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Case Series

Lessons from a Low-Volume and Non-academic Hospital: Optimizing Outcomes in Free Tissue Transfer—A Case Series by a Novice Plastic Surgeon

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ABSTRACT

Background: Free tissue transfer (FTT) has become the preferred method in modern reconstructive surgery, offering excellent functional and aesthetic outcomes, particularly for complex oncologic, traumatic, and post-infectious defects. This study describes the early experience and key lessons learned from a series of FTT procedures performed by a novice plastic surgeon at Nakhon Phanom Hospital, a standard-level (S-level) hospitals in Thailand.

Methods: Medical records of all patients who underwent FTT performed by a single surgeon were reviewed. Data collected included demographics, operative details, pathology results, and postoperative complications.

Results: Nineteen FTT procedures were identified, performed for reconstruction of the head and neck (n = 15) and lower extremities (n = 4). Five cases experienced postoperative complications resulting in flap compromise. Three of eight threatened flaps were successfully salvaged. The primary causes of flap loss were vascular complications, including venous congestion (26.3%) and arterial thrombosis (15.7%). The overall flap success rate was 73.7%.

Conclusions: Performing free tissue transfer as a young plastic surgeon embarking on reconstructive surgery in a non-academic hospital with no prior experience in this procedure posed significant challenges. Limited early postoperative monitoring capacity, insufficiently trained nursing staff, and the surgeon's learning curve contributed to delays in critical decision-making. Ultimately, improving outcomes in such settings requires recognizing systemic limitations, implementing continuous team training, and maintaining perseverance throughout the demanding early learning phase.

Keywords: Free tissue transfer (FTT), Novice Plastic Surgeon, Postoperative Complications, Non-Academic Hospital, Flap survival

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Introduction

Free tissue transfer (FTT) has revolutionized reconstructive surgery by providing reliable options for the restoration of complex composite defects following oncologic resection, trauma, or infection. The success rate is influenced by various factors such as venous anastomosis number, vascular crisis, and hematomas.[1] the number of cases. The overall success rate of free flap transfer was 95–99.2%.[2] These outcomes are usually reported in the high-volume center. The treating center was classified as large where there were more than 50 cases per year of free tissue transfer with double team consultants according to the British Association of Head and Neck Oncologists recommendations.[3] Many high-volume training centers have reported decreasing complication and failure rates while minimizing hospital stays. These improvements are likely multifactorial, resulting from improved team familiarity, streamlined perioperative processes, and increased surgeon experience.[4,5]

In contrast, the introduction of microsurgery in low-volume hospitals poses distinct challenges. All procedures, including neck dissection, tumor resection, and free-flap reconstruction, were performed by a single surgeon using a single-team approach.[6] Limited infrastructure, lack of trained nursing staff, and the absence of multidisciplinary microsurgical support can hinder both operative performance and postoperative monitoring.[7,8] Moreover, for young plastic surgeons embarking on their first independent microsurgical cases, these institutional and experiential constraints compound the inherent technical difficulty of free tissue transfer. Despite these challenges, the demand for reconstructive microsurgery continues to grow across all levels of healthcare systems,[9,10] particularly in regional or provincial hospitals where access to tertiary centers may be limited.

The present study reports a case series of free tissue transfers performed by one primary plastic surgeon through the entire procedures at Nakhon Phanom Hospital, a standard-level (S) hospital in northeastern Thailand, where no previous free flap surgery existed. This study aims to analyze early outcomes, flap success or failure rate, and share practical lessons learned from establishing microsurgery in a low-volume setting.

Materials and Methods

Study design

This is a retrospective case series of consecutive free tissue transfer (FTT) procedures performed by a single plastic surgeon (Sarinya Boonpoapichart) between [1st June 2023 – 1st June 2025] at Nakhon Phanom Hospital, a standard-level (S) provincial hospital in Thailand. Institutional review board approval was obtained. [NP-EC11-No.54/2568



Data collection

The electronic medical record (EMR) of all patients who underwent free tissue transfer for reconstructive purposes during the study period were included. Indications for reconstruction included oncologic resection defects, post-traumatic defects, and post-infectious soft-tissue loss. Patients who underwent local or regional flap reconstruction without microvascular anastomosis were excluded.

