



# Hybrid Combined Flaps and Biomaterials for Preservation of Ischemic Limb Following Massive Ablation of Recurrent Sarcoma

Isao Koshima<sup>1\*</sup>, Shuhei Yoshida<sup>1</sup>, Shogo Nagamatsu<sup>2</sup>, Kazunori Yokota<sup>2</sup>, Shuji Yamashita<sup>3</sup>, Haruki Mizuta<sup>4</sup> and Dalia Tobbia<sup>5</sup>

<sup>1</sup>International Center for Lymphedema, Hiroshima University, Japan

<sup>2</sup>Department of Plastic and Reconstructive Surgery, Hiroshima University, Japan

<sup>3</sup>Department of Plastic and Reconstructive Surgery, The University of Tokyo, Japan

<sup>4</sup>Department of Plastic and Reconstructive Surgery, National Cancer Center (former Okayama University Medical School, Okayama), Japan

<sup>5</sup>Department of Plastic and Reconstructive surgery, Plastische Chirurgie am Klosterstern, Germany

## Abstract

A case with recurrent liposarcoma is described in where combined VRAMC flap and emergency free latissimus dorsi musculocutaneous flap as well as artificial hip joint-femur, and femoral vessels were successfully transferred for repair of massive anterior thigh defect. The concept of a hybrid combination with tissue transfers including biomaterials (bone and vessels) can preserve a limb with widely invasive recurrent sarcoma. Emergency free LDMC flap transfer with flow-through pedicle anastomosis is also important to prevent exposure of artificial vessels and bone. In addition, prophylactic LVA is also very important approach for the prevention of postoperative lymphedema as a serious complication after massive resection in the proximal thigh.

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### \*Correspondence:

Isao Koshima, International Center for Lymphedema, Hiroshima University Hospital, 1-2-3, Kasumi, Minami-ku, Hiroshima City, 734-8551, Japan, Tel/ Fax: +81-82-257-6985; E-mail: koshimaipia@gmail.com

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## Introduction

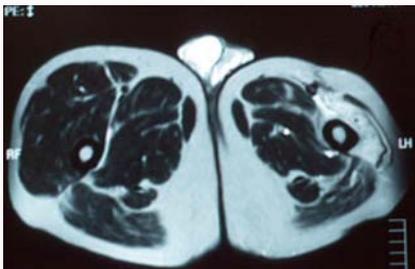
It is extremely difficult to salvage limbs with extensive recurrent sarcomas. The reason being, that the tumor extends to the bone and main vessel so the limb is usually amputated. A new concept such as chimera combined tissue transfer is necessary to make this difficult reconstruction possible. However, it is impossible to reconstruct the proximal portion of leg with even a chimera type one-stage repair because the widespread deficit usually involves important vessels, femur and femoral joints. In order to overcome this difficulty, hybrid type tissue reconstruction using biomaterials such as artificial joints and artificial vessels can be considered. We would like to report our success using this new hybrid concept to reconstruct complex defect following massive resection of recurrent cancer in the proximal thigh [1-4]. After the primary surgery, unexpected severe complications occurred but we are able to overcome them by performing a combination of reconstructive techniques detailed in this report.

## Case Presentation

A 52-year-old man presented with recurrent liposarcoma originating from the anterior aspect of the left proximal thigh. The proximal one third of the anterior thigh was already lost, and the invasive tumor had extended into the femoral vessels, femur bone and joint. The patient strongly desired preservation of the leg (Figure 1 and 2). Extensive and soft tissue resection was carried out to excise the recurrent sarcoma of the left thigh, resulting insubstantial loss of anterior compartment structures including the femoral artery and vein, femur joint. Resulting defect was repaired with combined rectus abdominis musculocutaneous flap and artificial vessels and metal joint for replacement of resected femoral artery and vein, the proximal femur and hip joint (Figure 3 and 4). The defect was repaired with combined rectus abdominis musculocutaneous flap and artificial vessels and metal joint for replacement of resected femoral artery, vein, and hip joint. The island rectus abdominis musculocutaneous flap was transferred as a split lateral half muscle. The resultant donor defect on the abdominal wall was covered with a mesh skin graft. Three days after the operation, congestion of the transferred flap occurred possibly due to postoperative tension in the sutured margin of the flap. Emergency free flap transfer was performed to salvage the artificial



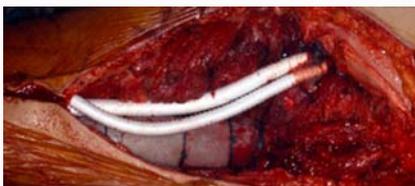
**Figure 1:** A 52-year-old man with a recurrent liposarcoma invading the femoral vessel and the hip joint.



**Figure 2:** CT shows previous resection of vastus lateral is muscle and tumor invasion around the femoral vessels and femur.



