Section: Plastic and Reconstructive Surgery

Case Series

THE CHALLENGING KNEE: RECONSTRUCTIVE OPTIONS AND OUTCOMES – A CASE SERIES

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ABSTRACT

Soft tissue defects around the knee remain a reconstructive challenge because of limited soft tissue coverage, frequent exposure of bones around knee and joint, tendons, prosthetics/ implants, and the need to cover these and preserve joint function as well. These defects commonly result from trauma, infection, burns, tumour excision, or complications following joint procedures with or without prosthetics/ implants. Successful reconstruction requires durable vascularized tissue that provides stable coverage, resists infection, and facilitates early rehabilitation while minimising donor-site morbidity. A wide range of reconstructive options, including local and regional fascio cutaneous flaps, muscle flaps, perforator-based flaps, cross-leg flaps, and free tissue transfer, are available. The flap selection is guided by defect size, location, tissue requirements, and patient factors. Reconstructive planning to be individualised, therefore essential to achieve optimal functional and aesthetic outcomes. We present a case series of nine patients with complex knee soft tissue defects reconstructed using various local, regional, and free flap techniques, all of whom achieved successful flap survival with satisfactory functional outcomes.

INTRODUCTION

Soft tissue defects around the knee present a significant reconstructive challenge because of the limited availability of local soft tissue, the subcutaneous location of the joint, and the need to preserve both stability and mobility. These defects commonly result from trauma, infection, burns, tumor excision, or postoperative wound complications following knee surgeries, often leading to exposure of bone, joint, tendons, implants, or prosthetic components. Inadequate soft tissue coverage may increase the risk of infection, delayed wound healing, implant exposure with failure of the surgery, joint stiffness, and functional impairment. Therefore, timely reconstruction with appropriate soft tissue coverage is essential to achieve durable wound healing and restore knee function.[1-3]

A wide range of reconstructive techniques has been described for the management of knee defects, like local fascio cutaneous flaps, muscle flaps, regional flaps, distant flaps, and free tissue transfer.[1-3] The selection of an appropriate reconstructive option depends on several factors, including the size and location of the defect, the extent of tissue loss, exposure of underlying vital structures, wound contamination or infection, previous surgical procedures, and the availability of local tissues.[1,3] Each reconstructive technique has specific indications, advantages, and limitations, and no single method is suitable for all clinical scinerios.[1,3] Despite the availability of various reconstructive techniques, reports describing use of various flap options for diverse knee defects remain limited.[1-4]

This case series illustrates the application of a defect-oriented reconstructive approach for the management of complex soft tissue defects involving the knee. The cases represent a broad spectrum of etiology, including road traffic injuries, post-infective defects, electrical burn injuries, oncological resections, and implant-related wound complications. Reconstruction was performed using various techniques tailored to the individual defects, including Transposition flap, Ponten fasciocutaneous flap, Hatchet flap, Propeller flap, Gastrocnemius muscle flap, Pedicled vastus lateralis muscle flap and Reverse anterolateral thigh flap, Cross-leg flap, Free latissimus dorsi muscle flap. The successful use of these techniques across varied clinical scenarios highlights the importance of the flap selection should be individualised to achieve durable wound coverage, protecting exposed vital structures, and preserving knee function

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Case Presentations

Case 1

A 31-year-old male presented with a history of a road traffic accident with a soft tissue defect over the right knee, exposing the knee joint, along with a distal femur fracture stabilized with an external fixator. Wound debridement was performed, and the knee defect was reconstructed using a transposition flap. (interpolation flap). The donor site was covered with a split-thickness skin graft (Figure 1). The flap settled well with minimal wound dehiscence, which was managed conservatively. The patient was followed up for 5 months postoperatively and developed a normal range of knee movements.

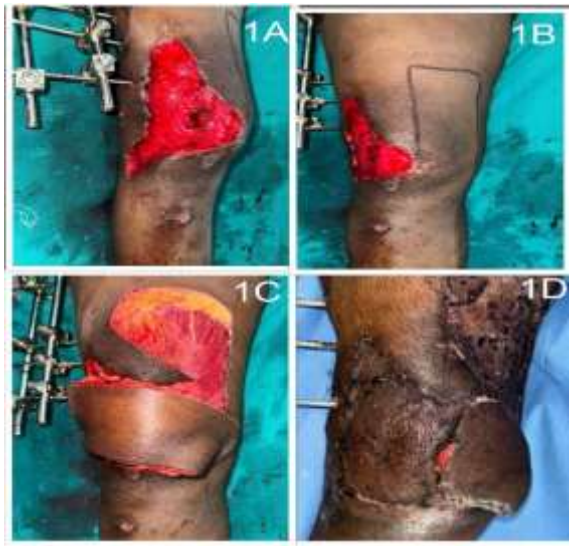

Figure 1: Reconstruction of a post-traumatic right knee soft tissue defect using a transposition flap.

