DOI: 10.38103/jcmhch.95.3

Original research

FREE COMPOSITE AND CHIMERIC ANTERIOR LATERAL THIGH FLAPS IN COVERING SECONDARY SOFT TISSUE DEFECT AFTER TUMOR RESECTION: AN OVERVIEW FROM THE MEDICAL LITERATURE TO CLINICAL APPLICATIONS

Le Hong Phuc[1,2], Phung Nguyen[2], Tran Nhat Tien[1,2], Le Nghi Thanh Nhan[1,2]
[1]Surgery Department, Hue University of Medicine and Pharmacy, Hue University
[2]Department of Orthopedics and Thoracix, Hospital of Hue University of Medicine and Pharmacy

ABSTRACT

Objective: *To evaluate the results of soft tissue defect treatment with ALT composite flaps in covering secondary soft tissue defects after radical tumors resection.*

Method: *From October 2017 to April 2023, we performed a series of 10 single-stage surgeries using composite anterior lateral thigh flap to cover secondary tissue defects in 2 cases covered Achilles tendon defects and 8 cases covered secondary defects after resection of tumors. In all patients with complex, multi-site secondary defects, in patients with secondary defects after resection of the head of the face, the defects are often complex, multi-plane, and multi-site, requiring the use of flaps flexibly and practicably to provide the best postoperative results for the patient. In 10 clinical cases, complex or clustered anterior femoral flaps were selected, and the pedicle and perforating artery branches were identified by hand-held Doppler. The identification of the perforating branches also helps to define the bounds of the flap. The flap is thinned if too thick. Microsurgery anastomosis was performed before the defect was covered.*

Result: *The size of the ALT flap ranges from 10 x 5cm to 15 x12 cm and the size of the Fascia lata (FL) flap ranges from 7 x 4 cm to 10 x 8 cm. The average peduncle length for skin flap and muscle flap is about 2.5-5 cm and about 3.5-7 cm, respectively. The thickness of the flap is about 6-13mm. After 3 months of surgery, all flaps are completely alive, close results of flaps are good, distant results are good with stable wound healing, most patients are satisfied with flap color, soft flap site, normal limb function.*

Conclusion: *The free ALT composite chimeric flaps become a viable and flexible option for single-stage, three-dimensional reconstruction of complex organ defects after tumor resection, by reducing the number of surgeries and the number of anastomosis. Improving treatment results for complex defects after cancer resection as well as reduce surgery and treatment time.*

Keywords: *ALT flap, composite flap, ALT chimeric flap, secondary defect.*

I. BACKGROUND

Currently, there is an increasing trend in large and complex soft tissue defects due to various causes, such as the rising incidence of head and neck cancers [1]. Extensive resection of cancerous tissues is still considered the primary treatment method [2,3]. Additionally, soft tissue defects resulting from trauma can be significant challenges. These secondary soft tissue defects in the head and neck region are often complex, involving multiple anatomical locations. These defects are frequently non-contiguous and multi-planar, making reconstructive surgery to cover them quite challenging [4].

Received: 12/9/2023. **Revised:** 15/4/2024. **Accepted:** 25/4/2024.
Corresponding author: Le Hong Phuc. Email: lhphuc@huemed-univ.edu.vn. Phone: 0935781357

Immediate flap reconstruction has become the gold standard for surgical treatment of secondary defects following tumor resection [5,6]. It offers effectiveness and the potential to enhance the patient's quality of life and aesthetic outcomes early in the recovery process [5,7]. For secondary defects in the head and neck, various reconstruction options are available, including local flaps, pedicled flaps, and free flaps. However, local flaps and pedicled flaps are less commonly used due to limitations in tissue availability and flexibility in design. The use of multiple flaps is also an option, but it comes with its own set of disadvantages.

