British Journal of Plastic Surgery (1987), **40**, 94–96

The pathogenicity of coagulase negative staphylococcus in the presence of silicone rubber implants

P. T. L. WONG, D. V. NIELD and C. T. K. KHOO

Department of Plastic Surgery, Wexham Park Hospital, Slough

Summary—Coagulase negative staphylococci have long been thought to be harmless skin commensals. However they are now recognised as important pathogens in patients who have undergone insertion of prosthetic devices.

We present three patients with infection following the insertion of silicone polymer prostheses, in whom a coagulase negative staphylococcus was the pathogen. All responded to antibiotic treatment.

It is important to alert the bacteriologist to the presence of an implanted prosthesis when wound swabs are sent from an area showing clinical signs of infection. The coagulase negative staphylococci may otherwise be regarded falsely as merely skin contaminants.

Coagulase negative staphylococci are normal human skin commensals, and are shed in large numbers from the skin surface along with skin squames. They are common contaminants of clinical specimens. Most laboratories label *Staphylococcus epidermidis* and *Staphylococcus albus* as coagulase negative staphylococci unless further tests for identification and antibiotic sensitivity are undertaken. This depends on the suspicion of pathogenicity.

These organisms do not form toxins or possess primary pathogenicity, as does the *Staphylococcus aureus*, but they are opportunistic pathogens. They are known to cause infection when there is local or systemic impairment of normal defence mechanisms, as in the presence of an implanted foreign body or in patients with immune deficiency. This group of organisms has increasingly been implicated as the cause of bacterial endocarditis following cardiac surgery (Geraci *et al.*, 1968; Watanakunakorn, 1977), and also in patients undergoing insertion of cerebrospinal fluid shunts (Shurtleff *et al.*, 1974).

Most clinical infections associated with silicone polymer implants are due to *Staphylococcus aureus* (Millender *et al.*, 1975; Courtiss *et al.*, 1979).

It has been suggested that a subclinical *Staphylococcus epidermidis* infection may be a causative factor in capsule formation following breast augmentation with silicone prostheses. The organism has been demonstrated in 55% of pockets prior to the insertion of implants, and at open capsulotomy 71% to 95% of capsules yielded positive cultures (Burkhardt *et al.*, 1981). Shah *et al.* (1981) also isolated this organism from breast capsules and they claimed that the instillation of *Staphylococcus epidermidis* at the site of silicone polymer implants in rabbit flanks promoted capsule formation. Other workers have, however, failed to find convincing evidence of the presence of bacteria in capsules around silicone polymer implants (Rudolph and Woodward, 1983).

Infection due to coagulase negative staphylococci associated with silicone polymer prosthesis insertion in the ear or the hand has not previously been reported.

Case Reports

Case 1

A 24-year-old female patient with unilateral congenital microtia underwent staged ear reconstruction with a Silastic® ear frame. The initial procedures were uneventful. Three years after completion of her reconstruction she underwent further surgery to deepen the postauricular sulcus. The wound became infected and she developed a persistent discharging sinus at the upper pole of the reconstructed pinna. The wound swabs consistently grew coagulase negative staphylococci, with occasional sparse isolates of *Streptococcus viridans*. The implant was removed, the pocket was curetted and the cavity was

irrigated with vancomycin solution for 48 hours through an indwelling catheter. Erythromycin was administered orally for 2 weeks postoperatively. The *Streptococcus viridans* had disappeared from the cultures by the 3rd day, and the coagulase negative staphylococcus was absent from cultures after the 5th day. The wound healed and a Silastic® ear frame was reinserted uneventfully 3 months later.

Case 2

A 52-year-old male patient with rheumatoid disease underwent excision of the right lower end of ulna, and capping of the bone with a Swanson design Silastic® prosthesis. Wrist joint and extensor tendon synovectomies were performed at the same time. This patient was on steroids for severe bronchial asthma. The initial postoperative course was uneventful. Six weeks later he developed tender swelling over the ulnar head prosthesis. There was redness of the skin but there were no constitutional symptoms. The swelling was aspirated and turbid fluid was obtained. This yielded coagulase negative staphylococcus on culture, which was sensitive to flucloxacillin. Oral penicillin and flucloxacillin were started before the bacteriological results were available, and the flucloxacillin was then continued for 2 weeks. There was full resolution of the local signs, the prosthesis remaining in place. The functional result of the procedure was excellent.