General demographic, clinical, and operative data were collected from the hospital EMRs. The patient demographics including age, sex, comorbidities, and ASA classification were recorded. Reviewing operative data to get the information of the defect site, type of free flap and use of vein graft, ischemic time, total operating time was done. The need for intensive care, postoperative complications, re-exploration, flap survival, duration of ICU and hospital stay were identified.

Surgical techniques

All procedures were performed under an operating microscope using standard microvascular techniques. Flap selection was based on defect size, location, and tissue requirements. Recipient vessels were chosen based on availability and vessel quality, with end-to-end or end-to-side anastomoses using 9-0 or 10-0 nylon sutures. Vein grafts were used when the recipient vessel length was inadequate.

Outcome Measures and Statistical Analysis

The primary outcome was flap survival, defined as complete viability of the transferred tissue at discharge. Secondary outcomes included flap complications, re-exploration, salvage success, and donor site morbidity. The successful salvage was defined as any flap that did not result in total loss. Descriptive statistics were calculated for continuous variables as mean ± standard deviation and for categorical variables as frequencies and percentages.

Results

A total of 19 patients underwent free tissue transfer during the study period (Table 1), with a mean age of 55.1 years. There were 12 males (63.1%) and 7 females (36.8%). Comorbidities were present in the patients, including hypertension (47.3%), diabetes mellitus (31.5%), and chronic kidney disease (21.0%). Most patients were classified as ASA III (73.6%), reflecting significant systemic comorbidities. The majority of reconstructions were performed for head and neck defects (15 cases, 78%), followed by lower extremity reconstructions (4 cases, 21%). The free flaps were distributed as follows: anterolateral thigh (ALT) flap: 7 cases (36.8%), free



fibula osteocutaneous flap: 6 cases (31.5%), radial forearm flap: 5 cases (26.3%), and other flaps: 1 case (5.2%). Defect locations included the tongue (31.5%), maxilla (15.7%), mandible (15.7%), lower extremity (15.7%), intraoral mucosa (10.5%), and scalp (0.5%). Vein grafts were required in 2 cases of maxillary reconstruction (10.5%).

The mean ischemic time was 97.2 ± 33.3 minutes, and the mean total operative time was 11.75 ± 4.0 hours. The mean ICU stay was 6.4 ± 5.7 days, and the mean total hospital stay was 20.3 ± 7.7 days. The overall flap survival rate was 73.7% (14 of 19). Prolonged ICU stays were most commonly observed in head and neck reconstruction cases, primarily due to the need for continued intubation while awaiting resolution of flap edema which typically required 7–10 days. In addition, cases requiring revision surgery with a second flap or complicated by failed extubation were associated with prolonged ICU stays. Postoperative monitoring included serial assessments of flap color, turgor, and capillary refill. Patient positioning and flap assessment were performed immediately after the patients arrived at the ward by the surgeon. The flap monitoring was performed every 4-6 hours by nursing staff, and it was always confirmed with the surgeon during the first 12-24 hours postoperatively.

