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CASE REPORTS

Free allogeneic muscle transfer for cranial reconstruction

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SUMMARY. An allogeneic muscle transfer was used to cover a large cranial defect in one of a pair of craniopagus twin separated a decade ago. Both separated twins died, 7 months apart, with the twin that had received the transfer dying first. The cause of death was generalised cytomegalovirus infection. An autopsy showed extensive brain necrosis caused by vascular insufficiency, a result of the abnormal vascular anatomy at birth. The muscle allograft showed no signs of rejection. Progress in immunosuppressive treatment over the last decade, which has enabled successful allogeneic nerve grafts and composite-tissue transplantations, might make muscle transplantation for the coverage of large defects, with and without functional demands, feasible in the future. © 2002 The British Association of Plastic Surgeons

Keywords: allogeneic muscle transplant, coverage of large defect, craniopagus twins, immunosuppressive therapy.

Case report

In 1990, after extensive neuroradiological investigations, neurosurgeons at the University Hospital of Vienna separated a pair of vertically conjoined craniopagus twins aged 3 years (Fig. 1).[1] In the first 2 years of their lives, tissue expanders had been implanted to generate enough soft tissue to reconstruct the craniums of both children after separation; however, this procedure failed because of infection and necrosis, and the expanders had to be removed.

After separation, the brain of one of the twins could be covered by an autologous tissue transfer. In the other twin, the skin flap used to cover the brain necrosed because of vascular problems. The enormous defect resulting from flap necrosis was temporarily covered with foreign material. The children were too small to allow the harvesting of adequate autologous tissue to cover the defect, so an allogeneic tissue transplant was required. With the approval of the local ethics committee, we took tissue from one of the twins' seven siblings, a 17-year-old sister with HLA antigen matching.

The cranium was reconstructed using tantalum nets and bars, to which frozen autologous bone was applied (Fig. 2). This was covered with free latissimus dorsi and serratus anterior muscle flaps harvested from the patient's sister (Fig. 3). An end-to-end microvascular anastomosis to the facial artery was performed, together with an end-to-side anastomosis to the external jugular vein. The well-vascularised muscle, on which no functional demands were placed, was covered with autologous split-thickness skin grafts. The muscle and skin healed uneventfully (Fig. 4).

Immunosuppressive therapy consisted of intravenously administered cyclosporine A at an initial dose of 5 mg kg^{-2} body weight, with the dose adjusted to maintain blood levels of the drug in the range 70–100 mg ml^{-2}, as determined by the monoclonal ARI method.[2] A short regimen of rabbit anti-T-lymphocyte globulin was administered at a dose of 3 mg kg^{-2} body weight, beginning 2 days before surgery and continuing for 3 days after surgery. In addition, human immunoglobulin (Cytotec, Biotest, Dreieich, Germany) was also administered, to reduce the risk of cytomegalovirus infection, at a dose of 4.5 g twice a week, beginning 3 days before surgery and continuing for 8 weeks after surgery.

Successive biopsies of the transplanted muscle, taken 3 weeks and 3 months after transfer, revealed the following: the superficial layers of the squamous cells were normal, with no cellular changes or inflammatory infiltrates; the subepithelial connective tissue showed dense, mainly perivascular, infiltrates and slight oedema; and there were no vascular lesions in any of the biopsies. In the entire postoperative period, only slight degenerative cytoplasmic changes were observed, with some minimal cell necrosis. All other muscle cells were normal.

The patient died 4 months after being separated from his twin. The cause of death was generalised cytomegalovirus infection with multi-organ involvement, notably the lung. The ubiquitous presence of an inflammatory infiltrate of lymphomononuclear cells in all organs, including the transplanted muscle, was considered to be concomitant with cytomegalovirus infection.

An autopsy showed that the tantalum net and the bone were firmly covered with connective tissue, and tissue was found in the gaps between the bone grafts and in the holes of the net. Thus, all the parts used to cover the cranium were firmly attached to each other. There were no necrotic patches in the reconstructed area. Macroscopically, the transplanted tissue appeared vital (Fig. 4).