Case 3

A 60-year-old man with rheumatoid disease affecting both hands and both knees underwent replacement arthroplasty of the metacarpophalangeal joints of the right hand, together with extensor tendon synovectomy and tendon repairs. Postoperatively, the index finger alone became acutely inflamed, and produced copious discharge from which a heavy growth of coagulase negative staphylococcus was cultured. The patient responded favourably to a 2 week course of oral amoxycillin and the local signs settled. The prosthesis remained in place and the functional results were favourable.

Prosthetic replacement in the upper limb

A retrospective review was carried out to assess the significance of coagulase negative staphylococcus infection in implant surgery in the upper limb (in hand, wrist and elbow joint replacements).

Between January 1983 and October 1985, 451 silicone polymer joint replacements were performed at Wexham Park Hospital, Slough, and the Canadian Red Cross Hospital, Taplow. Eight infections occurred and the causative organisms were:

Staphylococcus aureus	5
Coagulase negative staphylococcus	2
Inflamed, but no growth	1

The infection rate was 1.77%. All five prostheses with *Staphylococcus aureus* infection required eventual removal because of persistent clinical signs of infection. One patient in whom removal was delayed progressed to radiological evidence of osteomyelitis. Another patient had histological evidence of silicone synovitis in addition to a positive culture for *Staphylococcus aureus*.

In contrast, the cases which did not involve *Staphylococcus aureus* infection resolved satisfactorily with conservative treatment with splintage and antibiotics. The prostheses were not removed, and function was satisfactory.

Discussion

The importance of bacteriological cultures positive for coagulase negative staphylococci is still largely unrecognised. In our own Bacteriology Department such positive cultures were not regarded as significant. We made specific requests to have the staphylococcus reported only when we realised that this organism might behave as a pathogen in the presence of an implant.

In their review of infection after silicone prosthetic arthroplasty in the hand, Millender *et al.* (1975) included details of one patient who developed clinical signs of infection 24 hours after insertion of a silicone trapezium prosthesis. This was thought to be due to a streptococcus, but no organism was grown on culture. The patient was treated with intravenous and oral penicillin and the signs of infection settled. The prosthesis remained in place and all was well at follow-up 4 years later. The favourable outcome in response to antibiotics is similar to our experience with the two hand surgery patients in whom a coagulase negative staphylococcus was identified and treated. In our laboratory the coagulase negative staphylococcus would previously have been disregarded and the cultures would have been regarded as negative. It is possible that in other laboratories, too, the coagulase negative staphylococcus is being ignored because it is not thought to cause infection.

Attention has already been drawn to the possibility that low grade infection with coagulase negative staphylococci may be significant in the aetiology of breast capsule formation after augmentation with silicone polymer implants. The coagulase negative staphylococcus may be responsible for persistent effusions in replacement arthroplasties of the hand in the absence of other classical

signs of bacterial infection. Such effusions may previously have been ascribed to a "flare-up" of rheumatoid disease and inappropriately treated with local steroid injections.

Turck and Stamm (1980) have suggested that strains of *Staphylococcus epidermidis* are particularly likely to cause infection in the presence of certain prosthetic implants because of their unique ability to adhere to the surfaces of the prostheses, for example CSF shunts in hydrocephalic patients (Shurtleff *et al.*, 1974) or breast prostheses (Marion, 1984; Pollock, 1984). *Staphylococcus epidermidis* infection may be extremely difficult to eradicate if the prosthesis has a rough surface, such as a polyurethane foam coating. Marion (1984) expressed serious reservations about the use of such prostheses, and this concern was supported by Pollock (1984) who reported *Staphylococcus epidermidis* infection around a polyurethane-covered breast implant. In spite of surgical drainage and removal of the implant the infection persisted and "removal of all the polyurethane covering was impossible". Blue (1985) has recently reported that three strains of *Staphylococcus epidermidis* were isolated from purulent fluid within the outer lumen of a double lumen breast prosthesis in a patient with a capsular contracture following augmentation mammaplasty.