A total of 8 patients (42.1%) underwent re-exploration for suspected vascular compromise, of which 3 flaps (24%) were successfully salvaged. Flap loss occurred in 5 patients (26.3%). Complications at the recipient site included: venous congestion/thrombosis: 5 cases (26.3%), arterial thrombosis: 3 cases (15.7%) and hematoma: 1 case (0.05%). Three arterial thrombosis were found in cases with underlying disease of Systemic lupus nephritis, previous history of chemotherapy from breast cancer treatment, and the Gustilo class IIIB patients. All three maxillary reconstructions with fibular flap had venous congestion due to the increased distance from the pedicle to the recipient vessels compared to the mandibular defect. Only one flap was successfully salvaged with the use of a vein graft during reoperation. One venous congestion of the radial forearm flap in tongue reconstruction occurred from the compression of the post-operative hematoma. This case was resolved with the revision surgery of the venous anastomosis. Another venous congestion was found in a gunshot wound case of lower extremity reconstruction with ALT flap as a result of the pedicled kinking during flap positioning. No cases of infection or fistula were observed. Donor site complications were minimal, limited to 1 case (0.05%) of delayed wound healing; no infections, hematomas, or seromas occurred (Table 2).

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Table 1 Case summary

Case No.	Age, y	Sex	Location	Incident Details	Diagnosis	Recipient Site	Chronic medical conditions	Free flap performed	Flap survival
1	52	M	H&N	Neoplasm	SCC	Tongue	HT	ALT	Yes
2	81	F	H&N	Neoplasm	SCC	Mandible	DM	Radial forearm	Yes
3	32	M	Lower limb	Trauma	Gun shot wound	Lower leg	none	ALT	Yes
4	42	M	H&N	Neoplasm	SCC	Tongue	none	ALT	Yes
5	57	F	H&N	Neoplasm	SCC	Tongue	Thalassemia	Radial forearm	Yes
6	54	M	Lower limb	Neoplasm	Marjolin ulcer	Plantar foot	none	ALT	Yes
7	68	M	H&N	Neoplasm	SCC	Mandible	DM, HT, CKD	Fibula	Yes
8	69	F	H&N	Neoplasm	SCC	Maxilla	DM, HT, Goiter	Fibula	No
9	76	F	H&N	Neoplasm	SCC	Mandible	DM, HT, DLD	Fibula	Yes
10	49	M	H&N	Neoplasm	SCC	Cheek	HT	ALT	Yes
11	26	M	H&N	Neoplasm	SCC	Scalp	SLE	Latissimus dorsi	No
12	76	M	H&N	Neoplasm	SCC	Tongue	none	Radial forearm	Yes
13	12	M	Lower limb	Trauma	Internal hardware expose	Lower leg	none	ALT	No
14	59	M	H&N	Neoplasm	SCC	Maxilla	HT	Fibula	Yes
15	52	M	H&N	Neoplasm	SCC	FOM	none	Radial forearm	Yes
16	60	F	Lower limb	Trauma	Achilles rupture with soft tissue defect	Heel	DM, HT	ALT	Yes
17	67	F	H&N	Neoplasm	SCC	Tongue	DM, HT	Radial forearm	No
18	72	M	H&N	Neoplasm	SCC	Maxilla	none	Fibula	No
19	44	F	H&N	Neoplasm	SCC	Tongue	HT	Radial forearm	Yes

Table 2 Overall complications

Total patients	19 (%)
Recipient sites	
Flap loss	5 (26.3)
Arterial thrombosis	3 (15.7)
Venous congestion/Thrombosis	5 (26.3)
Hematoma	1 (0.05)
Infection	0
Partial flap loss	0
Fistula	0

The comparison of flap success rates between the first and second years of practice was illustrated in Figure 1. The reduction in flap success observed in the second year was attributed to an increased proportion of more complex cases. Contributing patient-related factors included a prior history of chemotherapy, severe lower-extremity trauma (Gustilo type IIIB fractures), and active vasculitis in patients with systemic lupus erythematosus. In addition, maxillary reconstruction posed greater technical challenges due to the increased distance between the flap pedicle and recipient vessels, necessitating the use of interposition vein grafts, which are associated with a higher risk of vascular anastomotic thrombosis.

