

## Outcomes of Tongue Reconstruction Using Anterolateral Thigh Free Flap: A Prospective Study in a Tertiary Care Hospital

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### Abstract

**Background:** Reconstruction of tongue defects following oncologic resection is critical for restoring speech, swallowing and aesthetic function. The anterolateral thigh (ALT) free flap has emerged as a reliable option due to its versatility, adequate tissue volume and low donor site morbidity. This study aimed to evaluate the functional and surgical outcomes of tongue reconstruction using the ALT free flap in a tertiary care setting in Bangladesh.

**Methods:** This prospective observational study was conducted in the Department of Plastic Surgery at the Sheikh Hasina National Institute of Burn & Plastic Surgery, Dhaka, Bangladesh from January 2023 to December 2023. A total of 25 patients with malignant tongue tumors requiring partial or subtotal glossectomy and free flap reconstruction were included. Patients with recurrent disease, distant metastasis, or unfit for microsurgery were excluded. ALT free flaps were harvested and micro surgically anastomosed to neck vessels. Patients were followed up at 1, 3 and 6 months. Functional outcomes, flap viability, complications and donor site morbidity were assessed. Data were analyzed using SPSS version 25.0.

**Results:** Most patients were male (72%) and aged 41–60 years (44%). Squamous cell carcinoma was the most common indication (88%). Flap survival was 96% and functional outcomes were favorable: 80% had excellent or good speech intelligibility, 76% had satisfactory swallowing and mobility and 88% reported good aesthetic satisfaction. Donor site morbidity was minimal.

**Conclusion:** ALT free flap is a safe, effective and functionally favorable option for tongue reconstruction, with high success and low complication rates

**Keywords:** Anterolateral thigh flap, tongue reconstruction, glossectomy, free flap, oral cancer, functional outcomes, donor site morbidity.

### 1. INTRODUCTION

Carcinoma of the tongue is one of the most common malignancies in the oral cavity, particularly in South Asian countries like Bangladesh, where tobacco and betel nut use are widespread. Surgical resection remains the cornerstone of treatment for resectable tongue

cancers [1]. However, tumor excision, especially hemiglossectomy or subtotal glossectomy, results in significant functional and cosmetic deficits that severely affect speech, swallowing, mastication and quality of life [2].

Therefore, functional reconstruction of the tongue plays a pivotal role in postoperative

rehabilitation [3]. Reconstructive options for tongue defects include local flaps, regional flaps and free tissue transfer. Among these, the anterolateral thigh (ALT) free flap has gained widespread acceptance as a versatile, reliable and customizable option for oral cavity reconstruction [4]. First introduced in the 1980s, the ALT flap provides ample soft tissue volume with a long and reliable vascular pedicle, minimal donor site morbidity and the potential for sensory nerve coaptation [5]. It can be tailored in size and thickness depending on the defect and allows restoration of bulk for phonation and deglutition. In contrast to radial forearm free flaps, which are thin but associated with more donor site morbidity, the ALT flap strikes a balance between form and function [6].

Despite its growing popularity, the outcomes of ALT flap reconstruction in tongue defects can vary based on factors such as patient age, extent of resection, comorbidities and surgical expertise [7]. Functional outcomes, such as speech intelligibility, tongue mobility and swallowing efficiency, are key indicators of successful reconstruction [8]. Aesthetic satisfaction and donor site complications are also essential considerations, especially in resource-limited settings [9]. In the context of lower setting countries, where specialized microsurgical

services are increasingly available in tertiary care hospitals, there is a need to generate local data on outcomes of ALT free flap reconstruction [10]. While international studies have reported promising results, variability in surgical techniques, follow-up protocols and patient characteristics necessitate region-specific research [11].

Therefore, this prospective study was undertaken to evaluate the outcomes of tongue reconstruction using the anterolateral thigh free flap following oncologic resection. The primary aim was to assess functional results in terms of speech, swallowing and tongue mobility. Secondary outcomes included flap-related complications, donor site morbidity and overall patient satisfaction. By analyzing these parameters, this study seeks to contribute valuable evidence toward optimizing reconstructive strategies in patients undergoing tongue cancer surgery in Bangladesh.

