Editorial

Arthroplasty infections

Antisepsis and asepsis in orthopedics

After the total hip arthroplasty had gained acceptance in the late 1960s, several large centers reported a 10 per cent rate of postoperative infections. Soon it was also realized that reoperations of infected arthroplasties carried a high risk of recurrent infection, and even death. Today, 20 years later, the overall infection rate following endoprosthetic arthroplasty is around 1 per cent, and less than half of that following total hip arthroplasty for arthrosis. Thus, Lidwell and his co-workers in this issue of *Acta Orthopaedica Scandinavica* report an infection rate of 0.4 per cent in their multinational prospective study. This pattern also applies to the success of reoperations of infected hip arthroplasties, which has increased to 80 per cent, as reported from several centers (Klenerman 1984). The risk of permanent disability following endoprosthetic surgery has accordingly been reduced from about 5 per cent to 0.1 per cent for a factor of 50 in 20 years. How has this been possible?

Lister (1867) was the first clinician to apply Pasteur's ideas; he succeeded because he used a highly sensitive model for his studies, notably open fracture of the tibia, which had a 30 per cent mortality in the 1850s (Bruns 1886). Today, joint prosthetic surgery has proved to be as sensitive a model for clinical studies of infections as Lister's open fractures. The impact of research in arthroplastic infections has engendered renewed interest in and an awareness of septic complications following amputations (Sonne-Holm 1985), fractures (Patzakis et al. 1974, Bergman 1979), and abdominal (Bröte 1975) and vascular surgery (Christenson et al. 1981).

Lister used crystallized carbolic acid (phenol) in the open wound and sprayed in the operating room. A hundred years later, Lister's *antiseptic* principle was still extant in a primitive form: many surgeons applied sulfonamide powder locally before skin closure and in open fractures, and systemic antibiotics were used on broad, rather vague, indications.

There was great protraction before the *aseptic* principle became genuinely understood, for orthopedic operating theaters were accessible to personnel wearing street clothes; and this permissiveness persisted almost up to the time when Charnley introduced his greenhouse. The initial ultraclean air systems proved difficult to apply, and they gained acceptance rather slowly. Further, body exhaust suits were heavy and lighting was inadequate. The entire aseptic apparatus was expensive, and the general consensus was that the preventive value of the various technologic components was difficult to assess. In addition, the clean air aseptic principle met stiff competition from the antiseptic principle, notably antibiotics administered systemically or applied locally mixed in the bone cement.

However, bacteriologists and infection specialists strongly opposed the employment of antibiotics prophylactically; the indiscriminate use of antibiotics had evoked growing concern for the risks associated with resistant strains of bacteria, superinfections, and kidney problems. In 1973, at the meeting of the American Academy of Orthopaedic Surgeons in Las Vegas, 2,000 orthopedic surgeons were lectured on the consequences of the abuse of antibiotics. However, the same year, reports on prospective randomized studies of arthroplasties in Lund and Malmö, Sweden (Ericson et al. 1973), and hip fractures in Boston (Boyd et al. 1973), clearly documented the value of preventive antibiotics for the first time (Norden 1983). Bacteriologic identification and immunologic verification of low-virulent bacteria, such as anaerobes, as a source of previously unidentified infections in joint prosthetic surgery was also shown (Kamme et al. 1976). The efficacy of antibiotics mixed in acrylic bone cement was first established in reoperations of infected hip arthroplasties (Buchholz et al. 1984) and then in a multicenter study of primary arthroplasties (Josefsson et al. 1981). Gentamicin-loaded cement beads introduced into infected cavities further established the effect of an antiseptic agent applied locally (Klemm 1976, Törholm 1984).

The work of Lidwell and his associates has now established beyond doubt that a clean air system does provide a reliably aseptic environment with sepsis being less frequent than when operations are performed in conventionally ventilated theaters. Systemic or local application of antibiotics or both have the same effect. However, when aseptic and antiseptic measures are combined, the infection rate is lower.

Because the risk of an arthroplasticy infection is less than 1 per cent, it is unlikely that further progress can be made in the average case; reliable documentation of differences would require a staggering number of rigorously controlled cases. The choice of preventive measures must now be based on practical and economic factors. This may explain why surgeons at 69 orthopedic units in Sweden performed 8,000 primary hip arthroplasties in 1985 employing 10 different strategies for infection prophylaxis (Ahnfelt 1986).

The Swedish multicenter studies of hip (Ahnfelt 1986) and knee arthroplasties (Knutson et al. 1986) demonstrate, however, that we should not be satisfied with the low average risk of postoperative infections. The risk is still higher in rheumatoid arthritis than in arthrosis and after previous osteotomy; and certain types of endoprostheses have carried particularly high risks, notably the hinge and Attenborough knee prostheses. By definition, these problems can only be obviated by multicenter, nationwide, and international collaboration to collect a sufficient number of cases in sparsely populated subsets. Also, research should focus on materials that are not merely biologically inert, but that also actively reject bacterial colonization (Gristina & Costerton 1984).

The orthopedic community has much to gain by having its own organizations provide the initiative for the quality control of major arthroplasties, which have now come closer to an industrial process than any other surgical form of intervention. Leaders of such projects will need the sense of purpose and the enthusiasm displayed by Dr. Lidwell in inspiring his co-workers to produce the data reported here.

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