Cephalic Vein-Pedicled Radial Forearm Semi-free Flap: An Alternative When no Suitable Vein in Recipient Site for Free Forearm Flap

Lei Zheng^{1,2} · Zhonggen Dong³ · Jia Zheng¹

Received: 29 January 2015 / Accepted: 13 May 2015 / Published online: 19 May 2015
© Society of the Hand & Microsurgeons of India 2015

Abstract The risk of venous thrombosis is the main factor of free forearm flap necrosis. In some cases there is no suitable vein at recipient site to provide venous return of the free flap. In this report, two cephalic vein-pedicled radial forearm semi-free flaps were used as an alternative to resurface soft tissue defects in submaxilla and anterior cervical area. The two flaps survived uneventfully. The cephalic vein-pedicled radial forearm semi-free flap could be harvested with a long cephalic vein pedicle, and could be an alternative when there was no suitable or healthy recipient veins at recipient site.

Keywords Cephalic vein · Radial forearm flap · Reconstruction

Introduction

The risk of venous thrombosis is the main factor leading to the necrosis of free forearm flap. In radiation-related recipient site, the venous system is often not reliable. Microvascular reconstruction of head and neck defects can be extremely challenging in patients with a history of prior neck dissection and/or

irradiation [1]. In some cases there is no suitable vein at recipient site to provide reliable venous return of the free flap. Since Nakayama et al. used the cephalic vein as the drainage vein and as a pedicle other than free vein to reconstruct a left face defect, there was another reconstructive alternative [2]. There were some reports about using the semi-free forearm flap for pharyngeal-esophageal, head and neck reconstruction [3–5]. Bénateau et al. proposed to harvest the radial forearm flap using the cephalic vein as the drainage vein and as a pedicle to reduce the risk of venous thrombosis [6]. In this report, two cephalic vein-pedicled radial forearm semi-free flaps were used as an alternative to resurface soft tissue defects in submaxilla and anterior cervical area.

Surgical Technique

We planned to repair the defects with radial forearm free flap, but after the resection of the tumor we found that there was no suitable vein at recipient site as recipient vein. The artery at the recipient site was healthy and appropriate for microvascular anastomosis. The radial forearm free flap was not suitable in such condition, the surgical procedure was changed and the cephalic vein-pedicled radial forearm semi-free flap was used as an alternative. The harvest of the flap was carried out in the conventional way which was described in the literature [7]. The comitant veins of the radial artery were ligated. The cephalic vein was kept with the flap and used as the sole drainage vein. Some adipofascial tissue was left around the cephalic vein to offer mechanical support to prevent kinking of the long venous pedicle. The operation time was shortened by taking adipofascial tissue around the cephalic vein and avoiding skeletonizing the cephalic vein pedicle. The cephalic vein was dissected up to the deltopectoral groove. A subcutaneous tunnel was made in supraclavicular and anterior

✉ Lei Zheng
lzheng@kleinertkutz.com

¹ Department of Orthopedics, Henan Provincial People's Hospital, Zhengzhou 450003, People's Republic of China

² Christine M. Kleinert Institute for Hand and Microsurgery, the Kleinert Kutz Hand Care Center, and the Department of Surgery, School of Medicine, University of Louisville, 225 Abraham Flexner Way, Suite 850, Louisville, KY 40202, USA

³ Department of Orthopedics, the Second Xiangya Hospital, Central South University, Changsha 410011, People's Republic of China

cervical areas. The flap and the cephalic vein went through the subcutaneous tunnel to reach the recipient site. The radial artery was anastomosed under the microscope to the recipient artery. The donor site of the flap was closed by skin graft from the abdominal wall.

