POSTER 60

Function following isolated free fibular glenohumeral fusion for paediatric proximal humeral sarcoma

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Background:
Multiple types of reconstruction have been employed for proximal humeral sarcoma. Preservation of a mobile glenohumeral joint by hemiarthroplasty or bone graft is associated with complications such as anterior instability, need for revision, and poor shoulder elevation when a functional deltoid cannot be preserved. Fusion of the glenohumeral joint facilitates reliable scapulohumeral motion, but the durability of allograft for this purpose remains a challenge when considering the longevity of paediatric survivors. Composite allograft/vascularised fibular autograft has been used to combine initial structural integrity with long-term durability, but it remains unclear whether an isolated vascularised fibular graft is sufficient, especially in paediatric patients.

Purpose:
We asked whether glenohumeral joint fusion with an isolated vascularised fibula results in sufficient stability and satisfactory functional outcomes in paediatric patients undergoing resection of proximal humeral sarcoma with sacrifice of the axillary nerve or deltoid muscle.

Methodology:
A retrospective review was conducted of paediatric patients at our institution that have undergone proximal humeral resection for sarcoma and glenohumeral fusion with an isolated free fibular transfer. In all cases, a subacromial plate was used to span the fusion and latissimus dorsi was transferred to function as an external rotator. Patient demographics, tumour characteristics, oncological treatment, surgical treatment, complications, and post-operative course were collected.

Results:
Nine patients (aged 6 – 15 years, 56% male) with sarcoma of the proximal humerus (8 osteosarcoma, 1 Ewing's sarcoma) underwent glenohumeral fusion using an isolated vascularised fibular free flap. All nerves except for the axillary nerve were preserved. Mean fibular length was 19.3 cm. One patient is deceased. Mean follow-up time was 18 months. All fibulae survived and demonstrated proximal and distal bony fusion. There were no fractures, suggesting mechanical sufficiency. Mean postoperative active range of motion was: shoulder flexion 58°, abduction 48°, external rotation 8° (beyond neutral); internal rotation hand to abdomen; elbow flexion 132° and extension -11°. Paediatric Toronto Extremity Salvage Scores were consistent with independent daily function. One patient developed transient neuropathic pain, two patients experienced transient radial nerve dysfunction, and two patients had surgical site infection (one requiring operative intervention). There were no shoulder skin flap problems and no donor site complications.

Conclusions:
Children with proximal humeral sarcoma undergoing free fibular transfer for glenohumeral fusion demonstrate excellent function and minimal complications. The scapulothoracic range of motion achieved rivals that of other reconstructions and living bone reconstruction has the potential benefit of very long-term durability in paediatric survivors.