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PEDICLED ABDOMINAL FLAP FOR MALIGNANT DEFECT RECONSTRUCTION: A VIABLE ALTERNATIVE TO FREE FLAP

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ABSTRACT

Introduction: The pedicled abdominal flap, a commonly used reconstructive option, remains relevant in the era of advanced microsurgery despite the rising preference for free flaps. While free flaps offer advantages, they also carry risks of flap failure and require complex microvascular anastomosis, making them less suitable for certain patients.
Case Illustration: A 48-year-old female with a non-healing chronic ulcer over the left upper arm, secondary to burn scarring from a flame burn 20 years ago, underwent tumor resection and debridement with full-thickness tissue loss. A pedicled axial fasciocutaneous flap based on paraumbilical perforators was taken from the left lumbar abdominal region and used to close the defect.
Discussion: This case report highlights the use of the pedicled abdominal flap in the reconstruction of defects resulting from malignancy, emphasizing its reliability and suitability in such complex scenarios. For individuals with malignancy, the pedicled abdominal flap is often favored due to its safer, single-stage procedure, minimizing complications and re-operation risks.
Conclusion: Compared to free flaps, the pedicled abdominal flap is a preferable choice in reconstructing defects in cancer patients due to its reliability, reduced risk of flap failure, and relatively simple surgical procedure. This is particularly important for cancer patients, where the focus is on achieving functional reconstruction while considering patient's prognosis.

Highlights:

1. Pedicled abdominal flap remains a reliable reconstructive option in the era of microsurgery.
2. Although a two-stage procedure, it provides safe and functional reconstruction.
3. Compared to free flaps, it offers a simpler approach with fewer complications, which is crucial for cancer patients with limited prognosis.

INTRODUCTION

In the era of continuously developing microsurgery, free flaps have gained preference replacing pedicled abdominal flap. However, with better aesthetic outcomes, free flaps still carry the inherent risk of flap failure (up to 10%) which can lead to significant complications.[1] On the other hand, the pedicled abdominal flap, although needs two stage reconstruction, is often preferred in certain patient populations, particularly those with malignancy. It offers a safer option than performing microvascular anastomosis, which requires greater technical expertise and carries higher risk of thrombosis.[2] In such clinical contexts, surgical decision-making often prioritizes the mitigation of complications, given that free flap procedures are linked to a greater incidence of flap loss, increased reoperation rates, and prolonged recovery periods.

Although pedicled abdominal flaps have been extensively utilized in reconstructive surgery, recent literature offers limited insight into their specific advantages for oncologic patients, particularly those with advanced malignancies who may be suboptimal candidates for free flap procedures due to significant comorbidities, limited life expectancy, or tumor-related constraints. Comprehensive comparative studies examining long-term outcomes, functional results, and complication rates between pedicled abdominal flaps and free flaps remain scarce, especially in the context of malignancy-related reconstruction outside the head and neck region.[3]

This case report aims to address these gaps by highlighting the role of pedicled abdominal flaps in the reconstruction of defects resulting from malignancy, focusing on their reliability, safety, and functional outcomes in a cohort that may not be suitable for free flap procedures. By presenting a detailed examination of this approach, we hope to establish that the pedicled abdominal flap remains an essential tool in oncologic reconstruction, offering a valuable alternative in specific patient populations in the era of advanced microsurgery.

CASE ILLUSTRATION

A 48-year-old female presented with a history of a non-healing ulcer over the left upper arm due to burn scarring from a flame injury sustained 20 years prior. The burn scar, initially stable, began to ulcerate and enlarge progressively over several years despite routine modern wound dressing measures. Clinical examination revealed an ulcerated lesion with irregular margins and induration, suggestive of malignancy (Figure 1).

Figure 1. Initial Defect of The Left Upper Arm

The patient underwent a biopsy, and histopathological examination revealed a well-differentiated squamous cell carcinoma, classified as not otherwise specified (NOS). Based on this diagnosis, the surgical oncology team planned a wide excision with a 1–2 cm safety margin to ensure complete tumor removal. Considering the potential for a significant tissue defect following resection, the patient was referred to the plastic surgery department for collaborative surgery to perform wound closure and reconstruction.

Following tumor resection, debridement of the defect was done which showed complete loss of skin, subcutaneous tissue, and fascia of the upper arm. A rectangle-shaped skin flap was designed on the left abdominal region on the same side as the defect on the affected upper arm. A pedicled abdominal flap was harvested from the left lumbar area of the abdomen, utilizing the paraumbilical perforators for vascularity. Theoretically, the flap can be located anywhere as long as it is designed above the central axis of the lateral abdomen area, so the position of the flap should be determined according to the area that is to be covered.[4] A split-thickness skin graft was harvested from the left thigh and applied to cover the donor site on the abdominal wall following flap harvest. Subsequently, the patient's upper arm was positioned against the abdomen and carefully immobilized using a splint, dressing, and plaster to maintain stability and support the healing process (Figure 2).