Case Report

Case 1

A 58-year-old man was diagnosed with squamous carcinoma in left submandibular area. After the first operation, the patient received radiation therapy. But 2 years later, the tumor came back. The patient suffered an enlarged palpable mass in left submaxilla. The patient was under general anesthesia in supine position. After resection of the tumor, the soft tissue defects with left mandible exposure were left. We planned to repair the defects with radial forearm free flap, but after the resection of the tumor we found that there was no healthy and suitable vein as recipient vein. So surgical procedure was changed and the cephalic vein-pedicled radial forearm semi-free flap was used as an alternative. The flap was designed in left forearm according to the shape of the soft tissue defects. The dimension of the flap was 9×5 cm (Fig. 1a). The cephalic vein was dissected up to the deltopectoral groove (Fig. 1b). The subcutaneous tunnel was made in supraclavicular area and anterior cervical area. The flap with the cephalic vein pedicle went through the subcutaneous tunnel to resurface the defects. The radial artery was anastomosed under the microscope with the artery at the recipient site. The donor site of the flap was closed by skin graft from the abdominal wall. The flap survived uneventfully (Fig. 1c). The donor site was free from complications.

Case 2

A 43-year-old man presented with soft tissue defects in left submaxilla and anterior cervical area after the resection of the squamous carcinoma and radical neck dissection (Fig. 2a). Before the operation the patient received radiation therapy. The patient was under general anesthesia in supine position. The radial forearm free flap was not used because of the absence of qualified recipient vein. The artery at the recipient site was healthy and appropriate for microvascular anastomosis. The conventional radial forearm free flap was not suitable in this condition. So the cephalic vein-pedicled radial forearm semi-free flap was adopted as an alternative. The flap was designed in the left forearm. The dimension of the flap was 13×6 cm. The cephalic vein was dissected up to the deltopectoral groove. The subcutaneous tunnel was made in supraclavicular area and anterior cervical area. The flap with the cephalic vein as the pedicle went through the

Fig. 1 a The dimension of the flap was 9×5 cm. b The cephalic vein was dissected up to the deltopectoral groove. c The flap survived uneventfully

subcutaneous tunnel to reconstruct the defects (Fig. 2b). The radial artery was anastomosed under the microscope with the artery at the recipient site. The donor site of the flap was closed by skin graft from the abdominal wall (Fig. 2c). The flap survived uneventfully (Fig. 2d). Through 9 months following up, there was no obvious soft tissue contracture in anterior cervical part.

Discussion

In the experimental rabbit model, it has been shown that after a single dose of radiotherapy, the patency of venous microanastomoses is reduced significantly, whereas the patency of arterial microanastomoses is not altered [8]. In a report involving 79 flaps, radiation reduces the chance of free flap

Fig. 2 **a** Soft tissue defects in left submaxilla and anterior cervical area. **b** The flap with the cephalic vein as the pedicle went through the subcutaneous tunnel. **c** The donor site of the flap 2 weeks postoperatively. **d** The flap survived uneventfully

survival by 4 %, whereas radiation together with chemotherapy given preoperatively reduce the chance by 46 % [9]. Burn, inflammatory changes after severe trauma, radical neck dissection can damage the vein at the recipient site too. In such conditions there will be no suitable or healthy vein at the recipient site, that makes the free flap a dilemma. The cephalic vein-pedicled radial forearm semi-free flap offers an alternative when there is no suitable or healthy vein at the recipient site. To EW et al. recommend the cephalic vein-pedicled radial forearm semi-free flap should be used more often in appropriate situations [10]. Kim KA et al. used cephalic vein in salvage microsurgical reconstruction in the head and neck, the long pedicle can be harvested to reach the mid-face or contralateral neck without undue tension [11]. Vasilakis et al. reported seven cases of head and neck reconstruction using cephalic vein transposition [12]. The cephalic vein transpositional graft is an effective technique for providing or augmenting venous drainage in free TRAM flap breast reconstruction, but venous anastomosis is essential [13]. The cephalic vein-pedicled radial forearm semi-free flap requires only one arterial anastomosis without venous anastomosis or venous graft. Safak T et al. transferred an arterialized cephalic venous flap from the anteromedial arm region to the neck [14]. The arterialized venous free flap is non-physiologic flap. Reports describing the use of arterialized venous free flaps reveal relatively high rates of flap failure resulting from venous insufficiency [15, 16].