Discussion

The technical demands of allogeneic muscle transplantation are no greater than those of autologous muscle transfer. The major problem associated with allografts is the need for immunosuppressive therapy, which has significant side effects. Since this operation was performed, a decade ago, progress has been made in this area. Thanks

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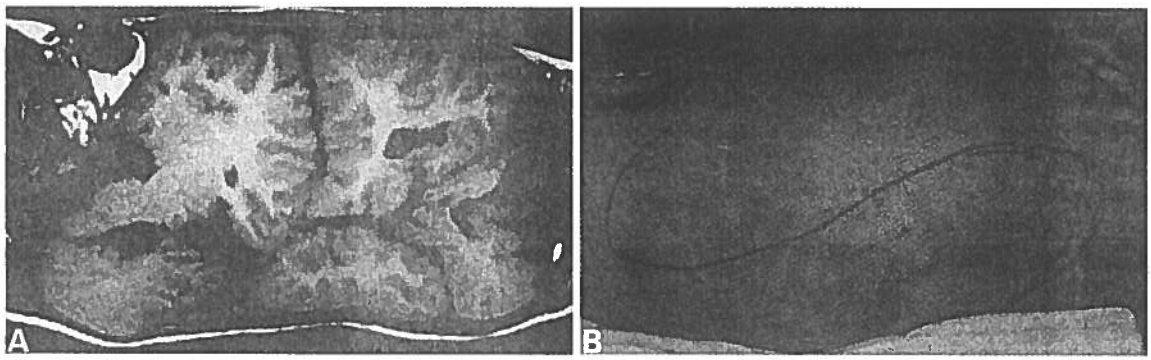

Figure 1—Vertically conjoined craniopagus twins: (A) preoperative CT scan; and (B) preoperative markings on the twins' head; note the scars in the temporo-occipital region resulting from the removal of tissue expanders.

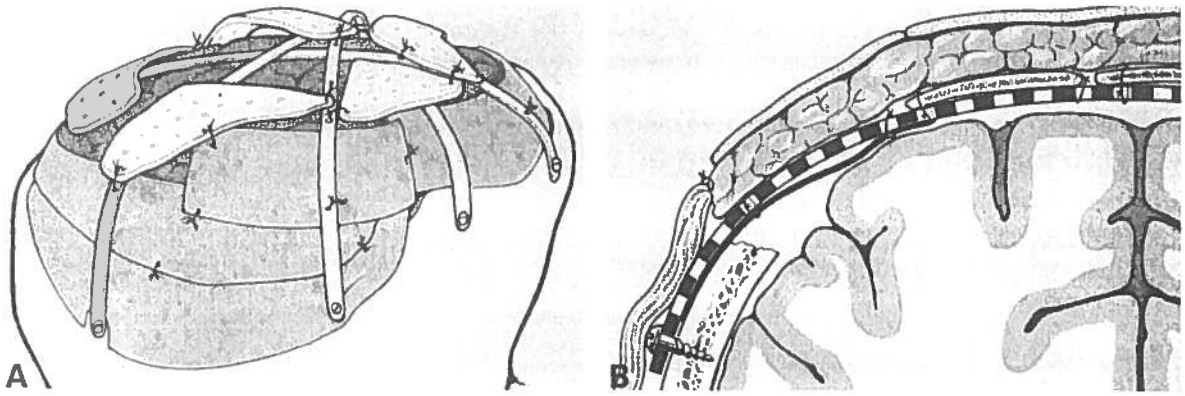

Figure 2—Reconstruction of the skull using a tantalus net, plates and autologous bone: schematic representations of (A) the right occipito-parietal region and (B) the frontal view.

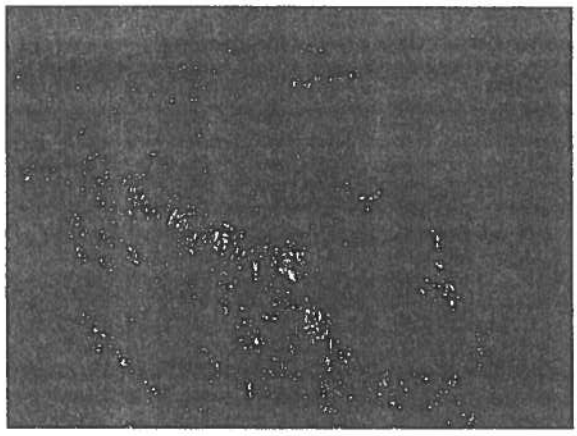

Figure 3—Allogeneic latissimus dorsi and serratus anterior muscle flaps, together with the blood vessels.

