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EDITORIALS AND ANNOTATIONS

METAL SENSITIVITY

Perhaps it was too much to expect that given expert surgery and good prosthetic design, infection and thrombo-embolism should remain the last major hurdles before replacement arthroplasty became as safe as most of our patients now seem to believe it to be. We have viewed the field of organ transplant surgery and have been thankful that our replacement joints contain no foreign proteins to excite an immune response with all the attendant problems of “rejection”. We knew of skin sensitivity to certain metals in general use, particularly to the nickel in watches, buckles and costume jewellery. None of us, however, could have been aware until recently that such sensitivity might be induced by the metal that we implant deeply into tissues for the internal fixation of fractures or for joint replacement. Now we hear of something which may be of much greater importance: the development of an immune reaction not in the skin, but deeply in the tissues adjacent to buried metals, which it is claimed may lead to obliterative vascular changes, local bone necrosis and loosening of the metal prosthesis.

In this issue Evans, Freeman, Miller and Roberts present with commendable clarity their arguments suggesting that metal sensitivity may be a cause of loosening of the metal component of hip prostheses. Their evidence is not overwhelming and does not lend itself to statistical analysis. Nevertheless it is by just such painstaking work, based upon clinical observation, that advances are made. They have opened up a whole new field of enquiry, a field already prepared by the work of Swanson, Freeman and Heath (1973), who by wear tests in laboratory simulators showed that cobalt and chromium were released into solution from prostheses in which both articulating components were composed of cobalt-chrome alloy, and by the observation of Colman, Herrington and Scales (1973) that patients with such prostheses show a raised level of cobalt and chromium in the blood and urine. Evans and his colleagues have now also demonstrated remarkably high levels of cobalt and chromium in the tissues adjacent to metal-to-metal cobalt-chrome prostheses and much lower figures when one component is made of polyethylene. Much more research is required before it can be assumed that these high concentrations are harmful. Larger clinical sensitivity studies will no doubt be forthcoming. From them will come not only the true incidence of metal sensitivity but also perhaps confirmation that such sensitivity precedes, and thus may cause, loosening rather than being no more than one result of it, as some now suspect. Other studies should confirm or refute the novel view that the local bone necrosis claimed to be responsible for the loosening is in fact due to metal sensitivity. Meanwhile let there be no doubt that the theoretical arguments advanced in no way transgress the bounds of our present knowledge in the field of immunity. The local vascular changes described could well be due to a local immune reaction, and it is perfectly reasonable to conclude that this might lead to local bone resorption and even to a raised sedimentation rate, now often regarded as an indication of infection.

Whatever one’s views on the practical significance of this new evidence of metal sensitivity, we surely cannot ignore it. Our first duty is to initiate further research; our second is to define our attitude until such time as the position becomes clearer, always bearing in mind that however important the theoretical perils, in practice the incidence of failure is still low.
Nevertheless, every failure is a disaster, and with the evidence that is now available orthopaedic surgeons should add the possibility of metal sensitivity to the other factors that already affect their choice of a joint prosthesis. The weight of this new factor will no doubt change with further research, but the first reaction is likely to be an acceleration of the trend away from all-metal articulations, particularly at the hip where there are already several well tried metal-on-polyethylene alternatives. This trend has long been established. No doubt surgeons have been influenced mainly by clinical results but also by knowledge of the much greater frictional resistance of all-metal articulations (Andersson, Freeman and Swanson 1972), which suggests a greater strain upon the bond between prosthesis and bone. Furthermore it has been shown by Heath, Freeman and Swanson (1971) that prostheses composed entirely of cobalt-chrome, when articulated under load in laboratory simulators, liberate wear particles which can be carcinogenic in the rat—an animal, however, that is notoriously prone to produce tumours with a number of experimentally introduced agents.

Apart from avoiding all-metal prostheses when an acceptable alternative is available, there is little further action that can be advised at present. Certainly, when in the judgement of the surgeon there is no such alternative—and this is likely for joints other than the hip—he should not be deterred by present evidence from using the prosthesis he considers best. There is still insufficient evidence for it to be incumbent upon us to patch test all our patients for cobalt, chromium or nickel sensitivity before operation. Nevertheless many surgeons may well now wish to do this. Frequent skin tests should certainly be avoided, because in theory at least such repetitive testing could induce systemic sensitisation. There are now in the course of development in vitro tests in which the direct effect of the sensitising agents on the patient’s lymphocytes can be observed. Such tests will enable patients to be screened without this risk.

Prosthetic joint replacement of the hip is one of the greatest developments in orthopaedic surgery, but as with other major operations, success cannot always be achieved. Yet another possible hazard has been added to those of which most of us are already well aware. Nevertheless, failures are uncommon and are most unlikely to deter surgeons from performing, or patients from accepting, an operation that can bring such great relief from suffering.

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**REFERENCES**


