



# The use of the latissimus dorsi myocutaneous flap in the reconstruction of complex head and neck defects

## Kompleks baş boyun defektlerinin rekonstrüksiyonunda latissimus dorsi kas deri flebi kullanımı

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**Objectives:** To compare and contrast the use of the latissimus dorsi myocutaneous flap in complex head and neck defects requiring major reconstructive surgery with respect to the other reconstruction techniques, and to emphasize the importance of this flap as a life and surgeon-saving reconstruction modality.

**Patients and Methods:** In this study, 20 cases (17 males, 3 females; mean age 58.5 years; range 48 to 72 years) of major head and neck operations reconstructed with a latissimus dorsi myocutaneous flap in İstanbul University, İstanbul Medical Faculty, Ear, Nose and Throat Clinic between October 2004 and November 2006 were retrospectively examined. The latissimus dorsi myocutaneous flap was preferred as a primary reconstructive modality in eight of the cases and a secondary reconstructive modality in the remaining 12 cases. The reasons for choosing the latissimus dorsi myocutaneous flap as the reconstructive modality were examined in this study and compared with other reconstruction techniques.

**Results:** Partial flap necrosis was observed in four of the 20 cases. In two of these unsuccessful cases, minor intervention was sufficient to achieve functionally satisfactory results. However, one case with partial flap necrosis was lost due to the uncontrollable primary disease. In the one remaining case who had undergone cranioplasty, partial necrosis of the flap developed after the completion of radiotherapy in the 4<sup>th</sup> postoperative month. No total flap necrosis was encountered in any of the cases.

**Conclusion:** The latissimus dorsi myocutaneous flap is a reconstructive modality with a high success rate and should be considered among reconstruction alternatives.

**Key Words:** Latissimus dorsi; myocutaneous flap; reconstruction.

**Amaç:** Kompleks baş boyun defektlerinin cerrahisinde majör rekonstrüksiyon gerektiren olgularda latissimus dorsi kas deri flebi kullanımı diğer karşıt rekonstrüksiyon yöntemleri ile karşılaştırılarak irdelendi ve bu flebin yaşamsal önemi ve alternatif bir rekonstrüksiyon yöntemi olarak bilinmesi gerektiği vurgulandı.

**Hastalar ve Yöntemler:** Bu çalışmada Ekim 2004 - Kasım 2006 tarihleri arasında İstanbul Üniversitesi İstanbul Tıp Fakültesi Kulak Burun Boğaz Kliniği'nde gerçekleştirilen ve latissimus dorsi kas deri flebi kullanılarak 20 olguda (17 erkek, 3 kadın; ort. yaş 58.5 yıl; dağılım 48-72 yıl) yapılan majör baş boyun rekonstrüksiyon ameliyatları geriye dönük olarak incelendi. Latissimus dorsi kas deri flebi olguların sekizinde birincil rekonstrüksiyon yöntemi, geri kalan 12'sinde ise ikincil rekonstrüksiyon yöntemi olarak tercih edildi. Çalışmada temel olarak latissimus dorsi kas deri flebinin bir rekonstrüksiyon yöntemi olarak neden tercih edildiği araştırıldı ve diğer rekonstrüksiyon yöntemleri ile karşılaştırıldı.

**Bulgular:** Yirmi olgudan dördünde kısmi flep nekrozu gözlemlendi. Bunlardan başarısız olan iki olguda minör girişimler ile fonksiyonel olarak tatmin edici sonuçlar alındı. Ancak, kısmi flep nekrozu gelişen bir olgu birincil hastalığın kontrol edilememesine bağlı olarak kaybedildi. Kraniyoplasti yapılmış olan diğer bir olguda ise ameliyat sonrası 4. ayda radyasyon tedavisinin bitimini takiben flepte parsiyel nekroz gelişti. Hiçbir olguda total flep nekrozu ile karşılaşılmadı.

**Sonuç:** Latissimus dorsi kas deri flebi, baş boyun rekonstrüksiyonunda başarı oranı yüksek olan ve rekonstrüksiyon seçenekleri arasında mutlaka bulundurulması gereken bir yöntemdir.

