Innervated Bilobed Radial Forearm Free Flap For Tongue Reconstruction

Parintosa Atmodiwirjo, Kristaninta Bangun, Siti Handayani,
Chaula Djamaloeddin, Eliza Nindita
Jakarta, Indonesia.

Background: Hemiglossectomy defects need reconstructions to restore normal functions and aesthetic outcomes. It is therefore prudent that well-planned reconstructive technique is needed for a good functional substitution for the defect.
Methods: This case report describes a 30 years old male who developed T2N1M0 squamous cell carcinoma of the left tongue. The patient underwent a tongue reconstruction following his hemiglossectomy involving floor of the mouth without mandibular resection
Result: The optimum method of reconstructing a major defect such as hemiglossectomy with floor of the mouth resection is best carried out by using microvascular free tissue transfer.
Summary: We conclude that the radial forearm free flap is good method for reconstructing major defects of the tongue. The radial forearm free flap is thin, can be raised without patient position change, has constant vascular anatomy, and provides an advantage in the aesthetic aspect at the donor site.
Key words: *Hemiglossectomy, free tissue transfer*

Latar Belakang: Defek Hemiglossectomy perlu direkonstruksi untuk mengembalikan fungsi normal dan hasil estetika yang baik. Oleh karena itu penting untuk memutuskan teknik rekonstruksi flap mana yang akan menawarkan hasil fungsional dan kosmetik terbaik.
Metodologi: Kasus seorang pria 30 tahun dengan karsinoma sel skuamosa lidah kiri (T2N1M0). Pasien menjalani rekonstruksi lidah setelah dilakukan hemiglossectomy yang melibatkan dasar mulut tanpa reseksi mandibula.
Hasil: Metode optimal untuk merekonstruksi defek luas hemiglossectomy yaitu dengan microvascular free tissue transfer.
Kesimpulan : Kami menyimpulkan bahwa radial forearm free flap adalah metode yang baik untuk merekonstruksi defek luas pada lidah. Radial forearm free flap sendiri dipilih karena tipis, bisa diambil tanpa harus merubah posisi pasien, memiliki anatomi pembuluh darah yang tetap, dan memiliki keuntungan dalam segi estetik pada area donor.
Kata kunci: *Hemiglossectomy, free tissue transfer*

Hemiglossectomy defects involving floor of the mouth need reconstructions to restore normal functions and aesthetic outcomes. Resection of the tongue markedly affected oral functions in a variety of ways including eliminates the mobility, altering intra-oral food manipulation, and impairing speech articulation. It is therefore prudent that well-planned reconstructive technique is needed for a good functional substitution for the defect. The reconstruction should aim at attaining optimal function while considering the different structures of the oral cavity as a functional integrity. Therefore, factors such as mobility, sensation, volume, and the shape of the tongue are critical elements for successful rehabilita-tion. It would be ideal to replace the resected tissue with tissue of similar properties, matching the size, shape, thickness, and pliability to achieve the maximal results.In hemiglossectomy which excision of the tongue