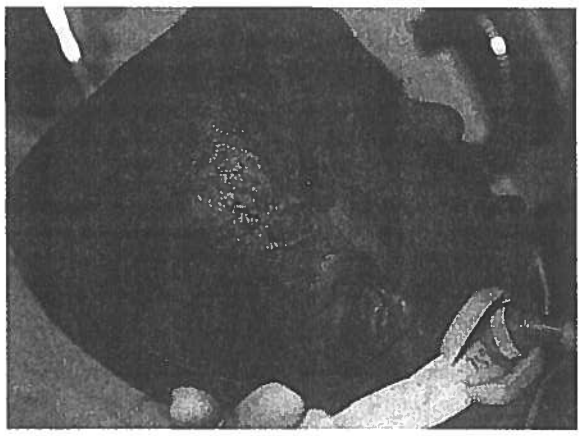

Figure 4—The allogeneic muscle and autologous skin transfers had completely healed 4 months after the separation of the craniopagus twins.

to these developments, the successful transplantation of allogeneic nerve tissue, and even of composite tissues such as hands, has become feasible.[3,4] It is expected that allogeneic muscle transplantation for the coverage of large defects, with or without functional demands, will become more common in the future.

A final comment is appropriate here. Both twins died, 4 months and 11 months, respectively, after separation. Autopsy showed extensive necrosis of the brain, resulting from inadequate vascularisation. Separation of craniopagus twins is limited by the vascular anatomy.

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Cross-limb vascular shunting as an auxiliary to major limb revascularisation

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SUMMARY. A 40-year-old male motorcyclist suffered a near-total amputation of his right foot. His limb was successfully salvaged with the aid of a cross-leg vascular shunt. Temporary arterial flow from the contralateral limb was transmitted via a pressure monitor tube to perfuse the avulsed part. This allowed the surgeon to carry out unhurried wound debridement, dissection of vital structures and skeletal fixation. The cannulation port was placed well distal to the proposed definitive anastomosis, to reduce damage to the endothelium. This procedure could be a valuable adjunct in major limb replantation, particularly in cases of prolonged ischaemia. © 2002 The British Association of Plastic Surgeons

Keywords: cross-limb bypass, major limb revascularisation, ischaemic insult.

Replantation or revascularisation of a limb is a race against time. A proximal extremity amputation, with its significant muscle content, is particularly vulnerable to an ischaemic insult. Cooling may help to delay irreversible damage; however, rapid restoration of the blood supply to the amputated part remains critical for limb salvage. Nunley et al suggested the use of a Sundt carotid shunt or a Pudenz peritoneal shunt as a temporary bridge between severed vascular ends to provide a rapid restoration of limb circulation.[1] However, the exploration of traumatised vessels within the mangled tissue may be difficult, and the temporary shunt must be withdrawn during definitive vascular repair, resulting in a further ischaemic insult to the injured limb.

Because of these drawbacks, we use the vessels of the contralateral limb to provide the inflow. Circulation is re-established more expediently, and there is no need to interrupt the shunting during the procedure.

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Case report

A 40-year-old male sustained a crush injury to his right leg in a motorcycle accident, which resulted in a near-total amputation of his right foot just above the ankle. He was seen in our accident and emergency department 4 h later. Examination revealed a compound comminuted fracture of the right ankle region (Fig. 1). The right foot was almost completely detached from the distal tibia, save for a few strips of tendon. The foot was cold and pale. There was no bleeding from the wound edge of the avulsed part.

The patient was taken to theatre for an attempted replantation. The dorsalis pedis artery of the traumatised foot and the contralateral posterior tibial artery were identified and connected with a piece of arterial pressure tubing (Fig. 2). The tube was equipped with two 'male connectors' and thus could be connected to an 18 Fr intravenous infusion catheter at each end. The target vessels were thus joined via a 'double-headed' conduit. The tube was filled with heparinised xylocaine solution (heparin 100 U ml^{-1} in 0.4% xylocaine). Vascular keepers were applied around the entry port to prevent the cannula from being dislodged. The keeper was made up of a vascular tape looped around a cannulated vessel and tightened using a vascular clamp or a haemostat. Profuse oozing from the wound edge and the return of a pinkish skin colour were seen 2 min after the vessels were connected. Venous drainage was provided by using