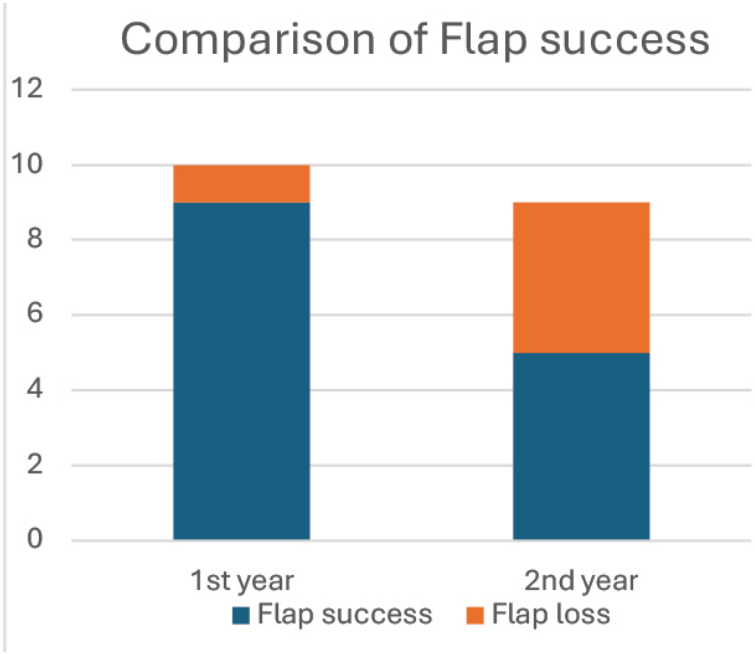


Figure 1 The bar chart demonstrates differences in flap success rates between the first and second years of surgical practice.visible cervical scar, illustrating cosmetic advantage.

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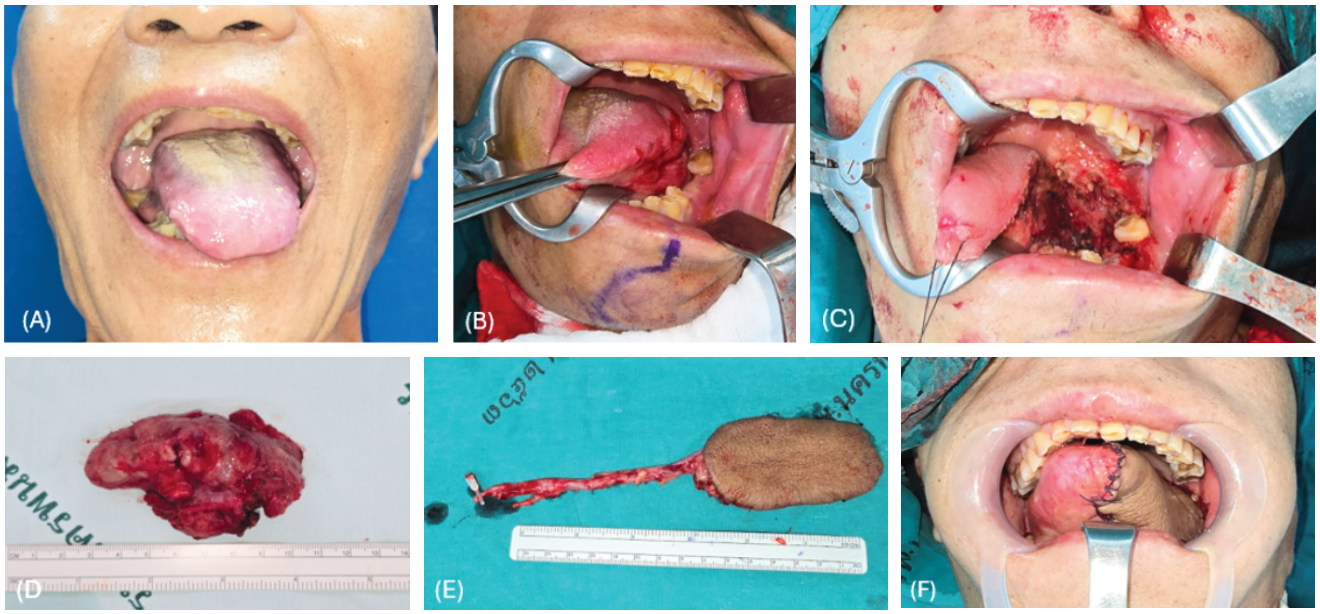