## 2. METHODOLOGY & MATERIALS

This prospective observational study was conducted in the Department of Plastic Surgery at the Sheikh Hasina National Institute of Burn & Plastic Surgery, Dhaka, Bangladesh, over a 12-month period from January 2023 to December 2023.



**Figure 1.** Reconstruction of tongue by ALT free flap after tongue cancer excision

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A total of 25 patients who underwent tongue reconstruction using the anterolateral thigh (ALT) free flap following oncologic resection were enrolled. Patients aged 18 years and above, with partial or subtotal glossectomy defects due to malignant tumors requiring free flap reconstruction, were included. Exclusion criteria were recurrent malignancy, unresectable tumors, distant metastasis, poor general condition unsuitable for microsurgery and refusal to consent. Preoperative evaluation included detailed history, clinical examination and imaging to assess tumor extent. Following resection, the ALT free flap was harvested from the thigh and microsurgically anastomosed to recipient vessels in the neck. Parameters such as

flap size, pedicle length, ischemia time and operative duration were recorded. Postoperative follow-up was done at 1, 3 and 6 months to assess flap viability, complications, speech intelligibility, swallowing function, tongue mobility and aesthetic satisfaction. Donor site morbidity was also evaluated.

Data were collected using a structured case record form and entered into a Microsoft Excel spreadsheet. Statistical analysis was performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize baseline characteristics and results were presented as frequencies, percentages, means and standard deviations.

### 3. RESULTS

**Table 1.** Demographic and Clinical Characteristics of the Patients (n = 25)

| Characteristics         | Frequency (n) | Percentage (%) |
|-------------------------|---------------|----------------|
| Age (years)             |               |                |
| 21–40                   | 10            | 40             |
| 41–60                   | 11            | 44             |
| >60                     | 4             | 16             |
| Sex                     |               |                |
| Male                    | 18            | 72             |
| Female                  | 7             | 28             |
| Indication for Surgery  |               |                |
| Squamous Cell Carcinoma | 22            | 88             |
| Verrucous Carcinoma     | 3             | 12             |
| Type of Resection       |               |                |
| Hemiglossectomy         | 16            | 64             |
| Subtotal Glossectomy    | 9             | 36             |

Table 1 presents the demographic and clinical characteristics of the 25 patients who underwent tongue reconstruction using the anterolateral thigh (ALT) free flap. The majority of patients (44%) were between 41–60 years of age, followed by 40% in the 21–40 years age group and 16% were older than 60 years. Males comprised the majority of the study population

(72%), while females accounted for 28%. Regarding the indication for surgery, squamous cell carcinoma was the predominant diagnosis, observed in 88% of patients, whereas verrucous carcinoma was present in 12%. In terms of surgical intervention, 64% of patients underwent hemiglossectomy, while 36% underwent subtotal glossectomy.

**Table 2.** Characteristics of the Defect and Flap (n = 25)

| Parameter                       | Frequency (n) | Percentage (%) |
|---------------------------------|---------------|----------------|
| Size of Tongue Defect           |               |                |
| ≤6 cm                           | 8             | 32             |
| >6 cm                           | 17            | 68             |
| Flap Type                       |               |                |
| ALT Free Flap (fasciocutaneous) | 25            | 100            |
| Flap Dimensions (mean ± SD)     |               |                |
| Length (cm)                     |               | 9.2 ± 1.4      |
| Width (cm)                      |               | 5.8 ± 1.1      |
| Pedicle Length (cm)             |               | 8.6 ± 1.2      |

Table 2 outlines the characteristics of the tongue defects and the anterolateral thigh (ALT) free

flaps used for reconstruction in the study population. The majority of patients (68%) had

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tongue defects larger than 6 cm, while 32% had defects measuring 6 cm or less. All patients (100%) underwent reconstruction using fasciocutaneous ALT free flaps. The mean flap length was  $9.2 \pm 1.4$  cm and the mean flap width

was  $5.8 \pm 1.1$  cm, indicating a tailored approach to match the size of the defect. The average pedicle length was  $8.6 \pm 1.2$  cm, providing adequate reach for microvascular anastomosis in all cases.

