

The Hemisoleus Muscle Flap: An Effective and Versatile Solution for Middle Third Leg Defects in the Modern Era of Free Flap Surgery at a Tertiary Care Facility

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Abstract:

Background: Leg defects with exposed bones, often resulting from trauma, present complex challenges in reconstructive surgery. The Hemisoleus muscle flap has emerged as a potential solution, offering versatility and effectiveness. This study aims to evaluate its utility in middle third leg defects.

Methods: A retrospective analysis of 50 patients with middle third leg defects was conducted. Patient demographics, injury characteristics, comorbidities, surgical procedures, and postoperative outcomes were assessed. Follow-up evaluations were performed at regular intervals.

Results: The Hemisoleus muscle flap demonstrated effectiveness across diverse patient demographics, with 74% men and 26% women. The average age was 38 years. Trauma, primarily motorcycle accidents, caused all injuries, resulting in bone exposure. Osteomyelitis was present in 16% of cases. Comorbidities included hypertension (20%), diabetes (20%), and smoking (30%). The hospitalization period averaged 6 days, and patients underwent outpatient follow-ups. Notably, only one infection case occurred, with no flap necrosis, suture dehiscence, or systemic complications. No additional surgeries were required, categorizing patients as Grade 1 according to the Clavien-Dindo Classification.

Conclusion: The Hemisoleus muscle flap proves safe and effective for middle third leg defects, even in diverse patient populations and with comorbidities. Its low complication rate underscores its reliability. This study reaffirms the value of muscle flaps in reconstructive surgery, emphasizing their continued importance in contemporary practice.

Recommendation: Based on our findings, we recommend considering the Hemisoleus muscle flap as a viable option for middle third leg defects with exposed bones, particularly in traumatic cases. Further research and collaborative efforts can help refine the technique and establish standardized guidelines for its application.

Keywords: Hemisoleus Muscle Flap, Middle Third Leg Defects, Trauma Reconstruction and Reconstructive Surgery.

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Introduction

The treatment of complex leg defects, particularly those affecting the middle third of the leg, has witnessed significant advancements in recent years, thanks to the evolution of microsurgical techniques and the increasing utilization of free flap surgeries. Among the myriad options available for reconstructing such defects, the Hemisoleus muscle flap has emerged as a highly effective and versatile choice, particularly in the modern era of free flap surgery [1]. This technique offers a unique set of advantages, including its reliability, minimal donor site morbidity, and adaptability for a wide range of

leg defects. In this era of specialized care, tertiary care facilities play a pivotal role in refining and optimizing such surgical approaches [2].

In this article, we delve into the Hemisoleus muscle flap as a valuable solution for addressing middle third leg defects, highlighting its distinct advantages and outcomes [3]. We explore the nuances of this surgical technique in the context of a tertiary care facility, where multidisciplinary expertise and state-of-the-art resources converge to elevate the standard of care for patients with complex leg defects [4].

To understand the significance of the Hemisoleus muscle flap in the modern era of free flap surgery, we will delve into the historical development of this procedure, review its anatomical considerations, and discuss its clinical applications. Additionally, we will examine relevant case studies and share insights from contemporary research to underscore its efficacy and versatility [5]. As the demand for optimal leg defect reconstruction continues to grow, this comprehensive exploration of the Hemisoleus muscle flap aims to provide clinicians, surgeons, and researchers with a thorough understanding of its potential in improving patient outcomes at tertiary care centers.

The aim of study is to evaluate the post-traumatic open wound in the middle third of the leg and treatment with microsurgical technique i.e. Hemisoleus muscle flap.

Methodology

Study Design: Retrospective study was conducted.

Study Setting: The research was conducted at PMCH during January 2023 to August 2023.

Participants: Participants with a post-traumatic open wound in the middle third of their leg were chosen as candidates for the application of the Hemisoleus muscle flap to address the defect.

Inclusion and Exclusion Criteria: Inclusion Criteria: Patients with middle third leg defects,

seeking treatment at a tertiary care facility, and suitable for Hemisoleus muscle flap reconstruction. Exclusion Criteria: Patients with contraindications to surgery, defects amenable to less invasive methods, unwillingness to provide consent, complex surgical history, or unrealistic expectations.

Study Size: A study of 50 patients with a post-traumatic open wound in the middle third of their leg were chosen in the study after meeting the inclusion criteria.

Data Collection and Analysis: Data was collected retrospectively from the medical records of patients. For this study, 50 patients with post traumatic raw area in the middle third of the leg were selected to cover the defect by Hemisoleus muscle flap.

Bias: To minimize bias, the aim of the study was not disclosed to the participants or healthcare providers during data collection. Additionally, data analysts were blinded to the identity of the participants

Statistical Analysis: Data were computed into an Excel data sheet and frequency along with percentages were calculated.

Ethical Considerations: The study was carried out in accordance with ethical guidelines, which included getting each participant's informed consent. The ethics committee examined and approved the study protocol.

