ORIGINAL ARTICLE

Use of distally based random flap in the management of soft tissue defects in upper two thirds of leg

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Abstract

Objective: To assess the results of cases with complex wounds exposing tibia who were managed with distally based random flaps.

Methods: The retrospective study was conducted at Aga Khan University Hospital, Karachi, and Dow University Hospital, Karachi and comprised data between February 2000 and March 2013of patients who had been admitted with a recent or prior history of trauma with a soft tissue defect in upper two-thirds of tibia and who had undergone coverage procedure using distal based flap.

Results: The mean age of the total 21 patients in the study was 29±9 years, and 20(95%)were male. Road traffic accident was the most common mechanism of injury in 13(62%). Tibia was exposed in all the 21(100%) cases requiring soft tissue coverage. There was associated fracture of tibia in 18(86%) patients. Mean flap length was 12±1.7 cm and width was 5.3 ±0.86 cm. Maximum size for the flap dissected was 15x7cm. Donor site was covered with split thickness skin graft in 19(90.5%) patients. Flap survival rate was 100%. Only 2(9.5%) patients developed partial flap necrosis. Clinical outcome was graded as good in 19(90.5%) patients and fair in 2(9.5%). Superficial infection was observed in 2(9.5%) patients.

Conclusion: Distal based flap appeared to be an effective solution for the coverage of soft tissue defects in upper two-thirds of leg.

Keywords: Distal based flap, Soft tissue defect in leg, Random pattern flap. (JPMA 64: S-15 (Suppl. 2); 2014)

Introduction

Complex wounds in the leg remain a challenge for orthopaedic surgeons. Tibia is a subcutaneous bone; extensive trauma, deep implant infection or osteomyelitis results in soft tissue defects and exposes tibia, requiring soft tissue procedure. There are number of options ranging from free microvascular flap coverage, rotational muscle or musculocutaneous flap, perforator based fasciocutaneous flaps and distally based fasciocutaneous flap.[1,2]

Microvascular free flap is a good option for reconstruction, but requires expertise in microvascular techniques which is not widely or easily available. In addition, it is associated with more complications like donor-site morbidity and risk of anastomosis failure.[3] Muscle or musculocutanaeous flap[4] is also proved to be a good alternative, but may be coupled with un-aesthetic donor-site defects. Perforator based fasciocutaneous flap[5] is an excellent option but requires experience, detail knowledge of the anatomy around the leg and exact location of perforators.

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A number of studies have established that there is a rich plexus present superficial to deep fascia contributed by the branches of anterior tibial, posterior tibial, peroneal and popliteal vessels.[6,7] Lagvanker[8] reported successful utilisation of distally based flap based on random blood supply in reconstruction of defects in upper two-third of the leg. There is a rich vascular fascial plexus running superficial to deep fascia, thus the plane of dissection of any flap should be deep to fascia.[9] Distal based random flap is a simple flap not requiring inclusion of any known vessel or its perforator. However, one should be cautious to keep the base of flap in upper two thirds; maintain the width:length ratio and not to let it exceed 1:3 in order to prevent complications.[8] We have been using this technique for the coverage of defects in the upper two-third of leg. The objective of this study was to present the results of our cases managed with distally based random flaps.

Patients and Methods

The retrospective audit was conducted at Aga Khan University Hospital (AKUH), Karachi, and Dow University Hospital, Karachi, from February 2000 to March 2013. All patients admitting with a recent or prior history of trauma with a soft tissue defect in upper two-third of tibia who underwent coverage procedure using distal based flap were included. Patient data was collected on a proforma containing details regarding demographics, location of

the defect, size of the defect, tibia fracture, mode of fixation, underlying exposed implants/osteomyelitis, surgical procedure performed, rate of flap survival and complications. Clinical outcome was recorded as being good, fair or poor depending upon the flap survival.[10] Good was considered as having no flap necrosis; fair as partial flap necrosis not requiring any further coverage procedure; and poor as complete flap necrosis requiring another coverage procedure.

