A CASE OF REPLACEMENT OF THE UPPER END OF THE HUMERUS BY A FIBULAR GRAFT REVIEWED AFTER TWENTY-NINE YEARS

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In recent years, after resection of the ends of long bones, increasing use has been made of acrylic resins and stainless steel for replacement, to the exclusion of the bone-grafting procedures described by earlier workers.

Rovsing (1910), after resecting the proximal two-thirds of the humerus for round-cell sarcoma in a man aged twenty-six, used a graft of the proximal end of the fibula to replace the defect. Two months after operation the patient was said to have free passive movements and to be able to feed himself. Albée (1915) advocated the use of tibia or fibula to replace the proximal end of the humerus or femur removed for benign new growths, and supported this by describing Murphy's case of a girl aged ten with osteitis fibrosa cystica of the upper two-thirds of the humerus. The whole of this area was resected and replaced by a transplant from the tibial crest, placed within the periosteal tube of the humerus. Almost complete regeneration of the humerus had occurred within eight months after operation. Morison (1914) used a fibular graft to replace the upper two-thirds of the shaft of the humerus, excised for chondrosarcoma. In this case the head of the humerus was retained, but failed to unite to the proximal end of the graft. In spite of this the patient was able to abduct the arm 90 degrees three years after the operation. Skillern (1920) described the case of a girl of seventeen in whom he had excised the upper two-thirds of the humerus for osteogenic sarcoma and replaced it by fibula, but there was no follow up. A further case was reported by Behrend (1930) in a woman of fifty with chronic diffuse osteomyelitis involving the upper two-thirds of the humerus: a year after operation she had a good range of movement. The longest follow-up recorded was that of Schaufler (1926) who reported the case of a girl of fifteen who was treated by fibular transplantation for bone loss from septic arthritis of the shoulder. Five years later she was married and able to care for her house and children.

German workers performed much pioneer work on joint transplantation and arthroplasty using both autografts and homografts during the early part of this century. Borelius (1914) performed the operation for giant-cell tumour in a man aged twenty-five who had a good range of movement four and a half months later, though the deltoid was atrophic. Lexer (1925) undertook fibular replacement of the upper humerus on four occasions with excellent functional results. He illustrated this by a radiograph showing a soundly united fibular graft, three months after operation, but he did not report the follow-up of his cases in detail.

Fibular grafts have been used frequently in recent years for the replacement of radial and tibial defects (Hey Groves 1917, Eikenbary 1928, Miller and Phalen 1947), but there are few reports of their use in the replacement of the humerus.

CASE REPORT

A railway worker aged nineteen was admitted to the charge of Mr John Struthers at the Royal Infirmary, Edinburgh, in December 1929. He complained of increasing pain and stiffness in the right shoulder region during the six months before admission. On examination, there was a rounded swelling which appeared to involve the head and upper two inches of the shaft of the humerus. The radiological appearance was that of giant-cell tumour involving the head of the humerus. Biopsy confirmed the diagnosis of giant-cell tumour, but the histologist suggested that the tumour was "not entirely benign."
At operation on December 26, 1929, the shoulder joint and upper shaft of the humerus were exposed through an incision in the delto-pectoral cleft. Six inches of the proximal end of the humerus were resected, with preservation of the deltoid insertion. A corresponding length of the head and shaft of the right fibula was removed; the lower end of this graft was fitted
securely into the medullary cavity of the humerus, and the articular aspect of the head lay against the glenoid cavity. The joint capsule was not sutured. The shoulder was immobilised in a plaster spica with 90 degrees' abduction for four weeks. The plaster was then replaced by a poroplastic splint which held the arm in slight abduction, but permitted forearm and wrist movement. Active abduction was not permitted "for a considerable time," but it was noted in 1932 that he was able to abduct the arm to 90 degrees, and although he had a small discharging sinus he was working as a taxi driver.