Result

Table 1: Patients with post traumatic raw area in the middle third of the leg

Parameter	Total Patients (n=50)	Percentage (%)
Gender		
- Male	37	74%
- Female	13	26%
Age (Years)		
- Range	17 – 59	
- Average Age	38	
Cause of Injuries		
- Trauma	50	30%
- Motorcycle Accidents		70%
Osteomyelitis	8	16%
Exposed Bone without Osteomyelitis	42	84%
Comorbidities		
- Hypertension	10	20%
- Diabetes	10	20%
- Smoking	15	30%
Hospitalization Period (Days)	6	
Follow-up Period		
- 10 Days		
- 1 Month		
- 6 Months		
- 1 Year		
Complications		
- Infection	1	
- Flap Necrosis	0	

- Suture Dehiscence	0	
- Systemic Complications	0	
Additional Plastic Surgery Procedures	0	
Clavien-Dindo Classification (Grade 1)	50	100%

In our study encompassing 50 patients, the Hemisoleus muscle flap demonstrated its effectiveness and versatility as a reconstructive solution for middle third leg defects. Among these patients, the gender distribution revealed 74% men and 26% women, highlighting the applicability of the procedure across diverse demographics. The average age of the cohort was 38 years, emphasizing its relevance in addressing leg defects spanning various age groups. Trauma remained the predominant cause of injuries, with all cases resulting in bone exposure, predominantly due to motorcycle accidents. Osteomyelitis was observed in 16% of the cases, while the majority (84%) had exposed bone without osteomyelitis. Comorbidities, such as hypertension, diabetes, and smoking, were present in 20%, 20%, and 30% of the patients, respectively. Post-surgery, patients typically experienced a short hospitalization period of approximately 6 days and underwent outpatient follow-ups at 10 days, 1 month, 6 months, and one year.

Remarkably, only one case of infection was noted, with no occurrences of flap necrosis, suture dehiscence, or systemic complications. Moreover, none of the patients required additional plastic surgery procedures, signifying favorable outcomes and categorization into Grade 1 as per the Clavien-Dindo Classification. These findings underscore the Hemisoleus muscle flap's efficacy and safety in addressing middle third leg defects in a diverse patient population.

Discussion

In our study of 50 patients, the Hemisoleus muscle flap proved effective for middle third leg defects. Gender distribution was 74% men and 26% women, demonstrating applicability across demographics. Average age was 38 years, highlighting relevance across age groups. Trauma, predominantly motorcycle accidents, caused injuries with bone exposure. Osteomyelitis was in 16% of cases, while 84% had exposed bone without osteomyelitis. Hypertension, diabetes, and smoking were common comorbidities. Hospitalization averaged 6 days, with outpatient follow-ups. There was one infection case, and no flap necrosis, suture dehiscence, or systemic issues. No additional surgeries were needed, categorizing patients as Grade 1 per the Clavien-Dindo Classification. These findings underscore the Hemisoleus muscle flap's safety and efficacy for diverse middle third leg defects.

Leg wounds pose unique challenges due to specific anatomical characteristics, including limited skin

elasticity, minimal subcutaneous tissue, a terminal arterial vascularization system, the presence of subcutaneous bone (tibia), and difficulties in venous return when in an upright position [6]. To address leg defects effectively, the leg is divided into three zones: proximal, middle, and distal. For the middle third of the tibia, the Hemisoleus muscle flap is a frequently employed and effective option [7]. Alternatively, sural flaps are used for reconstructing the distal third of the tibia. While free tissue transfer remains an option for all regions, its feasibility may decrease due to fibrosis formation and tissue devitalization after 72 hours, potentially necessitating skin grafts. Muscle flaps are among the preferred choices for regional reconstruction due to their ability to provide ample tissue bulk, efficient defect coverage, improved local blood circulation, and a conducive environment for osteogenesis [8]. Although fasciocutaneous flaps are less invasive and have lower blood flow and tissue oxygen tension compared to muscle flaps, the latter exhibit more robust and faster wound healing [9]. Perforator propeller flaps offer good blood supply and vascular axis preservation, but meticulous dissection is required to isolate vessels without causing damage. Primary donor site closure is often possible [10]. Comparatively, fasciocutaneous and perforator propeller flaps offer ease of elevation for secondary procedures, but muscle flaps, overall, remain the superior choice for leg wound coverage.

The Hemisoleus muscle flap stands out as a reliable option for covering defects in the middle third of the leg, even when osteomyelitic bone is involved. This sizable muscle, located deep within the leg's posterior compartment, derives its vascular supply from the posterior tibial artery and secondary pedicles. While its primary function is plantar flexion of the foot, it can be utilized as a muscle flap to ensure robust vascularization of defects [11]. The technique for raising this flap is straightforward, and it offers considerable versatility with a wide arc of movement, making it suitable for covering bone areas. Moreover, it contributes to infection control by facilitating the supply of antibiotic substances and tends to result in minimal postoperative complications and sequelae [12].

Conclusion

In this research, we employed the Hemisoleus muscle flap for reconstructing middle third leg defects with exposed bones. This procedure is straightforward to perform, with a steep learning curve, and it consistently yielded highly satisfactory outcomes. Furthermore, it resulted in minimal

functional consequences. Across all cases, our objective was accomplished with remarkable success. Hence, this study reaffirms the enduring value of muscle flaps, emphasizing that although this technique may be considered old, it remains invaluable. In certain circumstances, muscle flaps can be the preferred and primary choice as a local flap option.

Limitations: The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendation: : Based on our findings, we recommend considering the Hemisoleus muscle flap as a viable option for middle third leg defects with exposed bones, particularly in traumatic cases. Further research and collaborative efforts can help refine the technique and establish standardized guidelines for its application.

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