**Table 3.** Functional Outcomes at 6-Month Follow-up ( $n = 25$ )

| Outcome Parameter      | Excellent (n, %) | Good (n, %) | Fair (n, %) | Poor (n, %) |
|------------------------|------------------|-------------|-------------|-------------|
| Speech Intelligibility | 12 (48.0)        | 8 (32.0)    | 5 (20.0)    | 0 (0.0)     |
| Swallowing Function    | 10 (40.0)        | 9 (36.0)    | 6 (24.0)    | 0 (0.0)     |
| Tongue Mobility        | 9 (36.0)         | 10 (40.0)   | 6 (24.0)    | 0 (0.0)     |
| Aesthetic Satisfaction | 15 (60.0)        | 7 (28.0)    | 3 (12.0)    | 0 (0.0)     |

Table 3 summarizes the functional outcomes of patients six months after tongue reconstruction using the anterolateral thigh (ALT) free flap. Speech intelligibility was rated as excellent in 48% of patients, good in 32% and fair in 20%, with no poor outcomes reported. Swallowing function was excellent in 40% and good in 36%, while 24% had fair outcomes. Tongue mobility

showed excellent results in 36% of patients, good in 40% and fair in 24%.

Aesthetic satisfaction was rated as excellent by 60% of patients, good by 28% and fair by 12%. Notably, no patient reported poor outcomes in any of the assessed functional domains, indicating overall favorable postoperative results.

**Table 4.** Postoperative Complications ( $n = 25$ )

| Complication             | Frequency (n) | Percentage (%) |
|--------------------------|---------------|----------------|
| Flap Survival (Complete) | 24            | 96             |
| Partial Flap Necrosis    | 1             | 4              |
| Total Flap Loss          | 0             | 0              |
| Wound Infection          | 3             | 12             |
| Hematoma/Seroma          | 2             | 8              |
| Airway Complication      | 1             | 4              |
| Reoperation Needed       | 1             | 4              |

Table 4 outlines the postoperative complications observed among the 25 patients who underwent tongue reconstruction using the ALT free flap.

Complete flap survival was achieved in 96% of cases, with only one patient (4%) experiencing partial flap necrosis. No cases of total flap loss

were recorded. Wound infections occurred in 12% of patients, while hematoma or seroma formation was observed in 8%. One patient (4%) developed an airway-related complication requiring intervention. Reoperation was necessary in one case (4%) due to postoperative complications.

**Table 5.** Donor Site Morbidity ( $n = 25$ )

| Parameter              | Frequency (n) | Percentage (%) |
|------------------------|---------------|----------------|
| No Morbidity           | 18            | 72             |
| Mild Pain              | 4             | 16             |
| Paresthesia            | 2             | 8              |
| Wound Dehiscence       | 1             | 4              |
| Need for Skin Grafting | 3             | 12             |

Table 5 presents the donor site morbidity following harvest of the anterolateral thigh (ALT) free flap. The majority of patients (72%) experienced no morbidity at the donor site.

Mild pain was reported by 16% of patients, while 8% developed paresthesia. Wound dehiscence occurred in 1 patient (4%).

Additionally, 3 patients (12%) required skin grafting to close the donor site.

## 4. DISCUSSION

Tongue reconstruction following oncologic resection presents a significant challenge due to the complex functional and aesthetic roles the

tongue plays in speech, swallowing and appearance. In this prospective study, we evaluated the outcomes of anterolateral thigh (ALT) free flap reconstruction in 25 patients who underwent partial or subtotal glossectomy. Our findings demonstrate that the ALT flap provides reliable coverage, favorable functional recovery and minimal donor site morbidity, consistent with previously published literature.