Figure 2 A 56-year-old man with thalassemia was diagnosed with squamous cell carcinoma of the left tongue. (A) Preoperative examination showed deviation of the tongue to the left. (B) An ulcerative mass was noted on the left lateral tongue. (C) Tumor ablation was performed with left hemiglossectomy. (D) Resected specimen of the left hemi-tongue. (E) Harvesting of the radial forearm free flap. (F) Immediate postoperative appearance following tongue reconstruction with a radial forearm free flap

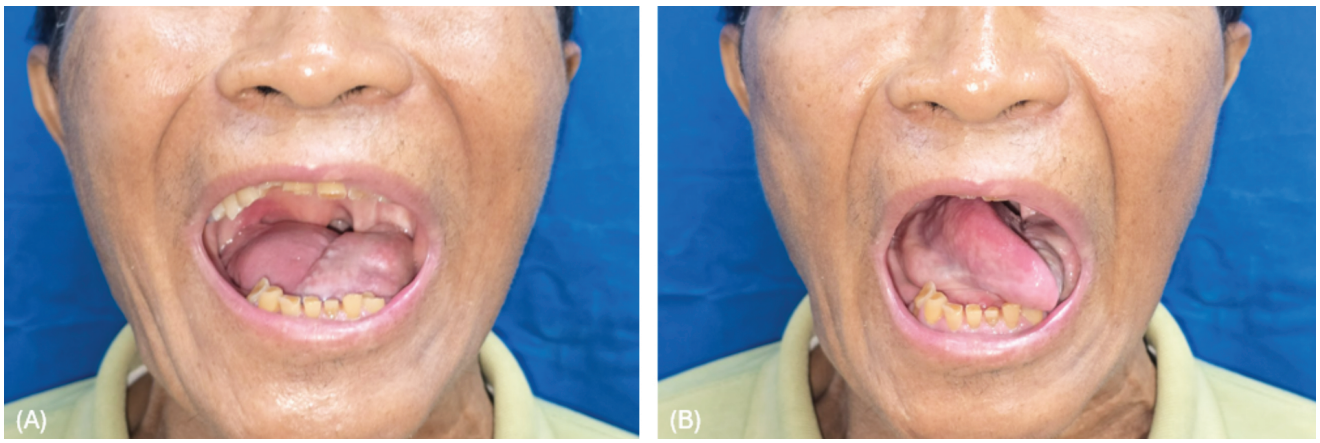


Figure 3 Outcome of radial forearm free flap reconstruction for the tongue. Photographs obtained 14 months postoperatively, following completion of adjuvant radiotherapy. (A, B) The patient demonstrates good tongue contour and mobility

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Figure 4 (A) A 32-year-old man presented with a gunshot wound of the distal third of the right lower leg with exposed tibia. (B) Design of a 6 × 14 cm anterolateral thigh (ALT) flap (width × length). (C) Harvesting of the ALT flap. (D) Immediate postoperative appearance following flap inset. (E) Venous congestion noted on postoperative day 1; partial suture release was performed prior to revision surgery.

