	0.5%	–	–	
Nickel Sulfate	2 %	–	–	
Cobalt Chloride	1 %	–	–	
Benzoic Acid	5 %	–	+	
Benzoyl Peroxide	1 %	++	++	
Pyridine	30 %	–	+	
Palacos-R	1:50	–		[b]
Refobacin-Palacos-R	1:50	–	–	–
Methylmethacrylate	1:10	–	–	–

[a] The evaluation was made according to proposals by the International Contact Dermatitis Research Group [2]

[b] Negative in 10 additional healthy control persons

terial growth. The patient was without pain for 3 weeks after the operation, when blisters preceded the development of a fistula. Repeated bacteriological analyses of the fistula continued to show no growth or only staphylococcus epidermidis. Since the patient was experiencing no pain, and since the resulting shortening of the patient's leg would have inconvenienced him, he would not agree to removal of the prosthesis. He was uncomfortable only because of the secretion from the fistula. Contact testing for allergy was performed to determine the cause.

Patch tests indicated positive reactions to Peruvian balsam, benzoic acid, benzoyl peroxide and pyridine (Table 1). When subsequent tests were performed on bone cements Palacos-R and Refobacin-Palacos-R, a positive reaction was found only to Palacos-R (Table 1). To exclude the possibility of toxic reaction, a control group of 10 healthy persons was included with no positive result due to the bone cements.

Bacteriological cultures again, including anaerobes showed no growth. Biopsy of the canal was examined, showing granular tissue with necrosis, interspersed with numerous eosinophils (cf. Prof. P. Meister, Pathologisches Institut der Ludwig-Maximilians-Universität München).

Discussion

The problem of loosening of hip total prosthesis is well known [9, 10], and many factors are considered responsible for it. However, to date there has been little success in explaining all such loosenings. Gschwend et al. [5] and Evans et al. [4] have indicated the possibility of loosening through contact allergic reactions to metallic ion components of the implants. No components of bone cement have hitherto been identified as causes of allergic responses.

In our patient the condition of the acetabulum made fixation difficult although the implantation itself was performed perfectly. Loosening of the prosthesis would hence be explicable on the basis of poor anatomical conditions alone. Abacterial loosening, however, does not produce a fistula. Since in many bacteriological tests neither aerobic nor anaerobic pathogenic microorganisms could be cultured, we felt this cause to be very improbable. The contact allergens demonstrated by patch tests are all, with the exception of the Peruvian balsam, ingredients used in bone cements currently marketed. It should be mentioned, that also Peruvian balsam contains benzoic acid.

Acrylate CMW-Bone-Cement with barium sulfate as the X-ray contrast medium was used in this patient. Components of acrylic polymerisates, especially the monomers, have been described as contact allergens [1, 7, 8]. It surprised us that, in the patch tests, the monomer methylmethacrylate, known as a contact allergen, gave a negative result, while the activator (benzoyl peroxide) and the polymerization inhibitor (pyridine) showed positive reactions. The positive reaction to benzoic acid is explained by the fact that benzoic acid is a product of the decomposition of benzoyl peroxide. Palacos-R as well as Refobacin-Palacos-R were tested. As these bone cements contain benzoyl peroxide as well as benzoic acid and pyridine, a positive reaction was anticipated, but this occurred only with Palacos-R. The manufacturer confirmed that with variation in the production technique, the level of benzoyl peroxide (within certain tolerances) can fluctuate. Hence it is possible that the quantity of benzoyl peroxide contained in Refobacin-Palacos-R was not identifiable in the specimen chosen.

The histological finding agreed with these results, showing, as expected in an allergic reaction, a significant round cell infiltrate with eosinophils. All the metals implanted (including plate and screws) produced negative results when tested.

We believe from the above results point that loosening did not result only from poor anatomical conditions. At least one other factor has to be considered in view the fistula, and we feel is allergy to ingredients in the bone cement. If allergy to components of the bone cement are responsible for loosening it could be concluded that a reimplant in such cases should not be undertaken and resection would be preferable.

It should be noted that pre-operative so-called "prophetic" patch tests are not recommended [12]. Even with a negative result, later allergic reaction after implant with bone cement cannot be excluded. In fact allergy can be induced through "prophetic" testing.

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