**Anahtar Sözcükler:** Latissimus dorsi; kas deri flebi; rekonstrüksiyon.

One of the most important aspects of head and neck surgery is the reconstruction of defects following ablative surgeries. Regardless of the etiology, the results of the reconstruction may not always be satisfactory due to the complex anatomy of the head and neck area.<sup>[1]</sup> Striving to achieve the preoperative functionality and postoperative cosmetic concerns are a few of the reasons why head and neck reconstruction is one of the most challenging areas of surgery. Many alternative methods have been developed to date to bring a solution for the challenging reconstruction of such a complex region of the human body.<sup>[2,3]</sup> Reconstructive surgeons have ever since been compelled to search for new and better techniques to eliminate the insufficiencies of older methods and to improve the results. Especially in the past 30 years, head and neck reconstructive surgery has advanced to a great extent, and many new techniques have been developed.<sup>[3,4]</sup> Among these, the free microvascular tissue flaps are by far the most multifaceted reconstruction methods that yield the best results.<sup>[3]</sup>

However, the majority of contemporary head and neck surgeons still prefer the less complicated, cheaper and more easily performed pedicled regional flaps rather than the free microvascular tissue flaps.<sup>[5]</sup> Owing to its proximity to the operation site, the convenience and ease of operation and its high success rate, the pectoralis major myocutaneous flap is the most commonly applied reconstruction method.<sup>[3]</sup> Nevertheless the search for an ideal reconstruction technique still continues vigorously.<sup>[3,5]</sup>

The latissimus dorsi myocutaneous flap (LDMF) is only one of the many head and neck reconstruction methods currently employed. In spite of some disadvantages, the application of this technique solves most of the major problems involved in reconstructive head and neck surgery.<sup>[6-11]</sup> General health status, low socioeconomic level of the patient or previous surgeries or trauma may preclude the use of sophisticated reconstruction methods like free flaps. In such helpless cases, the LDMF may be the only reconstructive alternative for the patient. This is why the LDMF should certainly be considered among the alternatives in even the most difficult cases.

#### PATIENTS AND METHODS

In İstanbul University, İstanbul Medical Faculty, Ear, Nose and Throat Clinic, the LDMF was performed on 20 cases (17 males, 3 females; mean age

58.5 years; range 48 to 72 years) of major head and neck reconstruction between October 2004 and November 2006 (Table 1). The LDMF was used as the primary reconstructive modality in eight of the cases, i.e. the first reconstructive operation ever applied to these patients for this disease was the LDMF. The common characteristic of this patient group was that the body-mass index (BMI) of each of the patients, with the exception of one, was above the accepted value. The patient with the normal BMI had a scarred anterior chest wall due to a previous abdominothoracic trauma.

The remaining 12 patients had undergone one or more reconstructive procedures prior to the application of the LDMF. The LDMF was performed as a secondary modality on these 12 cases after the failure of the initial reconstruction attempts or after the surgical salvage of recurrence of the primary disease along with the initial reconstruction method. In three of these patients, the LDMF was employed following the partial loss of previously performed pectoralis major myocutaneous flap or total necrotizing loss of the previously performed radial forearm free flap. Eight of the remaining patients were initially treated with other reconstructive cancer surgery methods but recurrence of the primary disease necessitated a wide surgical salvage for which the LDMF was used for reconstruction. The last case was a laryngeal carcinoma patient who was an organ preservation protocol therapy failure. After the completion of therapy, a wide radionecrosis of the laryngopharynx developed along with the overlying skin. There was no evidence of tumor recurrence but an unserviceable laryngopharyngeal complex with devitalized source of infection was present. A pectoralis major myocutaneous flap was used for supratracheostomal reconstruction, and a LDMF for pharyngeal reconstruction after three weeks.

In 13 of the 20 cases, the LDMF was performed by applying the single leaf reconstruction method, and seven of these cases involved the reconstruction of oropharyngeal mucosal surfaces whereas the remaining six comprised the covering of crucial arterial tissue and external skin reconstruction. In the rest of the cases involving the last seven patients, the LDMF was employed as double folded for the reconstruction of both skin and mucosal planes.

#### RESULTS

Total flap necrosis was not observed in any of the cases although partial necrosis did develop in

four patients, for the two of which minor suture techniques and rotation flaps were sufficient to achieve successful reconstruction. Of the remaining two, one of the patients experienced a wider partial necrosis, and due to the rapidly progressing disease that could not be taken under control, the patient was lost before further reconstructive efforts could be made. Partial necrosis was also observed in the patient who had undergone craniofacial resection on account of his advanced stage paranasal sinus carcinoma. Following the completion of radiotherapy, on the 4<sup>th</sup> postoperative month after the LDMF surgery, which was performed for the reconstruction of the anterior cranial base and the external skin, partial necrosis developed. The leading reasons for the necrosis were the radiation therapy and the development of osteoradionecrosis of the cranioplasty bone segment resulting in extraction reaction (Figure 1).

The most commonly encountered LDMF complications involve the donor site. In four of the



**Figure 1.** Delayed partial distal flap necrosis as a result of osteoradionecrosis of cranioplasty bone segment.

cases, variable degrees of skin dehiscence were observed on the primarily closed donor area, and most of them disappeared successfully with secondary healing. In three cases, seroma development on the donor site was detected, which, as a result of compresses and needle aspiration therapy, were completely eliminated.