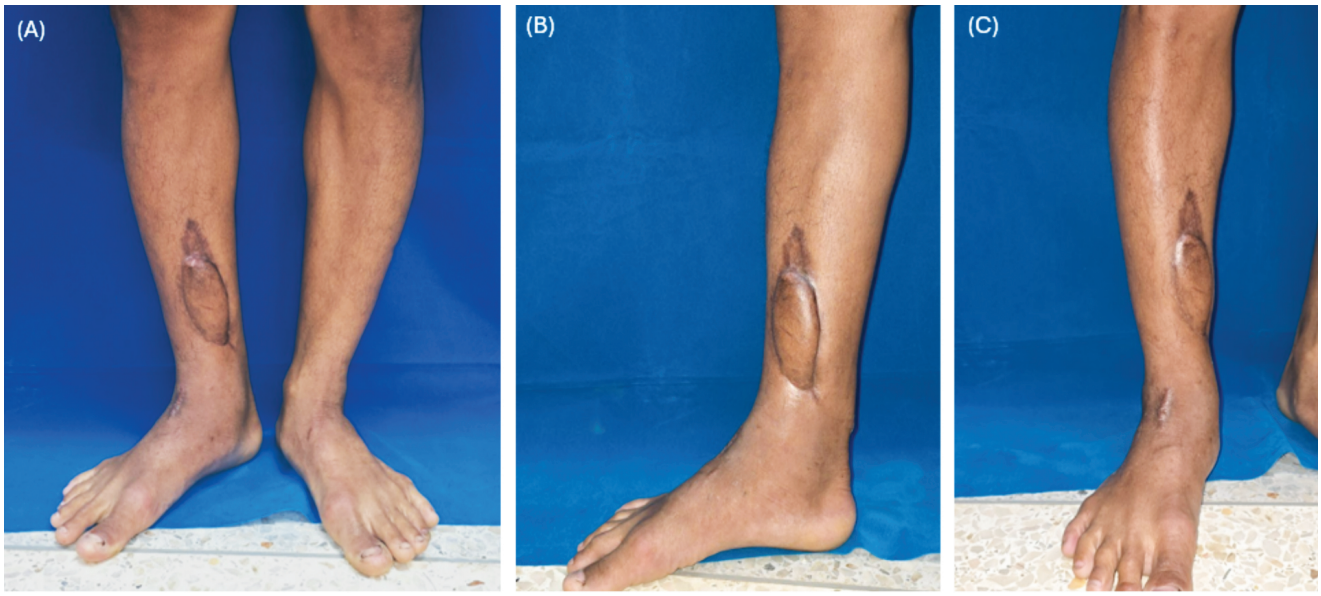


Figure 5 (A–C) Postoperative photographs obtained five months after surgery, shown in anteroposterior and lateral views of the lower leg following an anterolateral thigh (ALT) free flap reconstruction.

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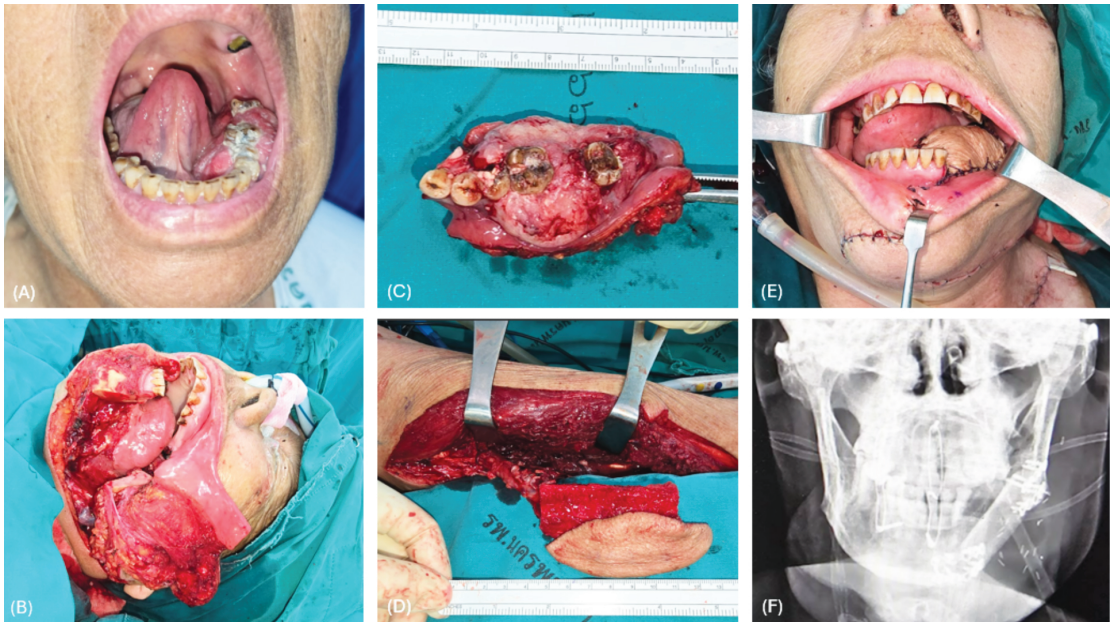


