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CASE REPORT

Cross-leg Flaps and Pressure Ulcers: An Experience from a Tertiary Care Centre in India

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ABSTRACT

Cross-leg flaps are done infrequently today due to advancements in micro- and super micro-surgeries. Problems like pressure ulcers, joint stiffness, etc., have been seen in cross-leg flaps. Pressure ulcer develops due to awkward positioning and prolonged immobilization of limbs. Sites for these ulcers include usual predisposed locations like the heel and the malleoli. Unusual sites like the dorsum of the recipient foot have also been found to develop pressure ulcers. Immobilization has been achieved by methods like external fixators, POP and dressings. Pressure ulcers prevention has been done by offloading with non-surgical strategies like air mattresses, gloves, pillows, etc. These are useful only for usual predisposed sites. For unusual predisposed sites other methods have not been described literature. External fixators, which have been used for immobilization in cross-leg flaps can be used with modifications to achieve surgical off-loading of these unusual sites. Patients operated with cross-leg flap from 2021 to 2023 at All India Institute of Medical Sciences (AIIMS), Patna in the Department of Burns and Plastic Surgery were identified from the departmental database. Their case record was retrieved from MRD, and relevant data regarding the method of immobilization, method of off-loading, development of pressure ulcer and other complications were obtained and analysed retrospectively. Three patients with history of RTA were operated with cross-leg flaps for various indications. Immobilization of legs was done by external fixators in first and third patient and with POP in second patient. Non-surgical off-loading with either air-mattress, gloves, pillows etc was used in all three patients. Surgical off-loading with modifications in external fixators was used in the third patient. Pressure ulcer developed in first and second patients. In both these patients, it developed at usual predisposed site of the heel of the recipient leg as well as unusual site of the dorsum of the foot of the recipient leg. The third patient was free of pressure ulcer. Non-surgical off loading alone is insufficient. External fixators used for immobilization can be used for surgical off-loading by modifications and adjustments in its design. Improvisation by adjusting pins and bars can be used for off-loading usual sites for pressure ulcers, like the heels, the calcaneal areas as well as unusual sites such as the dorsum of the foot.

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INTRODUCTION

Since, its inception and description by Hamilton in 1854 cross-leg flap[1] has been used for managing wounds of the leg and foot at all possible locations. With advancements in surgical techniques, expertise and availability of improved infrastructure, the use of cross-leg flaps has decreased a lot. Still, it has its indications like use as salvage flap,[2] in a single vessel limb,[3] for extensive damage to bones, for an exposed large segment of bone,[4] etc. It is a highly morbid procedure requiring immobilization for 3 weeks with subsequent delay, flap division and inset. Problems associated with it include partial flap loss,[3] suture line dehiscence, joint stiffness,[3] prolonged immobilization along with increased burden on the healthcare system and the relatives/attendants. In particular risk of decubitus pressure ulcers over various pressure points is increased. These points include not only usually predisposed sites like sacrum and heels but also unusual sites such as dorsum of the foot, depending on immobilization. Various methods have been used in preventing pressure ulcers in cross-leg flaps. Cost-effective innovations are needed for achieving a pressure ulcer-free and successful cross-leg flap.

CASE PRESENTATION

Three cases of cross-leg flaps are discussed with various etiologies, presentations, management strategies and associated complications of pressure ulcers. Table 1 provides a summary of all these cases.

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Table 1: Summary of cases with cross-leg flap

Pt S. No	Age (yrs)/ sex	Co-morbidity	Eitiology	Bone exposure/#	Fixation of #	Indication for cross-leg flap	Type of cross-leg flap	Period of immobilization (in weeks)	Method of immobilization	Method of off-loading	Complications		
											Flap loss	Suture dehiscence	Pressure ulcer
1	17/M	Nil	Road traffic accident	Yes, tibia#, >2/3 tibia exposed	Internal fixation	Exposed bone with implant, single vessel limb, no local flap available, salvage	Classical	3+1	External fixators	Air mattress, Pillow, water filled gloves	Nil	Nil	Yes, calcaneal area, dorsum of recipient leg
2	50 /F	Head injury	Road traffic accident + iatrogenic warmer burn	Yes, Middle third tibia exposed +extensive raw area over leg; no #	NA	Exposed tibia with no local flap available in compromised patient	Classical	5+1	POP cast immobilization across knee joint	Air mattress, pillows, air filled gloves	Partial loss at distal edges	Yes	Yes, over calcaneal area and dorsum of recipient leg, over trochanter u/l
3	54/M	Tobacco addiction	Road traffic accident	Yes, Lower 1/3 tibia exposed, #tibia and fibula	Internal fixation	Partially failed RSA with exposed tibia and implant	Reverse posterior artery perforator flap	3+1	External fixators	Air mattress, external fixators	Nil	Nil	Nil

