TOTAL PROSTHETIC REPLACEMENT OF A HUMERUS FOR CHRONIC OSTEOMYELITIS WITH A PATHOLOGICAL FRACTURE

REPORT OF A CASE

SHIGENORI YOSHIMOTO and HIROYUKI KANESO, TAKADA CITY and MASATAKA TATEMATSU, NARA, JAPAN

From the Yoshimoto Hospital, Takada City, and Nara National Hospital, Nara

A case is reported four years after successful total replacement of the left humerus for chronic osteomyelitis of six years' duration, with an axillary sinus that had persisted despite repeated operations and more distally a pathological fracture that had failed to unite after bone grafting. The disability was such that the patient had requested amputation, but he returned to his previous work as a driver six months after the total replacement and there has been no recurrence of infection.

The treatment of chronic osteomyelitis presents many problems even today with modern refinements of chemotherapy. Especially when a long bone is extensively affected throughout its length, the infection may not subside despite repeated operations and antibiotics. In July 1973 prosthetic replacement of the entire left humerus was carried out in our clinic for a patient with severe disability from chronic osteomyelitis, an open sinus and a pseudarthrosis, a most satisfactory result being obtained. We have been unable to find a report of a similar case in the literature.

CASE REPORT

A man aged forty-two, a driver, developed osteomyelitis of the left humerus in 1967. In that year a sinus in the axillary region was curetted twice at another hospital but remained open. In 1968 further curettage and excision of this sinus was twice performed without effect. The earlier radiographs from this period are not available. In October 1969 he lifted a heavy package and a pathological fracture occurred at the junction of middle and lowermost thirds of the shaft. He was then admitted to our clinic.

On admission the patient's general condition was satisfactory and there was no pyrexia. The humerus was grossly deformed (Fig. 1) and radiographs showed a pseudarthrosis in the lower third with evidence of diffuse bone infection (Fig. 2). Pus from the axillary sinus grew *Staphylococcus aureus*. Chemotherapy was commenced (Cephalothin sodium 2 grams per day and Minocycline hydrochloride 200 milligrams per day), and five days later the upper focus was again curetted, this making a fifth operation. The bacterial culture soon became negative and the sinus closed. Chemotherapy (aminobenzyl penicillin 1 gram per day) was continued for a month after his discharge from hospital in December 1969 with the arm free.

The patient was readmitted in March 1970 when iliac bone grafts were applied to the pseudarthrosis, followed by a plaster cast. Culture of the local tissue was negative. In May 1970, however, the axillary sinus opened again and by October 1970 the bone grafts had been completely absorbed. Thereafter the symptoms flared repeatedly and discharge of pus from the sinus continued.

It became quite impossible for this patient to lead a normal kind of life and in July 1973 he urgently requested amputation of his left arm. When the grave disadvantages of losing a hand with excellent function were explained to him, the patient agreed to have prosthetic replacement of the entire humerus, which we now regarded as the equivalent of a sequestrum. A design was immediately put in hand by one of us (M. T.).

FIG. 1

A photograph taken in October 1969 with a probe in the axillary sinus, showing the amount of deformation permitted by the pseudarthrosis and the degree of wasting of the musculature of the upper arm.

The prosthesis comprised three main parts—one of titanium and two of high density polyethylene (Fig. 3). The reason for dividing the prosthesis in this manner was to facilitate its insertion into the tunnel formed mainly by triceps and biceps after resection of the humerus. The head of the assembled prosthesis had a channel for the passage of the long head of biceps; the plastic lower end was made bifid in order to allow improved coaptation with the ulna during movement of the new joint. Foramina were made in various places for the attachment of muscles.

Operation—Under cover of the same antibiotics as before, Henry's anterior approach to the shoulder joint and antero-lateral surface of the humerus was used to give access for complete resection of the humerus. The cortex showed

Dr Shigenori Yoshimoto
Dr Hiroyuki Kaneso

Yoshimoto Hospital, Noguchi 136, Takada City, Japan.

Dr Masataka Tatematsu, Director, Division of Orthopaedic Surgery, Nara National Hospital, Higashikidera 1-51, Nara City, Japan.

FIG. 2

FIG. 3

FIG. 4

Figure 2—A radiograph taken in October 1969 showing the pseudarthrosis and multiple foci of bone infection above and below it. Figure 3—Showing the total prosthesis in its component parts and then assembled, with a probe in the channel for the long head of biceps. Figure 4—A radiograph taken three years after the last operation showing the metallic part of the prosthesis with the artificial head of humerus riding high in the glenoid fossa.

FIG. 5

Photographs taken over three years after total replacement of the humerus, showing the range of active scapulo-thoracic and elbow movement, the much improved musculature of the upper arm. The sinus had remained healed and the patient was well satisfied with the result.

widespread erosions and marked thickening of the periosteum. The related muscles were fibrosed and densely adherent, in particular triceps and biceps, brachialis and brachioradialis. The radial nerve having been dissected out and carefully protected, the cicatrised tissues were widely

resected. The prosthesis was then inserted in appropriate anatomical position.

As noted by Packard (1973), the most difficult problems were the treatment of the long heads of biceps, the deltoid, the latissimus dorsi and the rotator cuff. The tendon of the long

head of biceps, having been divided low down, was drawn through the channel in the head of the prosthesis and repaired outside the new glenohumeral joint. The deltoid and pectoralis major were attached by steel wire to the front of the shaft of the prosthesis; latissimus dorsi and teres major were sutured to the posterior surface. It was found impossible to attach subscapularis, supraspinatus, infraspinatus and teres minor. A radiograph taken after the operation is shown in Figure 4.

Progress—The long incision healed by first intention and the track of the excised sinus closed almost at the same time. All antibiotics were discontinued after one month. Passive exercise began at four weeks and active exercise at six weeks. The further convalescence was uneventful and the patient returned to his former work as a driver in January 1974, six months after the operation.

Up to the present, over four years from the operation, there has been no sign of recurrence of infection. The overall shortening of the limb is 3 centimetres. Active movement of the upper arm is almost entirely scapulo-thoracic, the range being 50 degrees of forward flexion, 35 degrees of extension and 60 degrees of abduction (Fig. 4). Flexion of the new elbow joint is from 30 to 90 degrees. Pronation and supination are almost normal. The power of biceps and triceps is 4+ on the Medical Research Council scale, and with the function of the hand fully retained, almost all the activities the patient

requires for his work as a driver are possible. Thus he uses his left arm in a normal fashion both for steering and for control of the hand brake.

DISCUSSION

The insertion of foreign matter into an infected region is generally regarded as contra-indicated (Neer 1955). In the present case, however, the sepsis was controlled by complete resection of all infected bone and soft tissue and by chemotherapy.

It is imperative for the surgeon to explain the indications for total replacement of any kind to the patient and to obtain his understanding. In this case the patient himself strongly desired amputation of the arm and there was no problem.

Total replacement of the humerus is certainly not indicated for all cases of chronic osteomyelitis that resist operative treatment and chemotherapy. Nevertheless it offers a solution when the disability is exceptionally severe and when all the facilities required for a procedure of this radical nature are available.

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