Figure 6 A 76-year-old woman was diagnosed with squamous cell carcinoma of the left lower gingiva with mandibular invasion (A). Tumor ablation was performed with segmental mandibulectomy and left modified radical neck dissection (B, C). Reconstruction was achieved using a fibular osteocutaneous flap harvested from the right lower extremity (D). Final flap inset and bony fixation with miniplates and screws are demonstrated in panels E and F.



Figure 7 (A–C) Postoperative photographs obtained one year after surgery, shown in anteroposterior and oblique views, demonstrating a well-contoured mandible. (D, E) Following completion of postoperative radiotherapy, resolution of flap bulk is observed



Discussion

Free tissue transfer (FTT) has become the cornerstone of modern reconstructive surgery, offering superior functional and aesthetic outcomes in the treatment of complex defects. It allows the plastic surgeon to perform wide excisions for tumor ablative surgery, especially in the most complex defects of the head and neck areas. However, surgical outcomes of FTT are typically reported from higher-volume centers with superior flap survival and salvaged flaps. In 2024, the systematic review reported an overall success rate of 95–99.2% for free flap transfer.[2] Siriraj Hospital, the high-level academic P-plus hospital in Thailand, reported a 92.8% flap success rate and 67.0% salvaged success rate during 2007-2011. There were 153 microvascular flaps during the five years of study, an average of 30 flaps per year.[11] Another study from Rajavithi Hospital, an A-plus level hospital of Thailand, has an 89.7% success rate of free flap reconstruction.[12] In contrast, performing microsurgery in a low-volume, resource-limited environment poses unique challenges. This case series presents the early experience of a young plastic surgeon establishing a free flap program at a standard-level (S) hospital in Thailand, with an overall flap success rate of 73.7% and only 24.0% salvaged flap success.

Challenges in a Low-Volume and Non-Academic Setting

Low-volume centers often face constraints in both technical and logistical aspects of microsurgery. The absence of a dedicated microsurgical team, long operating time, and inexperienced nursing staff can affect outcomes, particularly during the critical early postoperative period. The flap success rate of this study had an inferior result due to several reasons. A two-team surgical approach, in which ablative and reconstructive procedures are performed simultaneously, is not available at our institution. Only two scrubs and one circulating nurse were available for each operation due to the limited number of staff. Long operation usually occurs in the case of tumor ablation with immediate reconstruction. The average of operative time in this study was 11.75 (± 4.0) hours. The most common causes of flap loss were vascular compromise, including venous congestion (26.3%) and arterial thrombosis (15.7%). Early identification of vascular issues in this study was hindered by inconsistent postoperative monitoring, especially within the first 24 hours after surgery. The study by Zoccali et al emphasizes the compulsory monitoring of free flap hourly during the first 48 hours.[13] Shen et al present a high success rate



of flap salvage during the early 24-48 hours in a systematic review. In the first 24 hours, the flap was successfully 93.8% salvaged. The success decreased to 83.33% by day 2. Then, it declined remarkably to 12.1% by day 3, and none survived on day 4.[14]