**Figure 3:** Hip joint was replaced with a metal joint.



**Figure 4:** Femoral vessels were also replaced with artificial vessels.



**Figure 5:** Right: Three days after surgery, rectus abdominis MC flap showed ischemic change. Left: Emergency LDMC flap was transferred to release the tension of the RAMC flap.

vessels and bone using free latissimus dorsi musculocutaneous flap. The pedicle vessels of this flap were anastomosed to the left deep



**Figure 6:** Schema of concept on hybrid combined flaps and biomaterials. Defect was repaired with four components including artificial vessels (G), hip joint, rectus abdominis MC flap (R), and a free LDMC flap (L) with flow-through vascular anastomosis to the deep circumflex iliac vessels (D).



**Figure 7:** One year and four months after the primary surgery. Both flaps and biomaterials had no problems.



**Figure 8:** Right and middle: One year and five months after surgery, early stage lymphedema was repaired with prophylactic LVA. Left: Three years after surgery, there are no complications.

circumflex iliac vessels with flow-through vascular anastomoses. The donor defect on the back was covered with a mesh skin graft (Figure 5 and 6). Postoperatively, the patient was able to walk with crutches at three months after surgery. One and half years after surgery, lymphedema at the level of left ankle appeared. This was caused by repeated extensive resection of left groin region. Therefore, under local anesthesia single lymphaticovenular anastomosis was established at the medial aspect of the ankle joint. Lymphedema subsided within six months without any physiotherapy or compression (Figure 7). Three years after the primary surgery, there was no tumor recurrence, no lymphedema, no donor site morbidity, no infection or exposure of the artificial materials (Figure 8).

**Discussion**

Defects in the proximal thigh region could be easily repaired with the use of an island rectus abdominis musculocutaneous flap [5-10]. However, preservation of extremities it is still challenging in cases

with recurrent sarcoma in limbs because compartment resection is frequently necessary including both soft tissues such as femoral vessels and femur-hip joint [11]. For reported extensive soft and hard tissue defect, a hybrid reconstruction was successfully performed using a rectus abdominis musculocutaneous flap with artificial vessels and bone with joint. In addition, emergency free flap was performed postoperatively due to insufficient circulation of the flap. Therefore, we advocated this novel concept of hybrid and combined chimera flap as a viable option for reconstruction of massive hard and soft tissue defects and for the preservation of ischemic extremities. We anticipate that this will be an ever more popular method in the future to manage similar reconstructive challenges. Based on our result, it is possible to combine chimera flaps and biomaterials for the reconstruction of massive tissue defects including bone, joint, and trunk artery. It is well documented that combined flaps and biomaterials can be unreliable for mandibular reconstruction due to a high risk of early postoperative exposed biomaterials even at two and half years after surgery. This leads us to conclude that combined flaps and biomaterials can safely be used to cover a wide tissue defects in the proximal thigh, and a concept that differs from the management of similar defects in the head and neck region. We anticipate that this concept will be further explored in the future.

### Emergency free flap

In this surgery, on the 3rd postoperative day, insufficiency of flap circulation due to excessive tension occurred. In such an event, early emergency free flap to alleviate tension is required. Regarding the choice of emergency flap, Latissimus Dorsi Musculocutaneous (LDMC) flap from the lateral chest may be optimal because the flap can be elevated in the supine position. Also, in this case, the recipient vessels were completely lost in the thighs, and only deep the Deep Circumflex Iliac Artery (DCIA) was left. Another advantage of LDMC flap is that T shaped pedicle can be raised, making a flow-through type vascular anastomosis possible. Leading to an increased chance of success even in such a difficult case with only a single available recipient vessel, it is possible to perform two vascular anastomoses with both anterograde and reverse flow. Flow-through LDMC flap is extremely useful as an emergency free flap [12]. Prophylactic lymphaticovenular anastomosis in the early stage of lymphedema was successful in this case. Twenty years ago, we first proposed this concept in the middle '90's, and now it has become a very popular concept for the prevention of lymphedema. Theoretical background of this concept comes from our first detection of early stage degeneration of smooth muscle cells within the lymphatic channels in lymphedema [13]. Prophylactic lymphaticovenular anastomosis is essential in early stage edema which would become severe edema. Preservation of smooth muscle cells within lymphatic channel is very important for prevention of severe edema.

### Multi-stage chimera issue transfer, the same recipient vessels

We already reported the concept of a chimeric transplant that has multiple tissues with one nutrient blood vessel. The tissue transplantation this time is a differs from the conventional chimeric concept, in that it transplants two tissues secondarily on a single source vessel. Another advantage is that a chimeric type reconstruction

of even somewhat large defects can be performed as a single stage procedure and in a relatively short time. We have already presented this technique as a concept of "Hub flap (multistage chimera flap)" in the Helsinki World Society of Reconstructive Microsurgery in 2011 [14]. Going forward, this will be a useful technique for the cosmetic and functional reconstruction of wide defects.

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