In our three cases of coagulase negative staphylococcus infection, two patients with effusions responded to aspiration and specific antibiotic treatment alone, whilst the third patient developed a discharging sinus in the ear and required removal of the prosthesis before healing could occur. Archer *et al.* (1978) have reported successful control of *Staphylococcus epidermidis* infections in patients with prosthetic valve endocarditis and CSF shunt infection with combination antibiotic therapy, without removal of the prosthesis. We have used the local instillation of vancomycin solution to eradicate infection in one case when the prosthesis was removed, though oral antibiotics chosen on the basis of bacterial sensitivities have been satisfactory in controlling infection without removal of the prosthesis in two patients following hand and wrist implant surgery.

Acknowledgement

We are grateful to our colleagues Mr M. N. Saad and Mr D. M. Evans for kindly allowing us to include their patients in this report, and to Dr Hilary Andrews for bacteriological advice.

References

Archer, G. L., Tenenbaum, M. J. and Haywood, H. B. (1978). Rifampicin therapy of *Staphylococcus epidermidis*. Use in infections from indwelling artificial devices. *Journal of the American Medical Association*, **240**, 751.

Blue, A. I. (1985). *Staphylococcus epidermidis* and infection following augmentation mammaplasty (Letter). *Plastic and Reconstructive Surgey*, **76**, 969.

Burkhardt, B. R., Fried, M., Schnur, P. L. and Tofield, J. J. (1981). Capsules, infection and intraluminal antibiotics. *Plastic and Reconstructive Surgery*, **68**, 43.

Courtiss, E. H., Goldwyn, R. M. and Anastasi, G. W. (1979). The fate of breast implants with infections around them. *Plastic and Reconstructive Surgery*, **63**, 812.

Geraci, J. E., Hanson, K. C. and Giuliani, E. R. (1968). Endocarditis caused by coagulase negative staphylococci. *Mayo Clinic Proceedings*, **43**, 420.

Marion, R. B. (1984). Polyurethane-covered breast implant (Letter). *Plastic and Reconstructive Surgery*, **74**, 728.

Millender, L. H., Nalebuff, E. A., Hawkins, R. B. and Ennis, R. (1975). Infection after silicone prosthetic arthroplasty in the hand. *Journal of Bone and Joint Surgery*, **57**, 729.

Pollock, H. (1984). Polyurethane covered breast implant (Letter). *Plastic and Reconstructive Surgery*, **74**, 729.

Rudolph, R. and Woodward, M. (1983). Absence of visible bacteria in capsules around silicone breast implants. *Plastic and Reconstructive Surgery*, **72**, 32.

Shah, Z., Lehman, J. A. and Tan, J. (1981). Does infection play a role in breast capsular contracture? *Plastic and Reconstructive Surgery*, **68**, 34.

Shurtleff, D. B., Foltz, E. L., Weeks, R. D. and Loeser, J. (1974). Therapy of *Staphylococcus epidermidis* infections associated with cerebrospinal fluid shunts. *Paediatrics*, **53**, 55.

Turck, M. and Stamm, W. (1980). Staphylococcal infections. In *Harrison's Principles of Internal Medicine*, 9th Edition (K. J. Isselbacher, Ed.). New York: McGraw Hill Book Company.

Watanakunakorn, C. (1977). Changing epidemiology and new aspects of infective endocarditis. *Advances in Internal Medicine*, **22**, 21.

The Authors

P. T. L. Wong, FRCS, formerly SHO in Plastic Surgery, Wexham Park Hospital. Now Consultant Plastic Surgeon, Sarawak General Hospital, Kuching, East Malaysia.

Dalia V. Nield, FRCS(E), Registrar in Plastic Surgery, Wexham Park Hospital.

C. T. K. Khoo, FRCS, Consultant Plastic Surgeon, Wexham Park Hospital.

Requests for reprints to: Mr C. T. K. Khoo, FRCS, Department of Plastic Surgery, Wexham Park Hospital, Slough, Berkshire.