Case 2

A 49-year-old male presented with a post-infective soft tissue defect over the left knee following septic arthritis, resulting in exposure of the knee joint. Wound debridement was performed, and the soft tissue defect was reconstructed using a Hatchet flap (Figure 2). The flap settled well without any complications. The patient developed a normal range of knee movement.

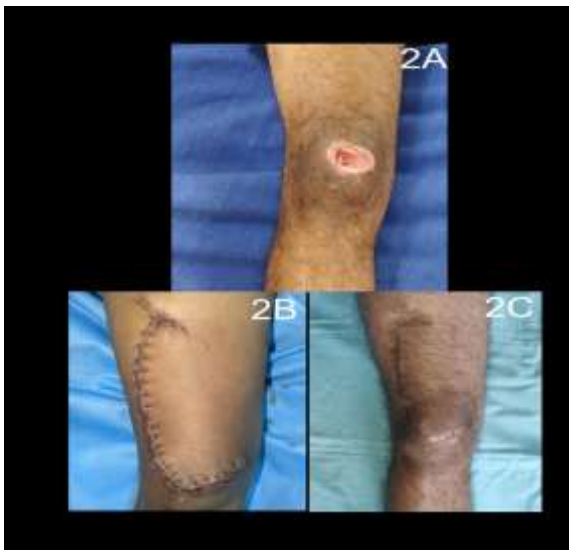

Figure 2: Reconstruction of a post-infective left knee soft tissue defect following septic arthritis using a Hatchet flap.

Case 3

A 42-year-old male presented with post-traumatic left knee hemarthrosis and a peripatellar soft tissue defect communicating with the knee joint. The wound was debrided, and the soft tissue defect around the left knee was reconstructed using a propeller flap (Figure 3). The flap settled well, and the patient developed a normal range of knee movement.

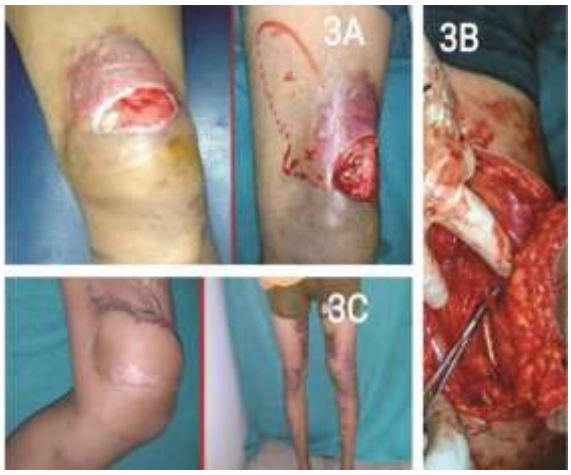

Figure 3. Reconstruction of a post-traumatic peripatellar soft tissue defect using a propeller flap.

Case 4

A 45-year-old male presented with a post-traumatic soft tissue defect over the left knee exposing the knee joint. Wound debridement was performed, followed by reconstruction using a medial gastrocnemius muscle flap with a split-thickness skin graft (Figure 4). The flap settled well, and the patient developed a full range of knee movement

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Figure 4: Reconstruction of a post-traumatic left knee soft tissue defect using a medial gastrocnemius muscle flap with split-thickness skin graft.

Case 5

A 32-year-old male with osteosarcoma of the left distal femur underwent wide local excision with Mega prosthesis performed by the surgical oncology team. Six months later, the patient developed a soft tissue sarcoma over the left knee joint. The surgical oncology team subsequently performed wide local excision of the neoplasm. Following excision, the patient presented with implant exposure and a soft tissue defect over the left knee. Reconstruction was performed using a pedicled vastus lateralis muscle flap with a split-thickness skin graft (Figure 5). The flap settled well, and the patient developed a good range of knee movement.