For the surgery, the recipient bed was prepared removing all the necrotic tissue and necrotic bone in case of osteomyelitis. In open tibia fractures, tibia was stabilised with external fixator in most of the cases. Skin on either side of the tibia can be utilised to raise the flap. Incision was given, deep fascia was dissected all around the margins and flap was raised carefully maintaining the width-to-length ratio according to preoperative planning. Flap was rotated over the defect and stitched. The donor site could be closed primarily in case of small defect, but it required split thickness skin graft in most cases. The patient leg was elevated in the post-operative period. Ambulation was allowed after 3rd post-operative day with non-weight bearing in patients with tibia fractures. The patients were discharged after 1st dressing change at day 5, taught about care of external fixator and followed up in the outpatient department (OPD).

Results

There were 21 patients in the study with overall mean age of 29 ± 9 years. Of the total, 20(95%) were male. Road traffic accident was the most common mechanism of injury in 13(62%), followed by osteomyelitis and implant infection in 3(14%)each, and gunshot injury in2(9.5%). Tibia was exposed in all the 21(100%) cases requiring soft tissue coverage. There was associated fracture of tibia in 15(71.4%) patients managed with external fixator; 3(14%) patients having tibia fractures managed at some other hospital with dynamic compression plate presented with skin necrosis and exposed implant; 3(14%) patients having osteomyelitis had prior history of trauma with exposed tibia and were managed with dressings and healing with secondary intention. Mean flap length was 12 ±1.7 cm and width was 5.3 ±0.86 cm. Maximum size for the flap dissected was 15x7cm. Donor site was covered with split thickness skin graft taken from the ipsilateral thigh in 19(90.5%) patients, while primary closure was possible in 2(9.5%) patients.Flap survival rate was 100%. Only 2(9.5%) patients developed partial flap necrosis. Clinical outcome was graded as good in 19(90.5%) patients and fair in 2(9.5%). Superficial infection was observed in 2(9.5%) patients who were managed with dressings and antibiotics. Three (14%) patients with osteomyelitis were treated with intravenous followed by oral antibiotics for a total of 6 weeks. Mean follow-up was 14 ±5.2 months ranging from 6 months to 2.5 years.

Case No. 1: A 24-year-old male sustained tibia fracture after road traffic injury. Initially managed at some other hospital. Internal fixation was done with plate and