### Technique

Although providing a detailed description of the LDMF technique is beyond the purpose of this paper, it would be appropriate to go over the main elements in the operation technique and highlight the important steps. A more comprehensive account of the operation technique may be found in the related literature.<sup>[3,12,13]</sup>

This flap is a myocutaneous island flap which consists of the latissimus dorsi muscle with its layering cutaneous part. The flap's main blood supply is derived from the thoracodorsal artery, a branch of the subscapular artery.<sup>[3,12]</sup> The vascular structure divides into two when it enters the muscle and this enables the use of the flap as two different islands.<sup>[13]</sup> The cutaneous blood supplying perforator vessels are more common in the cephalic parts of the flap than in the caudal parts and this condition leads to more common partial necrosis of the distal parts of the flap.<sup>[12]</sup>

Most of the literature indicates that the patient should be positioned in the lateral decubitus position for the elevation of the flap.<sup>[3]</sup> However, that requirement is usually stated as one of the most important disadvantages of the flap.<sup>[1,3]</sup> We believe that although the lateral decubitus positioning of the patient offers great convenience for the flap elevation, it is not indispensable. By using elevating bags placed under the shoulder and the hip,



**Figure 2.** Positioning of the patient and flap elevation.

the flap elevation can just as easily be performed (Figure 2). During the preparation for the surgery, the patient's arm should be wiped for sterilization and it must be mobile enough for easy positioning throughout the operation.

The skin island is marked according to the size and the location of the defect. The defect's cephalic layout on the head and neck region influences the length of the flap pedicle. It should also be taken into consideration that the perforating vessels decrease within the caudal part of the flap. The skin flap incision includes dermal and subdermal layers. The fascia of the latissimus dorsi muscle is added to the incision layers, and this fascia is sutured to the skin via absorbable suture material, for the protection of the perforating vessels. This maneuver reduces the risk of injury to the perforating vessels of the skin, which may occur during flap elevation due to pulling, mobilization or tension of the flap and as a result, partial necrosis of the flap may follow.

The skin incision is extended beyond the axilla's inferior border. The anterior part of the muscle is found using blunt dissection and finger dissection easily enables reaching underneath the muscle. The muscle fibers of the overlying latissimus dorsi muscle running perpendicular to the muscle fibers of the underlying serratus anterior muscle is the most important landmark at this stage. With a careful dissection under the inferior surface of latissimus dorsi, directed towards the superior part of the muscle, the pedicle of the thoracodorsal artery is found. Then the flap is separated with circular incision from the attached ribs, the thoracolumbar fascia and the spinous processes of the vertebrae. At this stage of the flap elevation, the main branch of the vascular pedicle which sustains the serratus muscles is founded and ligated. This maneuver provides liberation of the vascular pedicle and also prevents restriction of the arc of rotation of the flap. The transection of the latissimus dorsi muscle from the attachment to the humerus allows the complete rotation of the flap.

The thoracodorsal artery is dissected until the branching point from the subscapular artery. At this stage, special care must be taken to leave some fibroadipose tissue around the arterial pedicle for protection so that complications resulting from kinking or torsion of the pedicle may be avoided.

After completion of vascular pedicle dissection, a tunnel is made between the pectoralis major and

minor muscles for the transport of the flap to the head and neck region. The pectoralis major muscle is divided from the clavicle to complete the tunnel, and so the transfer of the flap from the thoracolumbar region to the head and neck is completed.

## DISCUSSION

The LDMF is not a frequently preferred reconstruction modality among present-day head and neck surgeons. This may be due to the disadvantages listed in table 1.<sup>[1,3]</sup> However, in our opinion, the leading reason is the presence of other more familiar and easier-to-perform reconstruction methods. The pectoralis major flap, the deltopectoral flap, the sternocleidomastoid flap, the forehead flap, the trapezius flap and the temporalis myofascial flap may all be mentioned among such modalities. Although the application of these reconstruction methods is easier, they may not necessarily be the most appropriate choice for the reconstruction of the particular defect or may simply be inapplicable under the specific circumstances. In these conditions, the use of the LDMF for reconstruction may prove to be vital.

The reconstruction method which is most commonly compared with the LDMF is the pectoralis major myocutaneous flap.<sup>[5]</sup> The pectoralis myocutaneous flap is usually the first choice for many head and neck surgeons because of its proximity to the head and neck region, easy preparation and high success rate. But in our opinion, the pectoralis major myocutaneous flap is not always a suitable reconstruction method for the head and neck region.