From the Division of Plastic Surgery, Department Of Surgery, Cipto Mangunkusumo General National Hospital, Universitas Indonesia.
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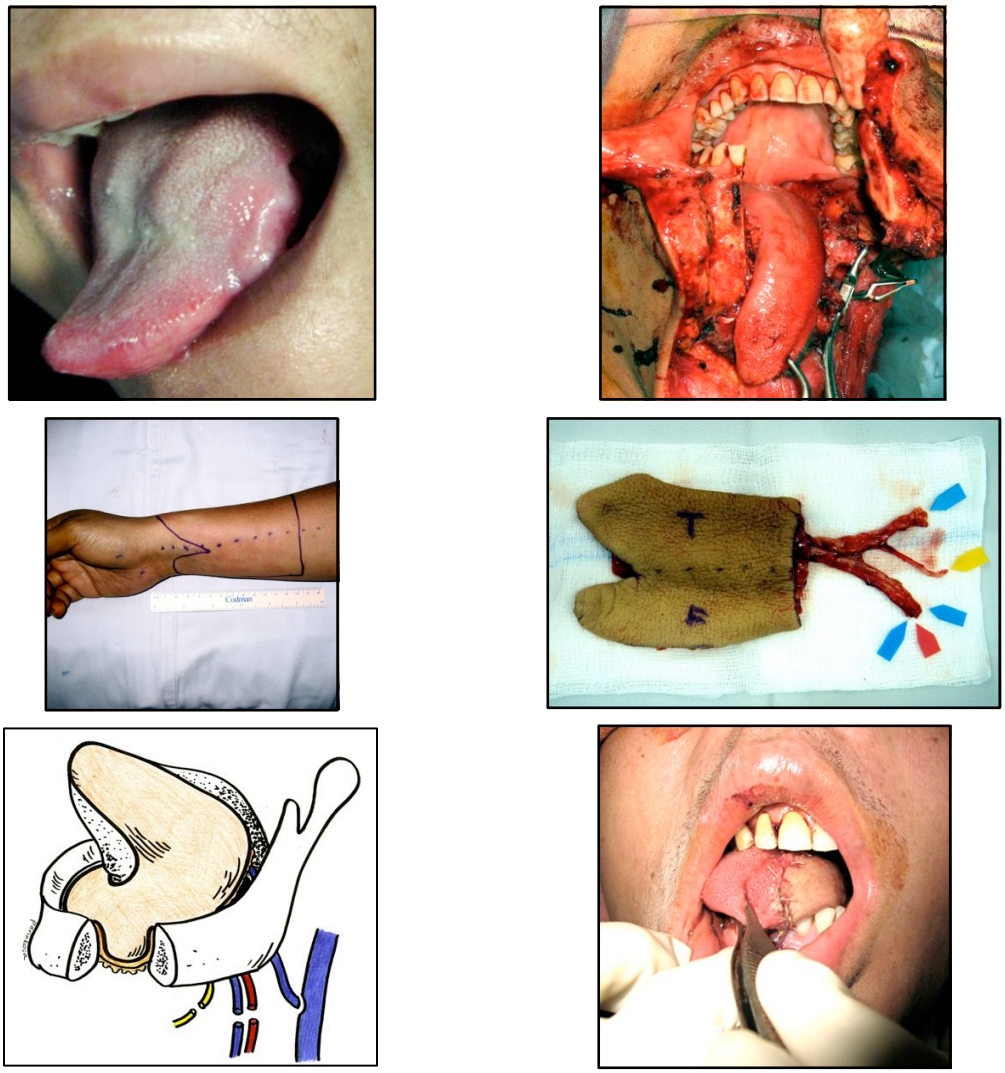

Figure 1. A 30 year-old-man with T2N1M0 squamous carcinoma of the left tongue *(upper left)* Hemiglossectomy defects involving floor of the mouth *(upper right)*. Bilobed Radial Forearm Flap marking at right hand patient *(middle left)*. A bilobed radial forearm flap with a width of about 8 cm and a length of about 10 cm is raised with a sensory nerve *(middle right)*. Schematic view of three-dimensional Innervated Bilobed Radial Forearm Free Flap for hemiglossectomy defect and floor of the mouth defect. Half folded bilobed radial forearm free flap for hemiglossectomy defect and half flap for floor of the mouth defect; Lateral antebrachial cutaneous nerve was anastomosed to lingual nerve; Venae comitantes was anastomosed to Superior thyroid vein; Radial artery was anastomosed to superior thyroid artery; cephalic vein was anastomosed end to side to Jugular vein *(below, left)*. Result of a reconstruction of a hemiglossectomy defect involving floor of the mouth with bilobed radial forearm free flap *(below, right)*.

is over than 20% needs tissues replacement in order to preserve the mobility and hence the function of the tongue. Tissue transfer procedure has become a gold standard in reconstructive plastic surgery especially for a complex tissue defects. A microvascular free tissue transfer reconstruction in cancer patient offers a significant improvement with a higher success rate, better functional results and aesthetic outcome. The free microvascular flap, with its rich vascularity permits a high degree of versatility and reliability in design for postoperative defects. The transfer of tissues require microscopic attachment of arteries, veins, and nerves to allow completion of the reconstruction that in turn allow nourishment to the flap. Deciding which flap would offer the best functional and cosmetic outcomes depends

on various factors including the size of the defect, location, type of tissues required, and availability of resources.

