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The role of the fibula head flap for joint reconstruction after osteoarticular resections



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Summary *Introduction and aim:* Endoprosthetic reconstruction is considered the mainstay of limb salvage in periarticular bone tumours. However, this procedure has limited durability especially when performed in young patients. The free fibula head flap including the proximal articular surface represents one option for hemiarthroplasty reconstruction. The aim of this study was to investigate the role of the fibula head flap for joint reconstruction after osteoarticular resections.

Patients and methods: All patients who underwent hemiarthroplasty procedures between 2000 and 2006 using the free fibula head flap were included in the study. Functional assessments were performed using the American Musculoskeletal Tumor Society (AMTS) classification.

Results: There were five males and two females (mean age: 22.6 ± 15.9 years). Five patients underwent reconstruction following resection of malignant bone tumours and two for chronic osteomyelitis of the distal humerus. In three patients, the fibula was used for distal radius and wrist joint reconstruction, and the remaining four patients for reconstruction of the distal humerus and elbow joint. A vascularised growth plate transfer based on the lateral geniculate vessels was performed in two patients. A technetium-bone scan confirmed viability of all flaps 10 days after surgery, and radiographic bony union was confirmed on average 5 months following surgery. There were no complications with the recipient or donor site after a median follow-up of 71 months (range: 12 months to 10 years). All patients achieved reasonable return of function and were able to perform all activities of daily living.

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Conclusions: We demonstrate that the hemiarthroplasty procedure using the free fibula flap with its proximal head is a safe procedure with good functional results. Performing autologous arthroplasty using a free fibula head flap may be a promising alternative to an endoprosthesis or alloplastic reconstruction with a low risk of complications and morbidity.

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Endoprosthetic reconstruction is the most common means of reconstruction in limb-preserving surgery (LPS) for peri-articular bone tumours.^{1–4} However, it has limited durability especially when performed in children and young adults secondary to failure of growth. This results in a cosmetically unacceptable result due to limb length discrepancies (LLDs) and also angular deformities in the forearm because of the two-bone construct.^{5,6} The free fibula head flap is suitable for hemiarthroplasty procedure since it can be harvested with the proximal articular surface (the proximal tibial–fibular joint). The fibular head can be utilised to reconstruct the joint surface, and in children, the fibular head would also encompass the growth plate allowing for continued limb growth and remodelling of the joint.⁷ Since its description, the free fibula flap is becoming more popular for LPS following oncological resection of long bones.^{8–10} Now, the free fibula flap is emerging as an option for reconstruction of osteoarticular defects such as the distal radius and wrist joint and the distal humerus and elbow joint that can simultaneously restore function and physiologic growth.

In these anatomic sites, it is not always possible to reconstruct such a deformity with non-vascularised autografts or allografts. While there are reports of using expandable endoprostheses, there are also potential risks of using an endoprosthesis.^{11,12} We hypothesise that following surgical resection of the distal radius or humerus, especially in children, reconstruction may be optimally performed with a vascularised free fibula head flap. Such a graft has the potential for growth and contains an articular surface similar to the original joint that can provide an effective joint surface.^{13–16}

Methods

Between 2000 and 2006, a total of seven free vascularised fibula head flaps were performed for hemiarthroplasty reconstruction at our institution. Patient medical records were reviewed for demographics, operative notes, postoperative function and complications. Radiographic evaluation of the reconstructed limb was performed to evaluate callus formation and bony union. A physiotherapy regimen was adjusted according to the structural stability. The range of motion and stability of the wrist joint were evaluated in three patients who underwent reconstruction of the distal radius. In the four patients who underwent humeral joint reconstruction, the AMTS classification was utilised to assess postoperative function.¹⁷ Functional assessment was performed 6 months following reconstruction. An Allen's test was performed in all patients prior to reconstruction and demonstrated normal perfusion through an intact palmar arch.¹⁸

Surgical technique

All operations were completed using a two-team approach in conjunction with orthopaedic surgery either following resection of the tumour or following debridement of osteomyelitis. The free fibula head flap was harvested as a pure osseous flap in five patients (Figure 1) and as an osteocutaneous free flap in the remaining two patients. In the patients undergoing distal radius reconstruction, the fibula flap was secured using plating and/or an intramedullary rod. Patients were immobilised in a plaster case for a minimum of 3 months to allow for bony union. Patients who underwent humeral elbow joint reconstruction were placed into external fixation for 3 months, followed by an elbow brace for an additional 6 months following the removal of the external fixator.

Results

Patients

There were five males and two females (mean age: 22.6 ± 15.9 years). Five patients had a primary bone tumour (osteosarcoma: $n = 2$; Ewing's sarcoma: $n = 1$; and giant cell tumour: $n = 1$). Two patients had a severe chronic osteomyelitis of the distal humerus following upper limb trauma. All patients with osteosarcoma received systemic chemotherapy (pre- and postoperative), and the patient with Ewing's sarcoma also underwent neoadjuvant radiation therapy (Table 1). The free fibula head reconstruction was performed in an immediate fashion for the two patients undergoing resection for an osteosarcoma. The remaining five patients underwent reconstruction in a staged fashion. Of the three oncologic patients who underwent delayed reconstruction, the free fibula head flap was performed at a median of 14 months (range: 7–18



Figure 1 Free fibula head flap: pure osseous flap.

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