Complex three-dimensional, multi-planar defects with various locations can be effectively addressed through composite flap reconstruction. This approach has several advantages, such as reducing surgical time and decreasing intraoperative and postoperative complications [6,8]. Injuries to extremities, such as Achilles tendon defects, are always challenging in reconstruction due to the complexity of the injury and the high risk of infection resulting from improper initial treatment [9].

The Anterolateral Thigh (ALT) flap was first described and applied in 1984 and has since become the preferred choice for covering soft tissue defects [1]. The composite ALT flap (with inclusion of the fascia lata and tensor fasciae latae muscle) is one of the widely used variations due to its numerous advantages in extremity defect reconstruction and secondary defect coverage following cancer resection [5,7,10,11]. Some of the advantages of the ALT flap include a long vascular pedicle, multiple perforators supplying various tissue components, consistent anatomy [12], minimal donor-site morbidity, and a reputation for safety and reliability [13]. The composite ALT flap, especially with its chimeric variant, is well-suited for complex, non-contiguous defects, allowing three-dimensional spatial reconstruction due to its composition of multiple component flaps. Each of these component flaps has its own vascular supply, branching from a common pedicle, the main pedicle of the chimeric ALT flap. This eliminates the need for separate multiple flaps and ensures an adequate blood supply to all component flaps without the need for multiple separate anastomoses. Given the advantages of free-style composite ALT flaps and chimeric ALT flaps mentioned, we employed these flaps in 10 cases with complex defects in our clinical series.

II. MATERIAL AND METHOD

2.1. Subjects

From October 2017 to April 2023, we conducted a series of 10 surgeries using composite and chimeric anterolateral thigh (ALT) flaps to cover secondary soft tissue defects. This included 2 cases for Achilles tendon defects and 8 cases for secondary defects following the resection of tumors in the head, face, and oral cavity. All patients presented with complex secondary defects affecting multiple anatomical regions. In patients with secondary defects in the head and face following tumor resection, these defects were often intricate, multi-planar, and multi-locational, necessitating the use of a versatile and feasible flap to achieve optimal postoperative outcomes for the patients.

2.2. Methods

This was a prospective, longitudinal study. The choice between composite and chimeric anterolateral thigh (ALT) flaps was made, and the vascular pedicle and perforator vessels were identified using handheld Doppler ultrasound. Identifying the perforator vessels also aided in determining the flap's boundaries. The flap was thinned if excessively thick. Microvascular anastomosis was performed prior to defect coverage.

Technique: The surgical objective is to simultaneously reconstruct the defect and provide soft tissue coverage. Composite or chimeric anterolateral thigh (ALT) flaps with a pedicle from the lateral femoral circumflex artery (LFCA) are utilized. The surgery is performed under general anesthesia, and two surgical teams work in parallel to reduce operative time.

Team 1: Flap Harvesting

The patient is placed in a supine position. The incision is a straight line connecting the anterior superior iliac spine and the upper border of the patella. The flap is harvested under the fascia, carefully identifying perforator vessels and branches within the fascia.

The vascular pedicle and perforator vessels arising from the LFCA are identified preoperatively using handheld Doppler ultrasound. Perforators on the same thigh side need to be detected.

Design the composite flap. For defects with non-contiguous surface and varying depths, a chimeric flap is preferred for achieving complete coverage. The flap pedicle is trimmed appropriately for an end-to-side or T-shaped vascular anastomosis.

Team 2: Preparation and Defect Coverage

The defect is cleaned and prepared for the flap transfer. The soft tissue defect is covered using a free-style composite ALT flap or chimeric ALT flap.

Wound closure involves careful hemostasis, blood pressure monitoring for the patient, flap survival assessment, and precise closure of the flap donor site. The flap is positioned under minimal tension to avoid compromising venous outflow. If the flap becomes excessively tight and threatens venous outflow, partial release may be performed, with final closure completed within 5-7 days when swelling subsides. All flap donor sites are closed during the same surgical session.