This is particularly the case with patients with high body-mass indices, with thick subcutaneous adipose tissue and with women with heavy breast-mass in short, it is true for cases where the pliability of the reconstruction tissue is crucial. For instance, if the subcutaneous fat tissue is thick, the pectoralis major myocutaneous flap may not be applicable in the total or subtotal hypopharyngeal or cervical esophageal reconstruction. In such a case, it is more logical to use a more pliable flap with almost no subcutaneous fat tissue and a thin muscle mass. A microvascular anastomosed free flap such as the radial forearm flap is more appropriate. However, the application of microvascular anastomosed flaps requires special equipment, training and experience. In addition, it is more costly and time consuming. That the more practical pedicled flap should be preferred is the common professional opinion of most present day head and neck surgeons. In such cases, the LDMF is the best

**Table 1.** The properties of 18 latissimus dorsi myocutaneous flap performed cases

No	Age/sex	Primary lesion	Reconstruction
1	64/E	Tongue + pharynx lateral wall + larynx	Primary
2	68/E	Tongue	Primary
3	56/E	Buccal mucosa	Primary
4	54/K	Oral cavity + Mandible	Secondary
5	58/E	Retromandibular trigone	Primary
6	46/E	Pharynx posterior wall (rev)	Secondary
7	63/E	Tonsil + pharynx (rev)	Secondary
8	48/E	Retromandibular trigone	Primary
9	70/E	Laryngopharyngectomy recurrence	Secondary
10	67/E	Peristomal recurrence	Primary
11	62/E	Pharynx lateral wall	Primary
12	59/E	Buccal mucosa	Secondary
13	54/E	Paranasal sinus	Secondary
14	56/E	Paranasal sinus	Primary
15	62/E	Larynx	Secondary
16	48/K	Oral cavity	Secondary
17	59/E	Tongue base	Secondary
18	48/K	Oral cavity	Secondary
19	72/E	Parotid	Secondary
20	56/E	Laryngopharynx	Secondary

choice. The latissimus dorsi muscle is one of the thinnest muscles in the human body and because denervation atrophy is bound to develop in time, it eventually acquires the characteristics of a fasciocutaneous flap.

The thoracodorsal artery provides the main blood supply for the LDMF. It divides into the superior and lateral branches after entering the muscle and each branch of the artery sustains different parts of the flap.<sup>[12,13]</sup> This characteristic of the vascular pedicle enables the application of the flap in two islands, which facilitates large pharyngocutaneous defects to be reconstructed as two separate flaps enabling the simultaneous reconstruction of mucosal and cutaneous defects.

**Table 2.** The disadvantages of the latissimus dorsi myocutaneous flap

- 1 Fragile pedicle
- 2 Necessity for positioning before the operation (?)
- 3 Excessive thoracic and axillary dissection is required.
- 4 If the XI. cranial nerve was sectioned earlier, it may lead to shoulder dysfunction.
- 5 Knowledge about the axillary vessel variations is necessary.

Although there are many advantages to applying the LDMF, the disadvantages are not to be dismissed lightly. First of all, the operation time is longer compared to the pectoralis major or other reconstruction flaps. Secondly, its vascular bundle is not under the protection of a large muscle-adipose tissue such as in the pectoralis major and therefore, it may bend over. Moreover, the possibility of complication development on the donor site is higher because of the mobility and greater width of the lateral thoracic region. The advantages and disadvantages of the application of the LDMF are summarized in tables 2 and 3.

**Table 3.** The advantages of the latissimus dorsi myocutaneous flap

- 1 Easy elevation
- 2 Minimal donor region morbidity
- 3 Thin flap
- 4 Large skin island (25x40 cm).
- 5 Long pedicle
- 6 Vascular pedicle is not affected by neck dissection
- 7 No need for microvascular team
- 8 Much shorter with respect to free flap

It should not be assumed that the purpose of this study is to prove that the LDMF is superior to other reconstruction methods. In the materials section, it is clearly stated that in 12 cases out of the total 20, the LDMF was applied as the secondary reconstruction modality. In the remaining eight cases, the LDMF was used as the primary reconstruction method but only because the body-mass indices of seven of these patients were too high to employ the pectoralis major myocutaneous flap and the chance of success of the major myocutaneous flap, if applied on the remaining patient, was considered uncertain due to the patient's scarred anterior chest wall resulting from a previous abdominotoracic trauma. Although the LDMF was not considered as the foremost reconstruction method in any of the cases, with a high success rate, it has proved its worth among reconstruction surgery techniques.

As a result, it can positively be asserted that the LDMF is a significantly effective reconstruction technique that should definitely be considered among the reconstruction alternatives of head and neck surgery clinics.

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