Journal of Plastic, Reconstructive & Aesthetic Surgery (2014) 67, 81—86

JPRAS
An International Journal of Surgical Reconstruction
www.JPRASurg.com

Shoulder silhouette and axilla reconstruction with free composite elbow tissue transfer following interscapulothoracic amputation☆

Georgios Koulaxouzidis*, **Filip Simunovic**, **G. Björn Stark**

Department of Plastic and Hand Surgery, University of Freiburg Medical Centre, 79106 Freiburg, Germany

Received 19 April 2013; accepted 6 October 2013

KEYWORDS
Interscapulothoracic amputation;
Forequarter amputation;
Free extremity flap;
Spare part surgery

Summary Interscapulothoracic amputation (ISTA) encompasses the removal of the upper limb, scapula and clavicle. As the reconstructive and oncologic limb-saving techniques improved, the indications for this formidable procedure decreased. However, it is still the appropriate procedure in cases with extensive oncologic or traumatic involvement of the shoulder girdle. Following ISTA, the surgeon is not only faced with a large defect but also with severe functional and aesthetic impairments. A solution to these problems is the immediate reconstruction with a free composite transfer from the amputated extremity. We successfully treated three oncologic cases and one traumatic case using this technique. The recipient vessels included the subclavian artery and vein in three cases and the internal thoracic vessels in one case. After a mean follow-up time of 4.5 years, two of the three tumour patients were free of recurrent disease. In all cases stable wound closure was achieved. Three out of four patients would opt for surgery again, in spite of the high occurrence of complications. One patient died after a 14-year event-free postoperative course. We conclude that the defect following ISTA can be successfully covered using a free composite tissue transfer of the amputated disease-free elbow and forearm, while simultaneously reconstructing the shoulder silhouette and axilla. This procedure reduces functional and aesthetic impairments and improves the quality of life.

☆ Part of this work was presented at the 42nd Annual Conference of the German Association of Plastic, Reconstructive and Aesthetic Surgeons (DGPRÄC), 29th September 2011 till 01st October 2011.

* Corresponding author. Tel.: +49 761 270 28170; fax: +49 761 270 25010.
E-mail address: georgios.koulaxouzidis@uniklinik-freiburg.de (G. Koulaxouzidis).

1748-6815/$ - see front matter
http://dx.doi.org/10.1016/j.bjps.2013.10.040

Interscapulothoracic amputation (ISTA, forequarter amputation) was first performed in 1808 by Ralph Cuming and published in 1887 by Paul Berger in a classic description of an anterior approach to ISTA.[1,2] In 1922, Littlewood described a posterior approach to ISTA and since then several modifications have been published. With the development of microsurgical techniques and multimodal therapy approaches leading to advances in limb-sparing oncologic surgery, the indications for ISTA have decreased. At the present time, it is performed only in rare cases of large tumours infiltrating the proximal part of the arm, shoulder and brachial plexus. In a large, retrospective, single-centre analysis of sarcoma patients, 2.3% were treated by ISTA.[3] In these patients, this mutilating operation allowed for a curative resection of the tumour. In a further group of patients suffering from advanced tumour disease with infiltration of the brachial plexus, tumour bleeding, ulceration, painful induration or even in massive chronic lymphoedema, ISTA was indicated as a palliative procedure.[4,5] The traumatic amputation of the whole upper extremity is a life-threatening injury and a seldom occurrence in the Western industrial nations.

Following ISTA, patients display the stigmatising 'gothic arc' chest. The loss of the shoulder silhouette renders wearing clothes difficult. It becomes difficult to change body position, and secondary spinal deformities develop. The difficulty of fixation of passive or myoelectric prostheses aggravates these problems, and 60% of these patients reject the upper limb prosthesis.[6] Phantom pain, affecting up to 87% of patients after ISTA, is another reason for prosthesis rejection.[3]

Local or free (osteo)myocutaneous flaps have been used for defect coverage following ISTA.[7,8] Adequate soft tissue coverage of bone and nerve reduces the incidence of phantom pain, but it does not resolve other aforementioned problems. The 'spare parts' concept that uses flaps from the distal unaffected part of the amputated extremity is an effective option for defect coverage. Large defects can be covered in this way, and even the stability of the thoracic wall can be restored by the radius or ulna in order to prevent a flail chest.[4,9–16]

In four cases, we used a composite free elbow tissue transfer to achieve reconstruction of the shoulder and axillary contour. We present our experience, discuss the indications and describe the operative technique, complications and outcomes.

Patients and methods

Between 1997 and 2010, four patients underwent reconstruction after ISTA with a free composite elbow tissue transfer at the Department of Plastic and Hand Surgery of the University of Freiburg Medical Centre. A retrospective chart review of the cases was performed with particular attention to patient demographics, indications, pathology, details of surgery, complications and outcomes.

Operative technique

The patients were positioned in a full lateral position. ISTA was performed with an anterior or posterior approach according to the location and extension of the tumour. The radiation-damaged soft tissue of the chest wall and back was generously resected. The perfusion of the extremity was preserved until the composite elbow vessels, as well as the recipient vessels, were prepared *in situ*. The hand was amputated at the distal forearm or wrist level (Figure 1). Respecting oncologic safety, the distal upper-arm soft tissue was circumferentially incised and the brachial artery and concomitant veins dissected for anastomosis. If indicated, frozen section analysis of representative soft tissue was performed. The subclavian artery and vein served as recipient vessels in three out of four cases. ISTA was completed and osteotomy of the humerus was performed at an above-elbow level after complete preparation of the graft. Bony fixation of the free composite elbow at the clavicle was performed either by plate (two cases) or by cerclage wire (two cases) osteosynthesis. The composite elbow transfer was osteosynthesised and anastomosed immediately. One arterial anastomosis is sufficient for perfusion of the flap, but a second venous anastomosis can augment the venous backflow capacity and provide additional safety. The shoulder contour was reconstructed using the olecranon and the 90° flexed elbow, and the axilla was recreated using the cubital skin crease.

Case reports

Case 1

A 46-year-old construction worker suffered a severe occupational accident as an auger amputated his left arm. Replantation was not possible, as the amputated part was massively crushed and contaminated with multiple fractures of the humerus. The elbow and adjacent parts of the brachial arm and forearm were spared relevant injuries. Immediate reconstruction of the shoulder contour by using the elbow as a free composite tissue transfer was performed. Bony fixation was achieved by plate osteosynthesis of the humerus to the clavicle and revascularisation by end-

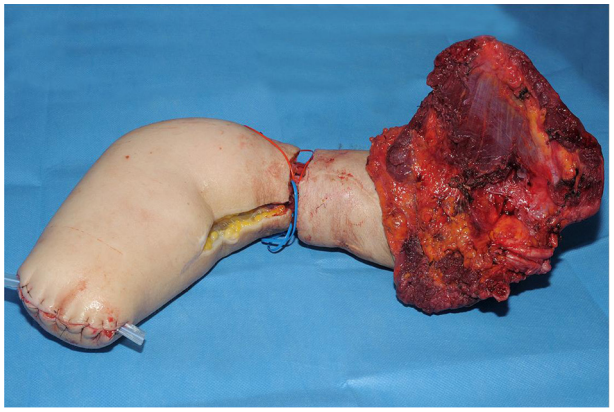

Figure 1 Picture shows the amputated right upper extremity after ISTA. The loops mark the brachial artery and vein as recipient vessels. To the right of the marked vessels is the shoulder girdle containing the tumour.