III. RESULTS

The dimensions of the ALT flaps ranged from 10 x 5 cm to 15 x 12 cm, while the dimensions of the tensor fasciae latae (TFL) flaps varied from approximately 7 x 4 cm to 10 x 8 cm. The average length of the vascular pedicle was about 4-5 cm, and the average length of the TFL flap's vascular pedicle was approximately 5 cm. The average thickness of the flaps was 8.6 mm.

Among the 10 patients who underwent surgery, all secondary soft tissue defects were fully covered and achieved satisfactory aesthetic and functional outcomes. Within the first 3 weeks, the flaps were assessed favorably, with complete flap survival following transfer. Initial surgical scars in both the donor and recipient sites were inconspicuous, and flap functionality was normal.

An evaluation conducted at the 3-month postoperative mark showed that all 10 out of 10 patients had achieved excellent results. The scars were stable, met aesthetic expectations, and remained inconspicuous in both the donor and recipient sites. Flap functionality on the donor side was normal, and all patients expressed satisfaction with their postoperative aesthetic outcomes.

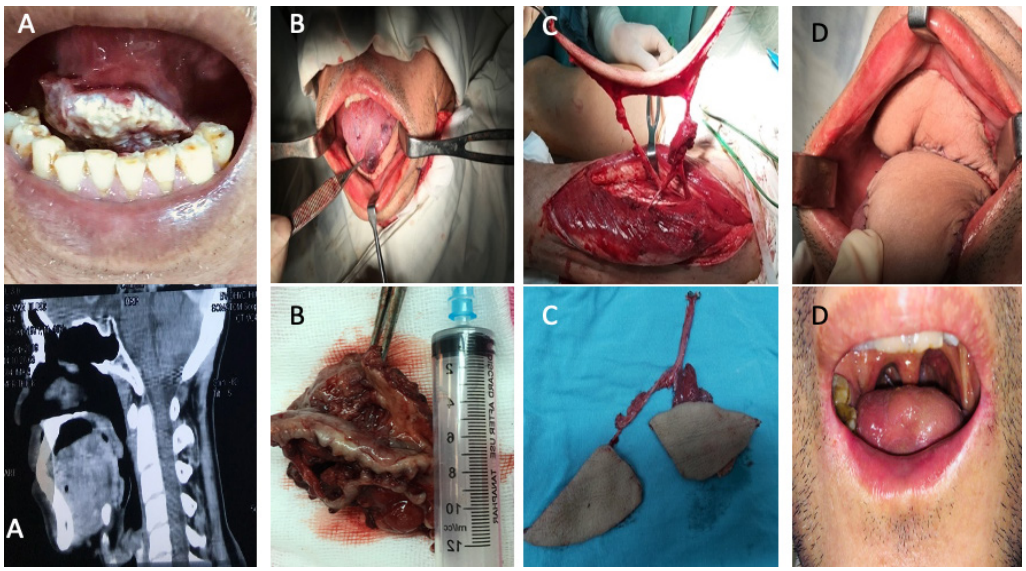

Figure 1: A 60-year-old male patient diagnosed with tongue cancer received treatment for a complex secondary soft tissue defect following tongue resection using a chimeric anterolateral thigh flap. The flap was well-maintained at the 3-month follow-up, and the flap had mucosalized. Images before surgery, during surgery, and at the 3-month follow-up are provided. A: Preoperative; B: Tumor excision;

C: Flap harvest; D: Postoperative results and 3-month follow-up

Figure 2: A 72-year-old patient was diagnosed with squamous cell carcinoma (SCC) in the oral mucosa. The tumor was excised, and cold biopsy was performed during surgery to confirm the tumor's boundaries. Subsequently, the patient underwent reconstructive surgery using a chimeric anterolateral thigh flap to cover the resulting defect. After surgery, the patient showed good recovery, with a well-preserved flap, and at the 3-month follow-up, the flap had mucosalized, contributing to an improved quality of life. A: Preoperative; B: Identifying the site, size, and flap harvest; C: Postoperative follow-up results