Case 1

A seventeen-year-old gentleman presented with fracture of tibia with exposure of more than 3/4th surface following RTA. He was managed with internal fixation for fracture. Classical cross-leg flap was done for coverage of exposed bone and implant since no loco regional flap was available and the limb was surviving on single vessel. Immobilization was done with external fixators for 3 weeks, followed by delay and subsequent division and inset 7 days later. External fixator was used only for immobilization of the legs. There was inadequate space between the two to facilitate air circulation and allow proper skin care during the period of immobilization. Offloading was done only with air mattress for the calcaneal area of the recipient leg. Subsequently, the patient developed a pressure ulcer at the calcaneum of the donor leg and the dorsum of junction of ankle and foot of the recipient leg(Figure *1*).

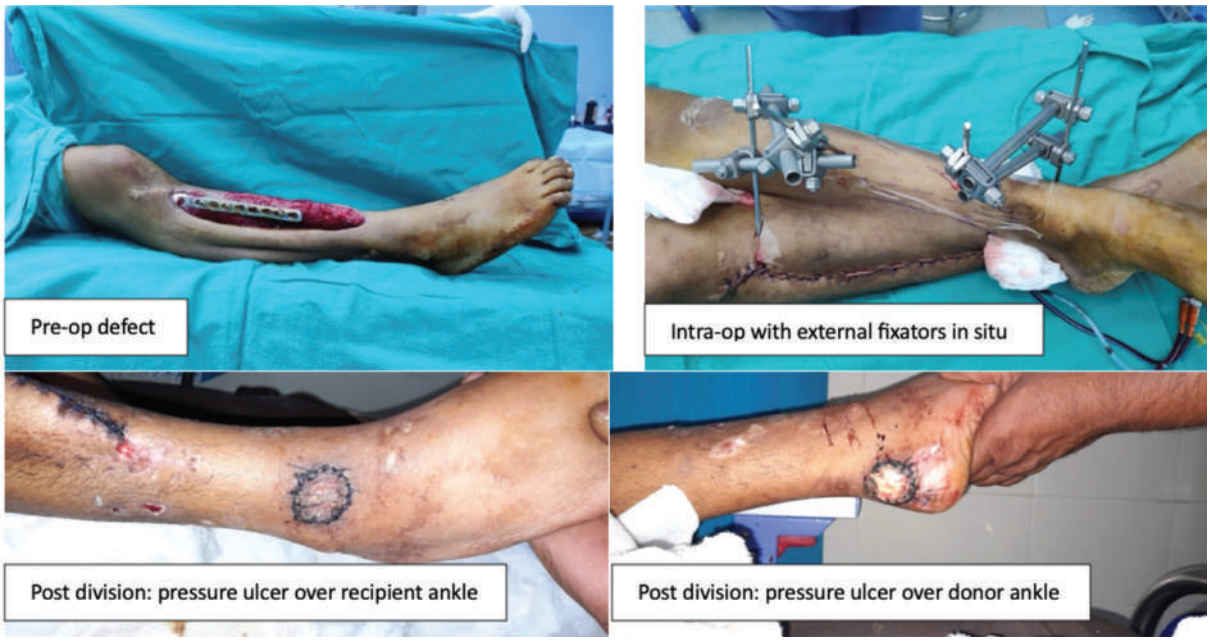

Figure 1: Case 1, pre-op defect, intra-op, post division and insetstatus.

Case 2

Fifty-five years old lady suffered with head injury following RTA. She suffered warmer burn of her legs with exposure of tibia and skin loss over middle third of her right leg. Cross-leg flap was done due to the unavailability of loco regional flaps and the patient being unfit for prolonged surgery. Classical cross-leg flap was done with immobilization using POP across the knee joint and near the ankle joint. Offloading was done with air-mattresses, pillows and air-filled balloons. There was partial dehiscence of the cross-leg flap on POD-5 for which POP was removed and resuturing was done after readjusting leg positions. No pressure ulcer was observed at that time. Due to this duration of immobilization was increased. On regular examination, the flap was found to take a longer time for sutureline to heal. Hence, the patient needed prolonged immobilization of 5 weeks. At the time of delay and division inset pressure ulcer was found to have developed at calcaneum and dorsum of the foot of the recipient leg as well as trochanter (Figure 2).