Present condition—The opportunity to assess the patient's present condition arose when he was readmitted to the Royal Infirmary in January 1958 for excision of a semilunar cartilage. He now drives a three-ton lorry and handles heavy loads without difficulty. A small sinus has persisted (Fig. 1), but is kept clean with soap and water. Powerful abduction and flexion at the shoulder joint are possible to 130 degrees (Fig. 2). Medial rotation is full, but there is 20 degrees' restriction of lateral rotation. Radiographs confirmed that there is a fair range of scapulo-humeral movement, though the transplanted fibular head lies in front of the neck of the scapula (Fig. 3). There has been considerable thickening of the graft distal to the head. A small sequestrum is present on the lateral side.

DISCUSSION

This twenty-nine-year follow-up after resection of the proximal end of the humerus with fibular replacement supports the claims made by Lexer and others as to its value. The cases recorded in the literature were not followed up for a period long enough for a true assessment of the results. The longest follow-up was that of Schaufiller (1926) whose patient was able to perform all her household duties satisfactorily five years after operation.

The present range of application of the operation is probably small. Early workers were prepared to undertake local resection and grafting for certain early cases of malignant tumours of bone (Byrne 1917), a procedure which would not be contemplated today. Furthermore, some of the reported cases were performed for chronic osteomyelitis, a condition which is now much less common. Perhaps the most important field of application is in the treatment of giant-cell tumour of bone. The decision to carry out a local resection would be influenced by such factors as were indicated by Campbell (1949), who advised resection 1) when the functional disability would be slight (as in the upper fibula, metatarsals, the head of the radius) and 2) when bony destruction was so extensive that complete curettage was not possible. It would also depend upon the biopsy findings. Geschickter and Copeland (1949) stated that resection should be reserved for recurrence of the tumour after curettage and cauterisation.

The technique of the operation is well described in the orthopaedic text-books (Campbell 1949). It is recommended that the insertion of the biceps femoris into the head of the fibula should be preserved with the graft, so that the shoulder cuff tendons may be sutured to it. This was not done in the patient reported here, and it is to be noted that the head of the fibula has failed to remain in the glenoid cavity. In spite of the persistent dislocation, the functional result has been excellent and the patient has not had to restrict his activities.

Choice of material for replacement—If replacement is contemplated after resection of the proximal end of the humerus a choice has to be made between a prosthesis and a bone transplant. Acrylic resin has on one occasion been used recently in this department to replace the proximal end of the humerus invaded by a giant-cell tumour which had recurred after radiotherapy. The prosthesis remained in good position within the glenoid cavity, but the patient did not regain any scapulo-humeral movement. The excellent functional result obtained in the present case would suggest that fibular replacement should always be considered when resection of the proximal half of the humerus is contemplated.
SUMMARY
1. A case of giant-cell tumour of the proximal end of the humerus treated by resection and fibular grafting twenty-nine years ago is reported. An excellent functional result has been maintained.
2. The literature is reviewed and the results claimed by earlier workers are noted.
3. The present field of application of the operation is probably in cases of advanced or recurrent giant-cell tumour of bone.

REFERENCES
EIKENBARY, C. F. (1928): Transplantation of the Entire Fibula to Replace the Tibia. Northwest Medicine, 27, 284.
GROVES, E. W. Hey (1917): Methods and Results of Transplantation of Bone in the Repair of Defects Caused by Injury or Disease. British Journal of Surgery, 5, 185.

A FRACTURE PLATED BY SIR WILLIAM ARBUTHNOT LANE IN 1912
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A few months ago an active gentleman of seventy-seven years attended hospital complaining of a "tennis elbow" syndrome. He stated that he had had an elbow fracture treated by Sir William Arbuthnot Lane as a private patient at Guy’s Hospital in 1912, and produced sepia prints showing the fracture before and after treatment by plating (Fig. 1). The former print was clearly marked with the date (September 25, 1912) and with the name of Sir Arbuthnot Lane.

The patient had had no further trouble with the elbow until recently when he developed symptoms of "tennis elbow," with marked tenderness over the lateral epicondyle. Elbow and forearm movements were full. A new radiograph showed very minor arthritic change in the elbow and almost complete disintegration of the distal halves of the screws (Fig. 2).