Figure 3: A 62-year-old male patient was diagnosed with squamous cell carcinoma at the heel, resulting in soft tissue and Achilles tendon defects following cancer tissue removal surgery. An ALT-TFL flap was utilized for reconstruction. The patient recovered well after the surgery. At the 3-month follow-up, the functionality of the Achilles tendon was restored. A: Preoperative; B: ALT-TFL flap; C: Postoperative follow-up results

IV. DISCUSSION

In recent times, there has been an increasing incidence of head and neck cancer [14], as well as soft tissue injuries in everyday life. This trend has led to more complex secondary soft tissue defects, posing challenges for surgeons. Additionally, there is a growing demand for effective treatment methods to improve the quality of life and reduce treatment time for patients.

Surgery is currently the preferred method for treating head and neck cancer [15]. However, after surgery, secondary defects are often characterized by

wide and deep tissue loss, involving multiple tissue components. To ensure avoidance of recurrence and to achieve structurally sound, functional, and anatomically satisfactory reconstruction, the choice of suitable materials is essential [16,17].

For complex secondary defects requiring a one-stage surgical solution, selecting the appropriate reconstructive material is crucial. While there are various options for closing postoperative defects, such as using nearby flaps or multiple flaps, closing defects in the head and neck region after tumor resection can be challenging due to the complex nature of these defects, involving multiple defect locations and planes [6,8].

Therefore, the application of composite or chimeric anterolateral thigh (ALT) flaps has become a preferred solution due to their advantages. Large-sized ALT flaps with long vascular pedicles that harmonize with the recipient site provide convenience in defect coverage and ensure aesthetic outcomes after surgery. Particularly, the chimeric anterolateral thigh flap offers versatility, as it can incorporate various tissue components from the same donor site, facilitating the reconstruction of non-contiguous, multi-planar, and three-dimensional defects [1,12,13,18,19].

In our study involving 10 cases of secondary soft tissue defect coverage using composite or chimeric anterolateral thigh flaps, all 10 flaps achieved excellent results at the 3-month postoperative assessment. In two cases involving Achilles tendon reconstruction, functional mobility of the tendon was restored postoperatively. All patients expressed satisfaction with the aesthetics of the flaps.

In three clinical cases, three patients presented with complex and multi-planar secondary soft tissue defects, posing difficulties in defect coverage. They required a flexible surgical approach, and therefore, they were treated with chimeric anterolateral thigh flaps. All three patients showed good postoperative recovery, with well-healed flaps and improved quality of life. These patients were satisfied with the aesthetic outcomes of the surgery.

V. CONCLUSION

The free composite or chimeric ALT flap is a suitable choice for soft tissue defects in various body regions due to the advantages of the ALT flap. Its flexibility and suitability for different types of defects in various tissues, especially in reconstructing complex three-dimensional organ defects following cancer resection, reduce the need for multiple surgeries and the number of anastomoses. This helps improve the treatment outcomes for complex soft tissue defects after cancer removal, as well as reduce surgical and treatment time.

Acknowledgments

This work was supported by Hue University under the Core Research Program, Grant No. NCM. DHH.2022.03