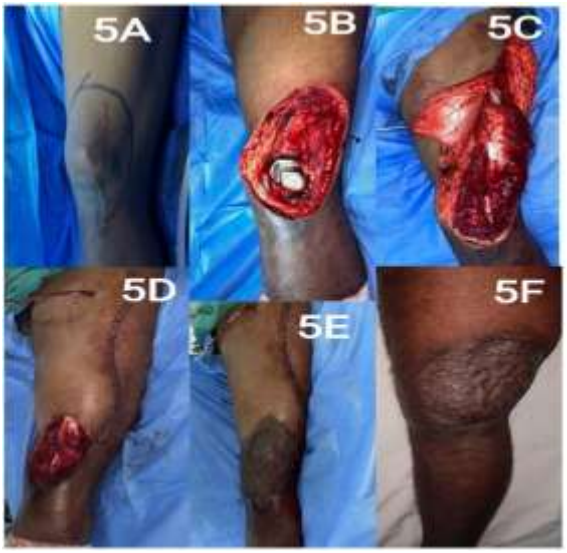

Figure 5: Reconstruction of a post-oncological left knee soft tissue defect with implant exposure using a pedicled vastus lateralis muscle flap and split-thickness skin graft.

Case 6

A 35-year-old female with a right total knee replacement presented with an exposed implant. The wound was thoroughly debrided, and reconstruction was initially performed using a transposition flap, which gone for partial necrosis. A cross-leg flap was then performed (Figure 6). The flap settled well, and the patient achieved a full range of knee movement.

Figure 6: Reconstruction of an exposed right total knee replacement implant using a cross-leg flap following transposition flap failure

Case 7

A 34-year-old male with bilateral electrical burn injuries involving the knees underwent wound debridement. The left knee defect was covered with a split-thickness skin graft. The right knee had an exposed joint, which was reconstructed using a pedicled reverse anterolateral thigh flap (Figure 7). The flap settled well, and the patient achieved a full range of motion after physiotherapy.

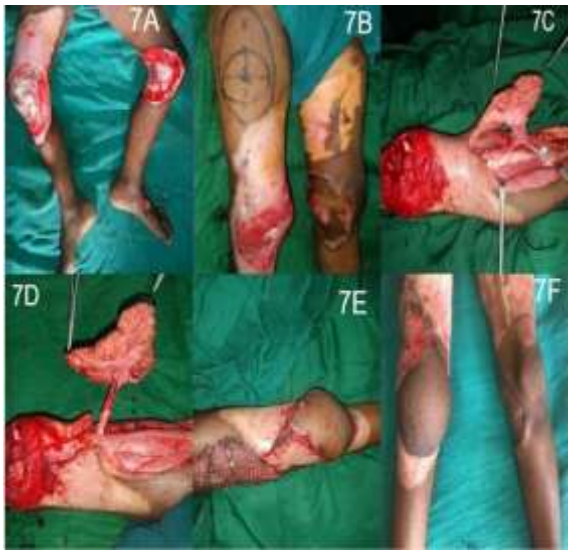

Figure 7: Reconstruction of a right knee soft tissue defect following electrical burn injury using a reverse anterolateral thigh flap.

Case 8

A 48-year-old female with a soft tissue sarcoma involving the lateral aspect of the left proximal leg and extending into the knee region underwent wide

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local excision followed by reconstruction using a free latissimus dorsi muscle flap (Figure 8). The flap settled well, and the patient achieved a good range of knee movement.

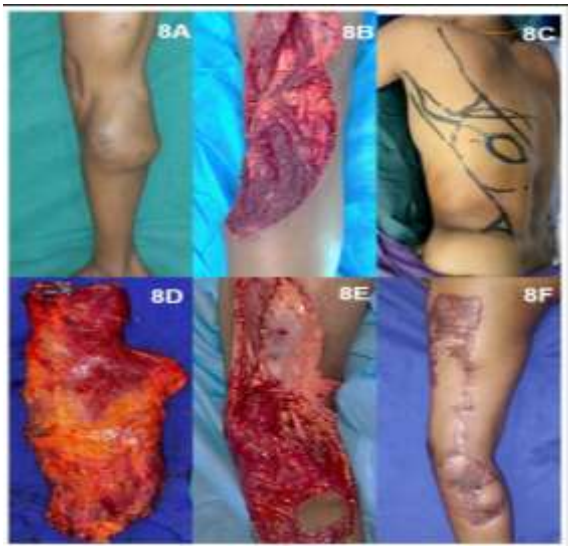

Figure 8: Reconstruction of a post-oncological knee soft tissue defect using a free latissimus dorsi muscle flap

Case 9

A 36-year-old male presented with a post-traumatic soft tissue defect of the right knee associated with a patellar fracture, for which patella plating was performed. Following implant infection, patellectomy was carried out. Wound debridement was performed, and the knee defect was reconstructed using a large dimention Ponten fasciocutaneous flap from the upper medial aspect of the leg (Figure 9).