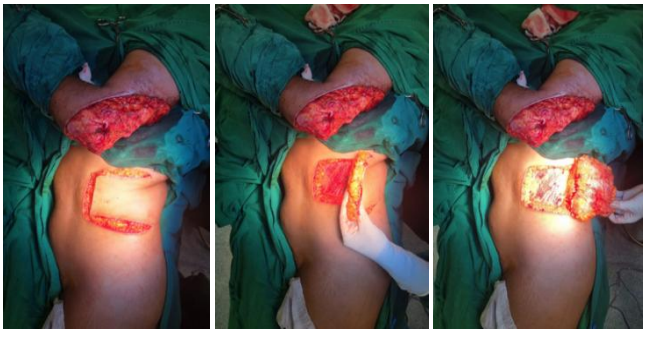

Figure 2. Flap Harvest and Immediate Postoperative Result

A follow-up examination five days post-operatively revealed that the flap remained viable and patient was discharged. The flap remained in place for three weeks, and then followed by another surgery for flap divison. After being divided, the flap showed reliable viability, with rapid capillary refill time, skin color demonstrated good tissue perfusion, wound dehiscence was not present, and skin graft healed well (Figure 3).

Figure 3. Flap Division 3 Weeks Post-Operatively

At 1 month follow-up, flap showed successful healing with stable soft tissue coverage across the entire left upper arm, and the donor at left abdomen showed complete epithelialization. Skin graft showed acceptable take nearing 95% viability, with remaining raw surface treated with regular wound care (Figure 4).

Figure 4. One month Post-Operative Of Flap And Donor Site

Patient then underwent radiotherapy to decrease risk of recurrence. At 3 month follow-up, the flap remains viable, the raw surface of previous skin graft has greatly reduced in size, and is covered by granulation tissue (Figure 5). Patient showed normal range of motion in the left upper extremity and was satisfied with the long-term outcomes. We did not get the 6 month and 1 year data since she did not come for another follow up.

Figure 5. 3 Month Post-Operative Shows Flap Remains Viable

DISCUSSION

Our case posed a challenge due to the upper extremity defect, requiring preservation of the patient's range of motion. The defect was extensive, with complete soft tissue loss, making skin grafts and local flaps unsuitable. Given the patient's history of well-differentiated squamous cell carcinoma and uncertain metastatic risk, microsurgical free flap reconstruction was deemed unnecessary, as its risks, such as prolonged surgery and potential flap loss could outweigh the benefits.

In cancer patients, selecting the right reconstructive approach is crucial for balancing function, aesthetics, and overall health. Since malignancy often shortens life expectancy and increases metastatic risk, a reliable, low-risk reconstruction is preferred. The pedicled abdominal flap is particularly advantageous for large defects, providing durable coverage with minimal surgical burden.

The pedicled abdominal flap relies on an established vascular anatomy, typically from the paraumbilical perforators, which ensures a predictable and robust blood supply compared to free flaps.[5] This vascular consistency reduces the risk of flap failure, a significant concern in cancer patients who may already have poor

perfusion or systemic factors, such as cachexia, malnutrition, or chemotherapy effects that compromise wound healing and flap viability.[6] Given that free flaps are more susceptible to complications such as thrombosis or venous congestion, which could necessitate reoperation, the pedicled abdominal flap minimizes the need for additional surgeries. This consideration is particularly relevant for patients with advanced malignancy, where further surgical interventions may pose additional risks.[7]

The pedicled abdominal flap is frequently used to repair defects in areas such as the upper extremity, chest wall, or abdominal wall, with the flap's size and shape easily customized to fit different defect requirements.[8] The relatively straightforward procedure of harvesting and shaping the abdominal flap makes it an appealing option, particularly in settings where advanced microvascular techniques or facilities may not be available.[9] Additionally, cancer patients often experience compromised immune function due to treatments such as chemotherapy or radiation therapy, which can impair wound healing and increase susceptibility to infections.[10] The pedicled abdominal flap, with its reliable blood supply and less complex surgical requirements, is associated with a lower incidence of wound-related complications compared to free flap procedures[11]. This simplicity is especially beneficial for patients who may not tolerate prolonged surgical times or the risks associated with microsurgical techniques.[12]

In this case, it was shown that the pedicled abdominal flap is a simple and effective reconstructive option. It is simpler, does not require microvascular anastomosis, and can be performed even in resource-limited settings.[13] The bulky nature of the flap is particularly advantageous for reconstruction around the elbow joint. It provides adequate soft tissue padding, which is critical in this area to prevent pressure points and wound breakdown. Furthermore, in our case, the flap did not require secondary thinning, as its volume was well-suited to the defect and provided sufficient coverage without compromising the range of motion. Another notable advantage was the rapid wound healing observed, which was important in this patient who required further radiotherapy. The reliable healing and early recovery allowed timely continuation of the patient's oncologic treatment, minimizing delays in the overall management plan.