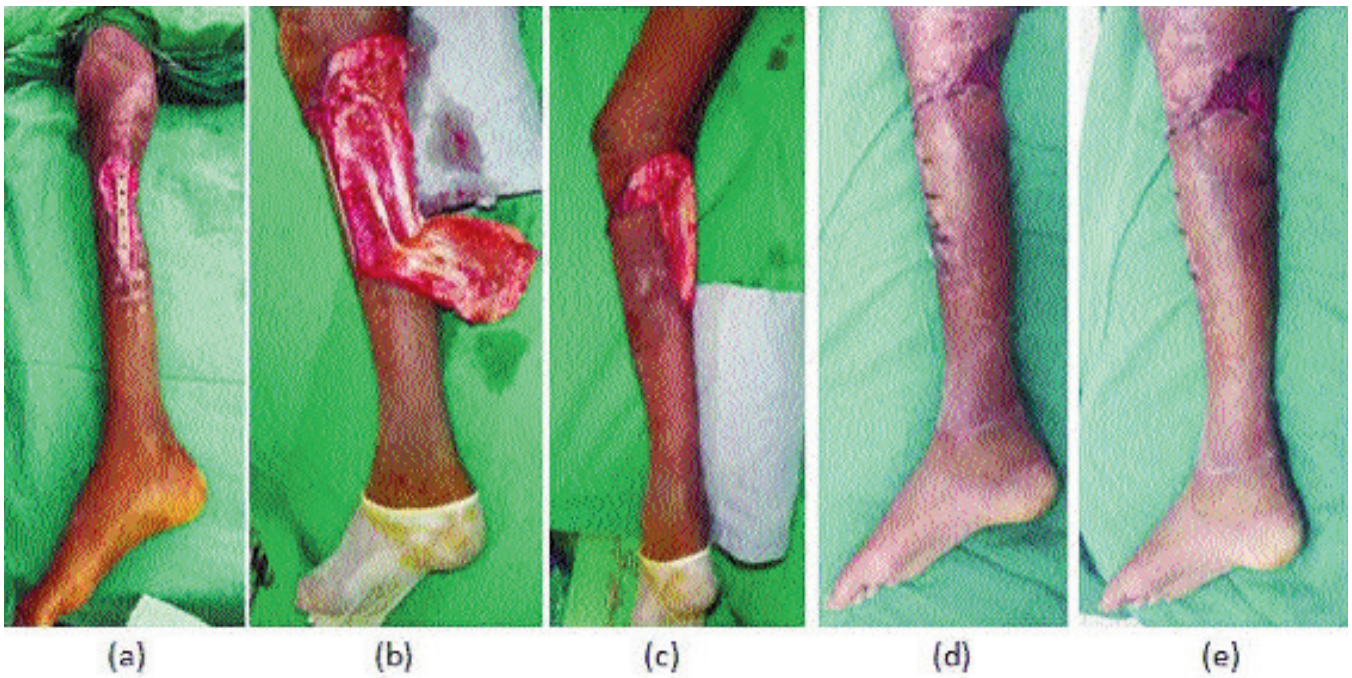

Figure-1: Twenty-four-year-old male. (A) Exposed tibia implant. (B) Distal based medial flap raised. (C) Flap rotated. (D and E) Two-week follow-up.

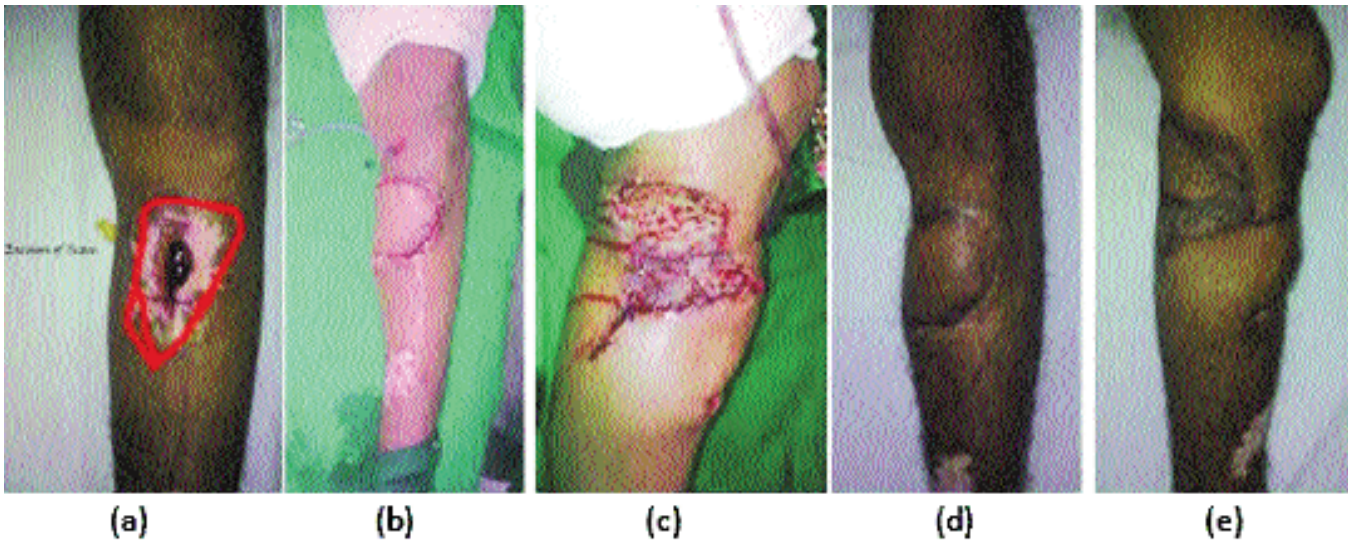

Figure-2: Thirty-four-year-old male. (A) Exposed tibia in the defect after debridement. (B) Distal based medial flap rotated to cover the defect. (C) Donor site was covered with skin graft. (D and E) Six-month follow-up.

resulted in necrosis of skin and exposure of implant. Distal based medial flap was raised to cover the implant while the donor site was covered with split thickness skin graft (Figure-1).

Case No. 2: 34-year-old male presented with osteomyelitis in upper tibia after a prior history of trauma and skin loss. Managed initially with dressings and healing with secondary intention. Debridement and excision of necrotic bone was done which led to skin necrosis with exposed bone. Distal based medial flap was raised to cover the defect and donor site was covered with split thickness skin graft (Figure-2).