A long cephalic vein pedicle can be harvested with the cephalic vein-pedicled radial forearm semi-free flap.

Compared with the cephalic vein pedicled upper arm flap, the cephalic vein-pedicled radial forearm semi-free flap could reach more distant site in head and neck. Compared with the pectoralis major or latissimus dorsi pedicled flap, the flap could reach the contralateral side of the neck [10]. The cephalic vein is located outside the radiation site, the cephalic-subclavian system is a high-flow, low-pressure system, which can offer sufficient venous drainage of the flap. Simplicity and efficiency of this technique make possible thinking about it even with existing receptors veins [3].

Acknowledgments We thank Ross Gibson for his help review and editing of the manuscript.

Compliance with Ethical Standards

Funding None

Conflict of Interest Lei Zheng, Zhonggen Dong, and Jia Zheng declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

1. Hanasono MM, Barnea Y, Skoracki RJ (2009) Microvascular surgery in the previously operated and irradiated neck. *Microsurgery* 29(1):1–7
2. Nakayama Y, Soeda S, Lino T (1986) A radial forearm flap based on an extended dissection of cephalic vein: the longest venous pedicle? *Br J Plast Surg* 39(4):454–457
3. Zapater E, Simón E, Ferrandis E, Vendrell JB (2001) Radial free flap with drainage through the cephalic vein dissected up to the deltoid region: a resource in the absence of receptor veins. *Acta Otorrinolaringol Esp* 52(7):617–620
4. Quilichini J, Benjoar MD, Hivelin M et al (2012) Semi-free radial forearm flap for head and neck reconstruction in vessel-depleted neck after radiotherapy or radical neck dissection. *Microsurgery* 32(4):269–274
5. Pierrel C, Bodin F, Schultz P et al (2015) Semi-free forearm flap for pharyngeal-esophageal reconstruction after radiation therapy. *Eur Ann Otorhinolaryngol Head Neck Dis* 132(2): 101–103
6. Bénateau H, Crasson F, Bencheman Y et al (2002) Contribution of the semi-free radial forearm flap for head and neck reconstruction. *Rev Stomatol Chir Maxillofac* 103(2):74–78
7. Soutar DS, McGregor IA (1986) The radial forearm flap in intraoral reconstruction: the experience of 60 consecutive cases. *Plast Reconstr Surg* 78(1):1–8
8. Krag C, De Rose G, Lyczakowski T et al (1982) Free flaps and irradiated recipient vessels: an experimental study in rabbits. *Br J Plast Surg* 35(3):328–336
9. Joe SA, Brown MT, Couch ME (1998) Microvascular free tissue transfer failure: the effects of radiation and chemotherapy. Fifth research workshop on biology, prevention and treatment of head and neck cancer. *Head Neck* 20(5):458
10. To EW, Wang JC (1999) Radial forearm free flap: hybrid version. *Plast Reconstr Surg* 104(4):1066–1069
11. Kim KA, Chandrasekhar BS (1998) Cephalic vein in salvage microsurgical reconstruction in the head and neck. *Br J Plast Surg* 51(1):2–7
12. Vasilakis V, Patel HD, Chen HC (2009) Head and neck reconstruction using cephalic vein transposition in the vessel-depleted neck. *Microsurgery* 29(8):598–602
13. Barnett GR, Carlisle IR, Gianoutsos MP (1996) The cephalic vein: an aid in free TRAM flap breast reconstruction. Report of 12 cases. *Plast Reconstr Surg* 97(1):77–78
14. Safak T, Akyürek M (2001) Cephalic vein-pedicled arterialized anteromedial arm venous flap for head and neck reconstruction. *Ann Plast Surg* 47(4):446–449
15. Klein C, Kovacs A, Stuckensen T (1997) Free arterialized venous forearm flaps for intraoral reconstruction. *Br J Plast Surg* 50(3): 166–171
16. Kovacs AF (1998) Comparison of two types of arterialized venous forearm flaps for oral reconstruction and proposal of a reliable procedure. *J Craniomaxillofac Surg* 26(4):249–254