There are inherent limitations with the use of a pedicled abdominal flap in upper extremity reconstruction. One of the most significant challenges is patient discomfort due to the positioning required during the initial period of flap insetting and integration. The need to maintain the arm in a flexed position, often attached to the abdomen for several weeks, can be uncomfortable and may lead to patient dissatisfaction. Prolonged immobilization carries the risk of elbow stiffness or contracture, which necessitates careful physiotherapy post-detachment.[14] Additionally, the morbidity at the donor site, including potential for wound complications, scarring, or delayed healing at the abdominal area, must be considered. Another limitation is the requirement for a two-stage procedure, as flap division and insetting typically need to be performed after an initial period of vascular ingrowth, prolonging the total treatment duration and potentially adding to the patient's overall surgical burden.[15]

Studies comparing pedicled flap and free flap in oncologic patients are limited especially in upper extremity reconstruction. In a systematic review on head and neck cancer, patients underwent pedicle flap has shorter surgery time, ICU and hospital stay, with lower cost. However, it has higher rate of any complications although there are variations across studies. Flap failure and necrosis happened in 31% cases of pedicled flap compared to 4% on free flap group (p 0.02). Partial necrosis happens in lesser

extent (11% vs 2.8%). Infection and wound dehiscence were observed in 17% and 10% in pedicled flap compared to 3% and 0% in free flap, respectively.[16] A small study (n=38) on upper extremity sarcoma showed that pedicled flap resulted in higher complications (55.6% vs 5%; p 0.00), yet without significant differences on infection or flap loss (11.1% vs 0%).[17]

This case highlights the novelty of utilizing a pedicled abdominal flap for extensive upper extremity reconstruction in a cancer patient who required a balance between oncologic safety and functional preservation. While pedicled abdominal flaps have been traditionally used in various reconstructive scenarios, their application in this context offering a simple, robust, and timely solution without delaying adjuvant therapy demonstrates an adaptable approach in complex oncologic reconstruction. While the pedicled abdominal flap offers a reliable, simple, and effective solution for large soft tissue defects in the upper extremity, particularly in oncologic patients, careful consideration of patient selection, postoperativemanagement, and potential complications is essential to optimize outcomes. Moreover, The pedicled abdominal flap is a safe option, especially in centers without microsurgical backup. It saves operating time and minimizes donor site morbidity. Postoperative monitoring is required to ensure flap viability.

Future studies are required to compare the long-term outcomes of pedicled abdominal flaps with free flaps, particularly in upper limb reconstruction in cancer patients. Such studies are essential to determine not only functional and aesthetic outcomes but also complication rates, patient satisfaction, and quality of life. Multicenter trials involving heterogeneous patient groups, large numbers of patients, and longer follow-up will provide more robust and generalizable data. Moreover, comparative investigations can determine patient-specific variables affecting flap selection and guide individualized reconstructive planning. Lastly, such efforts will pave the way for the formulation of evidence-based practice guidelines that optimize outcomes in this difficult-to-treat population.

Table 1. Comparison of Pedicled Flap (PF) and Free Flap (FF) in Oncologic Reconstruction [15-22]

Parameter	Pedicled Flap (PF)	Free Flap (FF)
Operative Time	Shorter (mean: 6h 53m)	Longer (mean: 9h 18m)
ICU & Hospital Stay	Shorter ICU (0.1–1 d); shorter hospital stay (esp. SMIF/SCAIF)	Longer ICU (1.4–2 d); longer hospital stay
Cost	Lower	Higher
Availability & Feasibility in Resource-Limited Settings	High; suitable without microsurgery	Limited; needs specialized infrastructure
Technical Demand	Less demanding	Requires microvascular expertise
Postoperative Complications	Higher overall; flap loss (31%), infection (17%), dehiscence (10%)	Lower overall; flap loss (4%), infection (3%), dehiscence (0%)
Functional & QoL Outcomes	Acceptable; lower scores in speech/social; suitable for moderate defects	Superior; better scores in function, speech, emotion; preferred for large/complex defects
Recovery Time	Faster initial wound healing	Slower wound healing, but better long-term function
Donor Site Morbidity	Present (e.g., abdominal wall, PMMF)	Variable (e.g., RFFF, ALT)
Versatility & Defect Coverage	Good for small–moderate defects; limited for >70 cm^2	Excellent for large, composite, 3D defects
Suitability in Comorbid Patients	Safer; less invasive	Riskier in patients with high CCI (>4)
Aesthetic Outcomes	Acceptable	Often superior with better contouring

CONCLUSION

Compared with free flap reconstruction, the pedicled abdominal flap continues to serve as a dependable and effective alternative for addressing soft tissue defects in cancer patients, particularly those with compromised systemic health or advanced-stage malignancies. This technique inherently reduces surgical risk, lowers the incidence of flap failure, and provides a more accessible reconstructive option, especially in clinical environments where microsurgical expertise is limited. Given these advantages, the pedicled abdominal flap warrants consideration for a wider spectrum of both oncologic and non-oncologic reconstructive applications. Future research should prioritize the evaluation of long-term functional outcomes, patient-reported quality of life measures, and the continued optimization of flap design to enhance surgical success while minimizing donor site morbidity.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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The authors declare that no funding was received for this study.

AUTHOR CONTRIBUTION

BK contributed to the investigation, writing, and data curation for this study. PTU was responsible for the conceptualization, writing, and data curation. Both authors collaborated closely throughout the research process and contributed significantly at every stage, from investigation to manuscript preparation.

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