Discussion

Distal based random flap proved to be a successful option for coverage of defects in upper two-third of tibia in our series. The most common mechanism of injury was road traffic accident. Partial flap necrosis was observed in 2 patients, but we were able to manage those patients with serial dressings and none of them required any further coverage procedure. Clinical outcome was graded good in 19 patients and fair in 2 patients.

Loss of soft tissue over tibia remained a challenge to orthopaedic surgeons and resulted in number of complications and poor outcome.[11] There are number of options for coverage of these defects ranging from free tissue transfer to local rotational flaps. Free tissue transfer is technically demanding option and its facility is not readily or easily available. However, it is still a good option in large defects which cannot be managed with local or regional flaps. In contrast, the non-microvascular flaps are technically less demanding and can be easily mastered by the surgeons.[12] There are a number of local flaps described for coverage in upper two-thirds of tibia, including proximal or distal based random flaps and fasciocutaneous perforator based flaps.[13] Perforator based flaps require precise knowledge of the anatomy of local perforators and sometime requires identification with hand-held Doppler ultrasound. Availability of multi-detector computed tomography (CT) angiography made it easy to identify different perforators and helps in preoperative planning for such flaps.[14] On the other hand, proximal or distal based flaps do not require identification of these perforators. Surgeons must be cautious to maintain the maximum width-length ratio to 1:3 and keep the dissecting plane below deep fasica.

Although proximal based flap is a better choice in most patients, but distal based flap is a good alternative in patients with wounds in the proximal leg due to trauma. Secondly, as tibia is wider in the proximal third, thus smaller distal based flap is required to cover the defect in the upper third compared to proximal based flap. In addition, oblique flap margin due to wider proximal tibia will not lead to formation of prominent dog ear in order to cover the defect.[8]

Lagvankar8presented the results of distal based random flap in reconstruction of upper two-thirds of tibia after road traffic accident and reported success in all 10 patients. Two patients had continuous discharge postoperatively which settled after sequestrectomy. In our series, we utilized this flap in 21 patients and all our flaps survived except for partial necrosis in two patients.

Superficial infection was observed in 2 patients that responded to antibiotics and dressings.

Lagvankar[15] also utilised this technique in reconstruction of heel and lower-third defects in leg by using distal based flap in stages. He reported his results of 8 cases with necrosis in one patient and partial necrosis in another. In the first patient, width-length ratio was kept 1:4.

Latifogluet al[16] reported the results of their 10 patients in whom they utilised fasciocutaneous flaps in reconstruction of lower leg, ankle and heel. Six flaps were proximal based, while 4 were distal based. Two distal based flaps were used to cover defects in the middle-third in which one patient developed superficial necrosis. Two distal flaps were utilised to cover ankle and heel in a tube fashion (staged procedure). One developed oedema and the second developed venous congestion. In our series, we utilised this flap only for upper two-thirds and had superficial necrosis in only one patient.

Robotti et al[17] utilised distal based flap in reconstruction of war-related foot and ankle wounds. Defects in 12 patients were covered. They even dissected the flaps upto 5:1 length-width ratio. They reported 1 complete necrosis and partial necrosis in 2 patients.

Dhamangaonkar et al[18] reported the results of distal based sural flap with intact cutaneous pedicle in 109 patients. Among 102 patients, 91 flaps healed uneventfully, while 9 patients had edge necrosis. Shahzad et al[19] reported results of their 50 patients with defects in lower leg and foot which were covered by using distal based sural flap. All of the flaps survived with no major complication. There are other distal based flaps described based on the named arteries. But in our series we utilised distal based flaps on random blood supply for reconstruction of upper two-thirds.

The retrospective nature of this audit and small number of subjects represent the limitation of our study. However, the ease of technique without the need of expertise in microvascular skills, makes the procedure a viable option for orthopaedic surgeons managing lower-limb trauma with soft tissue defects. It is of real help, especially for those working in remote areas with lack of advanced surgical facilities.

Conclusion

Distal based flap appears to be an effective solution for coverage of soft tissue defects in upper two-thirds of leg. Simple surgical technique makes it a useful option in underdeveloped areas where microvascular surgical expertise is not available.

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