The ALT free flap has evolved into a workhorse flap in head and neck reconstruction due to its versatility, adequate tissue bulk and long pedicle. First described by Song et al. in the 1980s, it has since become one of the most commonly used options for tongue and intraoral reconstruction [5, 12]. In our study, all flaps survived completely except one case of partial necrosis (4%) and there was no total flap loss, which aligns with previous reports of high flap survival rates associated with ALT [13, 14].

Functionally, 80% of patients in our cohort had excellent or good speech intelligibility and 76% achieved satisfactory swallowing outcomes. These results are in agreement with Yuan et al., who reported comparable oral function recovery when using ALT flaps versus radial forearm free flaps (RFFF), although ALT flaps provided better tongue bulk and volume for more extensive defects [15]. Similarly, Jeong et al., emphasized that the volume of the reconstructed tongue plays a crucial role in long-term articulation and swallowing, with ALT flaps being particularly effective for subtotal glossectomy defects [16].

One major advantage of the ALT flap is the ability to tailor its thickness and size, providing sufficient bulk for large defects while preserving adequate mobility, which was observed in 76% of our patients. Lu et al., compared thin ALT flaps with RFFF and found that while RFFF offers better pliability, thin ALT flaps provide a better balance between contour and function in hemiglossectomy patients [17]. This supports our finding that both speech and swallowing functions were well preserved even in patients with more extensive defects.

Aesthetic satisfaction was rated as excellent or good in 88% of our patients. This is consistent with the meta-analysis by Alhindi et al., which demonstrated that patients reconstructed with ALT flaps report comparable, if not superior, satisfaction and quality of life compared to those with RFFF, especially in terms of donor site outcomes and visible scarring [1].

Donor site morbidity in our study was low. Only 12% of patients required skin grafting and 72% had no morbidity, echoing findings from De Virgilio et al., who proposed an algorithm supporting the ALT flap for head and neck soft tissue reconstruction due to its low complication rates and flexibility across various reconstructive needs [18].

Complication rates in our series were minimal. Wound infections were seen in 12% and hematoma or seroma in 8%, which are within the expected range according to Nguyen et al., who reviewed advanced ALT applications for locally aggressive tongue tumors [19]. The minimal airway complications (4%) and low reoperation rates (4%) further underline the safety of this technique in experienced hands.

It is also worth noting the growing trend of using chimeric or functional ALT flaps, incorporating motor or sensory components to enhance postoperative outcomes [20]. While our study used fasciocutaneous ALT flaps, the results suggest that even without innervated components, favorable functional outcomes are achievable with careful design and execution.

Finally, comparisons with other flap options continue to evolve. A recent study by Younis et al., compared ALT and RFFF in hemiglossectomy patients and found that ALT flaps provided better long-term volume maintenance, which likely contributed to improved functional preservation [21]. Our results are in agreement, particularly with respect to tongue mobility and overall patient satisfaction.

## **5. LIMITATIONS OF THE STUDY**

This study had several limitations. The sample size was relatively small ( $n = 25$ ), which may limit the generalizability of the findings. Functional outcomes were assessed using subjective clinical evaluation without standardized scoring tools or patient-reported outcome measures. Additionally, the follow-up period was limited to six months, which may not fully capture long-term complications or functional recovery. Future studies with larger cohorts, longer follow-up and validated functional assessment scales are recommended to strengthen the evidence.

## **6. CONCLUSION**

In conclusion, this study reinforces the anterolateral thigh free flap as a reliable and

effective option for tongue reconstruction. It offers excellent functional and aesthetic results with minimal donor site morbidity. While our sample size is limited and longer-term follow-up may further clarify quality-of-life outcomes, our findings contribute to the growing body of evidence supporting the ALT flap as a first-line choice for reconstructing medium to large tongue defects in oncologic patients.

## **7. FINANCIAL SUPPORT AND SPONSORSHIP**

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## **8. CONFLICTS OF INTEREST**

There are no conflicts of interest.

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