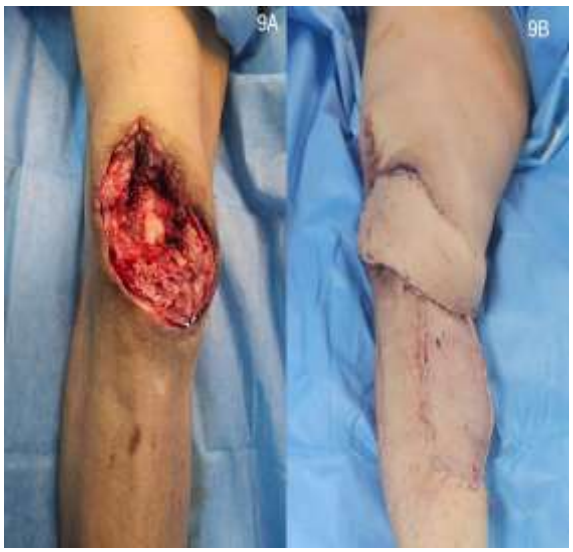

Figure 9: Reconstruction of a post-traumatic right knee soft tissue defect using a Ponten fasciocutaneous flap following implant infection and patellectomy

DISCUSSION

Soft tissue defects around the knee remain a reconstructive challenge because of limited local tissue, frequent exposure of the joint, bone, tendons, or implants, and the need to preserve joint function in addition to addressing the defects.[1] The present case series demonstrates that successful reconstruction depends on selecting the most appropriate flap according to the size, location, cause of the defect, and condition of the surrounding tissues rather than relying on a single reconstructive technique.

Trauma was the most common cause of soft tissue defects in our series. The defects following infection, tumour excision, electrical burns, and implant-related complications were also encountered. Various types of reconstructive procedures, including transposition, Hatchet, propeller, gastrocnemius muscle, pedicled vastus lateralis muscle, cross-leg, reverse anterolateral thigh, free latissimus dorsi muscle, and Ponten fascio cutaneous flaps, were successfully used based on individual wound requirements. This supports the concept that flap selection should be individualised for the particular defect.

Local fascio cutaneous flaps provided satisfactory coverage for relatively small and moderate defects with healthy adjacent tissue. Similarly, recent studies have reported favourable outcomes with perforator-based pedicled and propeller flaps, highlighting their versatility and suitability for selected knee defects.[5] Muscle flaps, including the medial gastrocnemius and vastus lateralis, were useful in patients with exposed joints or implants, while free tissue transfer offered reliable coverage for extensive defects following tumour excision.[6,7] These findings are consistent with previous reports demonstrating the effectiveness of muscle and free flaps for complex knee reconstruction. But the major dis advantage of free flaps is selecting the recipient vessel for anastomosis and strenuous dissection because of deep placement of vessels.

The reverse anterolateral thigh flap and cross-leg flap were valuable options in patients with complex defects where local tissue was limited or previous reconstructions had failed. There are recommendations for defect-specific reconstructive algorithms to achieve durable coverage with satisfactory functional outcomes.[3,8]

All patients in the present case series achieved satisfactory wound healing and recovery of knee movement. Flap-related complications like wound dehiscence, marginal flap necrosis, and minimal graft loss, were managed successfully with appropriate secondary procedures or conservative treatment. Our experience underscores the importance of comprehensive defect evaluation, meticulous debridement, and individualized flap selection in knee reconstruction. A defect-specific reconstructive strategy can consistently provide durable soft tissue coverage, preserve knee function, and result in

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satisfactory clinical outcomes across diverse reconstructive scenarios.

CONCLUSION

Soft tissue defects around the knee can be successfully managed using a variety of reconstructive techniques based on defect characteristics. This case series demonstrates that appropriate flap selection, meticulous wound debridement, and careful surgical planning provide durable soft tissue coverage, satisfactory wound healing, and good functional recovery across diverse clinical scenarios.

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