REFERENCES

1. Song Y, Chen G, Song Y. The free thigh flap: a new free flap concept based on the septocutaneous artery. Br J Plast Surg. 1984; 37: 149–159.
2. Argiris A, Eng C. Epidemiology, Staging, and Screening of Head and Neck Cancer. In: Head and Neck Cancer. Boston: Kluwer Academic Publishers: 15–60.
3. Homer JJ, Fardy MJ. Surgery in head and neck cancer: United Kingdom National Multidisciplinary Guidelines. J Laryngol Otol. 2016; 130: S68–S70.
4. Longo B, Nicolotti M, Ferri G, Belli E, Santanelli F. Sagittal Split Osteotomy of the Fibula for Modeling the New Mandibular Angle. Journal of Craniofacial Surgery. 2013; 24: 71–74.
5. Kim HS, Chung CH, Chang YJ. Free-flap reconstruction in recurrent head and neck cancer: A retrospective review of 124 cases. Arch Craniofac Surg. 2020; 21: 27–34.
6. Homer JJ, Fardy MJ. Surgery in head and neck cancer: United Kingdom National Multidisciplinary Guidelines. J Laryngol Otol. 2016; 130: S68–S70.
7. Zhang C, Sun J, Zhu H et al. Microsurgical free flap reconstructions of the head and neck region: Shanghai experience of 34 years and 4640 flaps. Int J Oral Maxillofac Surg. 2015; 44: 675–684.
8. Argiris A, Eng C. Epidemiology, Staging, and Screening of Head and Neck Cancer. In: Head and Neck Cancer. Boston: Kluwer Academic Publishers: 15–60.
9. Son TT, Dung PTV, Thuy TTH, Chien VH, Phuc LH, Huy LA. One-stage reconstruction of the massive overlying skin and Achilles tendon defects using a free chimeric anterolateral thigh flap with fascia lata. Microsurgery. 2022; 42: 659–667.
10. Shieh S-J, Chiu H-Y, Yu J-C, Pan S-C, Tsai S-T, Shen C-L. Free Anterolateral Thigh Flap for Reconstruction of

Head and Neck Defects following Cancer Ablation. Plast Reconstr Surg. 2000; 105: 2349–2357.

11. Kuo Y-R, Jeng S-F, Kuo M-H, Liu Y-T, Lai P-W. Versatility of the Free Anterolateral Thigh Flap for Reconstruction of Soft-Tissue Defects: Review of 140 Cases. Ann Plast Surg. 2002; 48: 161–166.
12. Choi S-W, Park J-Y, Hur M-S et al. An Anatomic Assessment on Perforators of the Lateral Circumflex Femoral Artery for Anterolateral Thigh Flap. Journal of Craniofacial Surgery. 2007; 18: 866–871.
13. Shieh S-J, Chiu H-Y, Yu J-C, Pan S-C, Tsai S-T, Shen C-L. Free Anterolateral Thigh Flap for Reconstruction of Head and Neck Defects following Cancer Ablation. Plast Reconstr Surg. 2000; 105: 2349–2357.
14. Kawakita D, Oze I, Iwasaki S, Matsuda T, Matsuo K, Ito H. Trends in the incidence of head and neck cancer by subsite between 1993 and 2015 in Japan. Cancer Med. 2022; 11: 1553–1560.
15. Wang Y, Wang S, Qu Y, Yang Y. Clinicopathological characteristics, treatment and prognosis of oral adenocarcinoma: a population-based study. European Archives of Oto-Rhino-Laryngology. 2023; 280: 3365–3374.
16. Lin DT, Coppit GL, Burkey BB. Use of the anterolateral thigh flap for reconstruction of the head and neck. Curr Opin Otolaryngol Head Neck Surg. 2004; 12: 300–304.
17. Wong C-H, Wei F-C. Microsurgical free flap in head and neck reconstruction. Head Neck. 2010; 32: 1236–1245.
18. Koshima I. Free Anterolateral Thigh Flap for Reconstruction of Head and Neck Defects following Cancer Ablation by Shyh-Jou Shieh, M.D., Haw-Yen Chiu, M.D., Jui-Chin Yu, M.D., Shin-Chen Pan, M.D., Sen-Tien Tsai, M.D., and Ching-Liang Shen, Ph.D. Plast Reconstr Surg. 2000; 105: 2358–2360.
19. Jiang C, Guo F, Li N et al. Multipaddled Anterolateral Thigh Chimeric Flap for Reconstruction of Complex Defects in Head and Neck. PLoS One. 2014; 9: e106326.