PATIENTS AND METHODS

A 30 years old male with T2N1M0 left tongue squamous cell carcinoma was referred to our Plastic and Reconstructive Division for tongue reconstruction following his hemiglossectomy involving floor of the mouth without mandibular resection as seen in Figure 1. The reconstruction of the tongue was taken place in one stage after the glossectomy and radical neck dissection was done. Tumor-free margin has already confirmed by intraoperative frozen section. Potency of the ulnar and radial arteries was assessed preoperatively via an Allen test. Skin marking was then performed on the right forearm with a bilobed design to replace the amount of resected tissue accurately. The pedicle consists of the radial artery in 6 cm long, the venae comitantes and one cephalic vein branch.

The lateral antebrachial cutaneous nerve that supplies sensation to the volar forearm skin was also harvested in 5 cm in length along with the flap. The flap size was 10 x 8 cm. One lobe of the flap was used to restore the shape and volume of the tongue, while the second lobe was used to resurface the floor of the mouth. The recipient artery was superior thyroid artery, which is commonly used for vascularization of a free flap because it has an excellent flow[15]. The recipient veins are the external jugular vein, and superior thyroid vein, which runs in close proximity to the superior thyroid artery. Reinnervation of the lateral antebrachial cutaneous nerve was performed to the stump of the lingual nerve. Microscopic attachment was performed for end-to-end anastomosis and end-to-side anastomosis for the jugular vein. The forearm defect then closed with full-thickness skin graft from the lower abdominal part of the patient.

DISCUSSION

Ablative surgery for cancer of the tongue is the reason most patients require reconstruction in the area to provide with a functional as well as structural restoration. The most important factor affecting function of the tongue is the extent of surgical resection; therefore any reconstruction should be aimed at maintaining volume of the tongue, shape, mobility, and sensation. Reconstruction strategies of the defects are dependent on the type and amount of tissue resected. To decide the most suitable reconstruction method following tongue resections, the defect itself should be clearly defined[3, 5, 17].

The complex functional and aesthetic demands of tongue reconstruction make the replacement of lost tissues with tissues of similar characteristics critically important. By matching tissue size, thickness, shape, and pliability, maximal oral function can be preserved. The main principles in reconstructing tongue defects are maximizing function of residual tongue, maintaining adequate volume of the reconstructed tongue, maximizing the mobility of the residual tongue, and attempting to retain or restore tactile and motor sensation[12, 17].

The optimum method of reconstructing a major defect such as hemiglossectomy with floor of the mouth resection is best carried out by using microvascular free tissue transfer[10, 16]. In general, free flaps tend to be more accepted since they are devoid of the tethering effects of pedicle flaps in tongue reconstruction. The advantages of free tissue transfer are the improved blood supply which is important in wound healing and the survival of the transposed tissue itself, the unrestricted flap positioning, the potential for sensitivity and motor functions, and the availability of composite tissue in a large amount. Microvascular free flaps have allowed great flexibility to import composite tissues matching the requirements and have become the method of choice with more than 90% rate of success[8, 21].

The flap is based on the radial artery and venae comitantes, together with the subcutaneous forearm veins. It is commonly used for reconstruction of tongue defects following malignant tongue tumor resection[4]. The consistent anatomy, its rich vascularity with generous vessel diameter, the pedicle

length, and a convenient donor site location are the proven advantages[15]. The radial forearm free flap has the capacity to fill the defect very well and is suitable because it also has various virtues. These includes provision of soft, thin, pliable, predominantly hairless skin tissue, and readily conform to the varying contours within the oral cavity. Despite the flap is thin, it provides an adequate bulk for the patient's defect, and with proper insetting preserves the mobility of the remaining tongue without tethering[3]. It offers a significant improvement in the functional and aesthetic rehabilitation of the patient[13]. The need for bulk must be balanced by the competing need for maximal mobility of the residual tongue.