Clinical bedside assessment remains the standard method for flap monitoring. Vigilant assessment within the first 48 hours is critical, as it allows early identification of vascular compromise, facilitating prompt salvage and enhancing flap survival.[15] Flap-monitoring protocols vary significantly among plastic surgery units. A commonly used schedule includes checks every 30 minutes for the first 3 hours, hourly for the next 48 hours, and every 2 hours until 72 hours postoperatively. Monitoring is then reduced to every 4–8 hours until discharge.[16] However, given our hospital's circumstances, the single plastic surgeon who introduced free tissue transfer is responsible for all aspects of care, including performing the surgery, conducting flap monitoring, and managing ward rounds. The reduced frequency of flap monitoring (every 4–6 hours during the first 48 postoperative hours) is performed in our setting, which delays the detection of flap compromise and increases the risk of unsuccessful salvage. These emphasize the importance of early detection and timely re-exploration in improving salvage rates.

Strategies for Optimizing Outcomes

Several strategies contributed to improved outcomes over time. First, the implementation of a structured flap monitoring protocol—combining frequent clinical assessment with standardized documentation—enhanced early recognition of vascular compromise. Nowadays, clinical assessment remains the most valuable tool for flap monitoring. A review study of flap monitoring presents that the free flap outcomes were not influenced by the extent of resident or physician involvement in postoperative monitoring. Further findings support that a high-volume, well-trained nursing-led flap monitoring system can reliably and efficiently identify flap compromise.[17] Training sessions for nursing staff on flap observation and escalation criteria are essential in bridging the knowledge gap. In the past few decades, the application of Indocyanine Green (ICG) fluorescence imaging for intraoperative flap perfusion assessment was useful in identifying the best perforator during operations and reducing the incidence of postoperative complications, such as flap necrosis and congestion.[18] However, the cost of using ICG was not included in the Medical Expense Reimbursement from the Thai National Health Security Office, causing limited usage in the public hospital.

Comparison with Reported Outcomes

The overall flap success rate of 73.7% in this study is lower than the >95% rates (2). However,



similar success rates have been documented in early experiences of surgeons initiating microsurgical programs in low-volume settings. Reported by Andrey Karpenko et al in 2021, the study had a total of 58 flaps over the period of 6 years, equal to 9.6 flaps per year on average. During the first 2 years, the success rate was 72.2% of the total 18 flaps. The success rate increases remarkably to 95% of the total 40 cases in the last 3 years.[19] Similarly, our study had the same ratio of 9.5 flaps per year in 2 years. The flap success rate was 73.7% which is a comparable result. Therefore, the outcomes in this series reflect a realistic trajectory of a developing microsurgical service rather than poor performance.

Center-specific strategies to improve the outcomes

Several strategies were implemented to improve free flap outcomes. These included the establishment of a structured multidisciplinary microsurgical team and the implementation of standardized perioperative care and flap monitoring pathways. In addition, collaboration with regional academic centers provided valuable guidance in case selection and intraoperative troubleshooting. Ongoing development of close cooperation among surgeons, anesthesiologists, scrub nurses, and ICU nurses further enhanced perioperative coordination and postoperative care.

Limitations

This study is limited by its retrospective nature, small sample size, and the absence of long-term functional outcome assessment. A comparative analysis was not feasible due to the small sample size of the study. Nevertheless, the study provides valuable insight into the challenges faced during the establishment of a microsurgical program in a resource-constrained setting.

Conclusions

Establishing free tissue transfer in a low-volume, non-academic hospital is challenging but achievable. The Initial success rates for free flap surgery during the early stages were significantly lower than current rates >95%.[2] Flap survival was only 73.7% in this study. The disparity in success rates underscores the significant role of surgeon experience. Finally, the flap success depends on recognizing system limitations, engaging in continuous team training, and maintaining perseverance through the steep learning curve. The lessons from this early experience may help young plastic surgeons aiming to initiate microsurgical programs in similar environments.

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