The most important contraindication for harvesting a radial forearm free flap is related to the vascular supply of the hand. An Allen test should be performed preoperatively. Usually, the non dominant arm is selected for the donor site. But in our case, the flap was harvested from the dominant part, which is the right forearm, since the left forearm has been used for intravenous chemotherapy prior to the tongue resection. The vessels condition of the left forearm might not be in a good condition for getting such a quality flap. It is best to avoid any needle sticks in the antecubital fossa or blood pressure measurements on the donor site arm before the surgery. Venepuncture for drawing blood or infusion therapy of the donor forearm was prohibited to prevent intima trauma or venous thrombosis[6].

As described by *Urken and Biller*, a bilobed design flap for reconstruction after significant glossectomy helps to prevent tethering of the root of the tongue to the inner table of mandible. The interdigitation of flap segments permits maximum excursion of residual viable tongue tissue, separate the neotongue from the floor of the mouth, and thereby fascilitating and maximizing the postoperative tongue mobility and function. One lobe of the flap was used to restore the shape and volume of the tongue, while the second lobe was used to resurface the floor of the mouth[17, 18].

Reinnervation of the lateral antebrachial cutaneous nerve to the lingual nerve through microsurgical nerve anastomosis has been reported successful in providing sensation to the oral cavity, enhancing the ability to sense ingested food in the mouth, and facilitating mastication. Although the non-innervated flap did restore reasonable sensation, sensory recovery seems better and faster when the cutaneous nerve of the forearm flap is connected to the lingual nerve. Several studies have shown objectively superior and an earlier return of sensation in patients who underwent reconstruction with innervated radial forearm flaps. Further investigation demonstrated that only the lingual and inferior alveolar nerves proved superior to the posterior auricular nerve, cervical plexus, or the hypoglossal nerve. Selection of the recipient nerve and the suturing technique may contribute to the success in sensory restoration[1, 3, 8, 10, 22].

The other popular microvascular free tissue flap techniques for defects in oral cavity are the rectus abdominis musculocutaneous flap and the anterolateral thigh flap. However, the rectus abdominis flap often seems too bulky, provides a large amount of muscle and skin[5, 7, 15]. It has been shown to be a reliable option for total glossectomy defects. Most commonly it is chosen for patients with deep defects, for covering large surfaces and even the entire floor of the mouth, in which sufficient flap volume is needed while the radial forearm flap is too thin and not adequate[3].

The anterolateral thigh flap is thicker than the radial forearm flap and usually thinner than the rectus abdominis flap. It could be the ideal flap for hemiglossectomy defect reconstructions or as a good choice for total or near-total glossectomy reconstruction when radial forearm flap is too thin or when the morbidity of harvesting a free forearm flap is too great[14]. This ALT flap sometimes requiring second-stage thinning[15]. It also has the potential for sensory reinnervation with the lateral femoral cutaneous nerve, and is based on the descending branch of the lateral circumflex femoral artery and its two-vena comitantes. Varying amounts of muscle can be included when needed[3, 7].

Closure of the donor site defect is performed by using full-thickness skin graft (FTSG)

from the lower abdominal wall. FTSGs retain more of the characteristics of normal skin elements compare with the relative thinner split-thickness skin grafts. The more preserved dermal sweat glands and better preserved sebaceous gland function in FTSG will keep the grafted skin well lubricated and soft. It is also often preferred on account of the better aesthetic result with less pigmentary changes especially hyper-pigmentation and fewer complications[15, 19, 20, 21]. In addition, FTSGs achieve better final sensation.

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SUMMARY

The radial forearm free flap has been used for reconstruction of the tongue, including the oral floor, after hemiglossectomy. Our case reports has shown that it is good method for reconstructing small or medium-sized defects of the tongue. The radial forearm free flap is thin, can be raised without patient position change, has constant vascular anatomy, and provides an advantage in the aesthetic aspect at the donor site.

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Parintosa Atmodiwirjo, M.D.
Plastic Surgery Division
Ciptomangunkusumo Hospital
Jalan Diponegoro 71, Salemba, Jakarta
parintosaa@yahoo.com

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