Case 3

A 54-years-old tobacco addict was referred to the Plastic Surgery department for a fractured and exposed lower 1/3rd of right tibia. The fracture was managed with reduction and internal fixation. For exposed bone RSA flap was done which failed partially. Subsequently reverse posterior tibial artery perforator cross-leg flap was done to cover the bone. External fixator was used for immobilization. The same framework was also improvised to surgically offload the predisposed pressure points of the recipient as well as donor legs (usual as well as unusual) for the prevention of pressure ulcers. Adequate space was created between the legs and between the legs and underlying resting surface of bed and maintained by adjusting the length and site of the rods and screws in the external fixator. An air mattress was the non-surgical adjuvant method used to prevent pressure ulcer. The division and inset were done after 3 weeks of immobilization and one week of subsequent delay. There was no incidence of pressure ulcer in the patient (Figure 3).

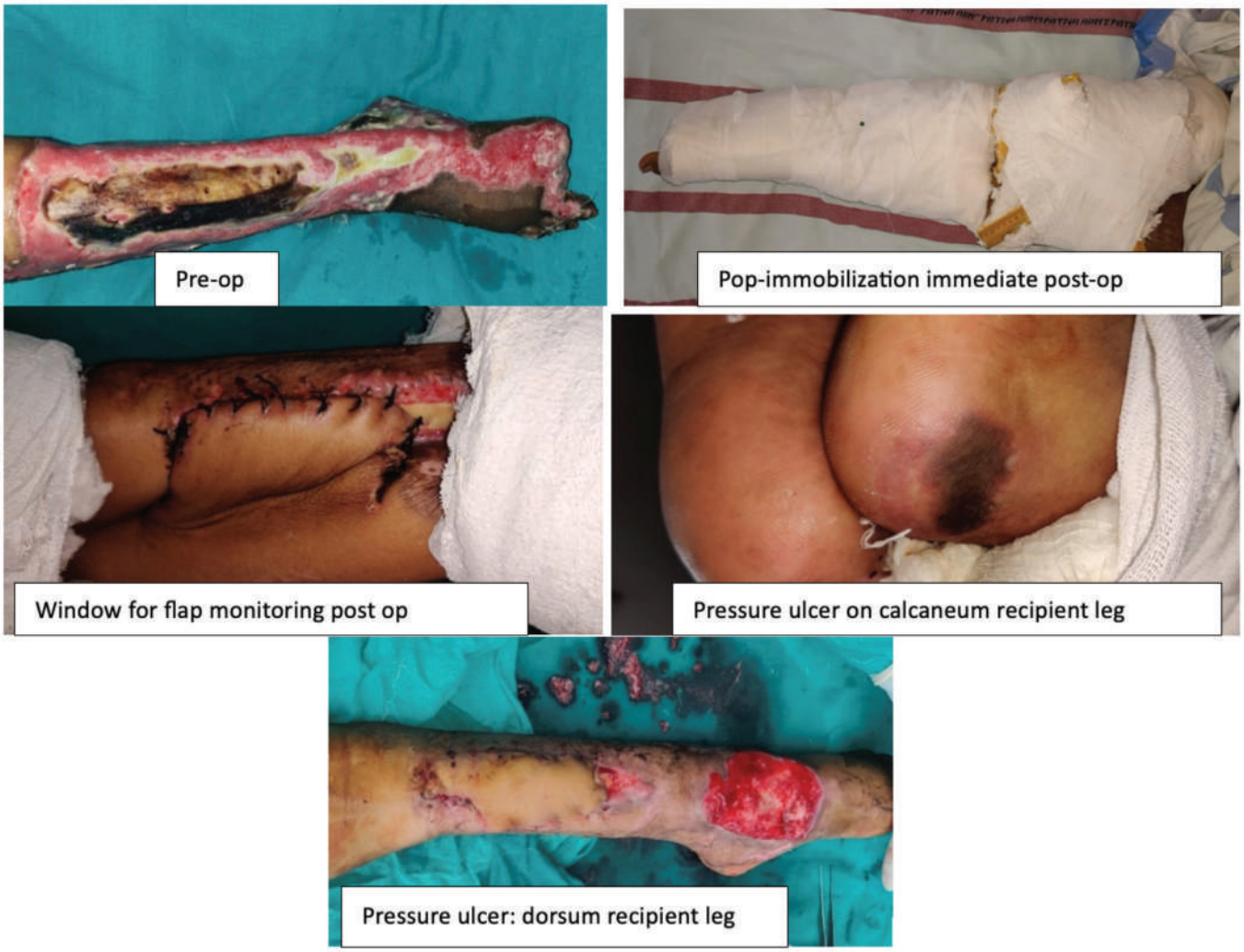

Figure 2: Case 2, pre-op, post-op, post division and inset status.

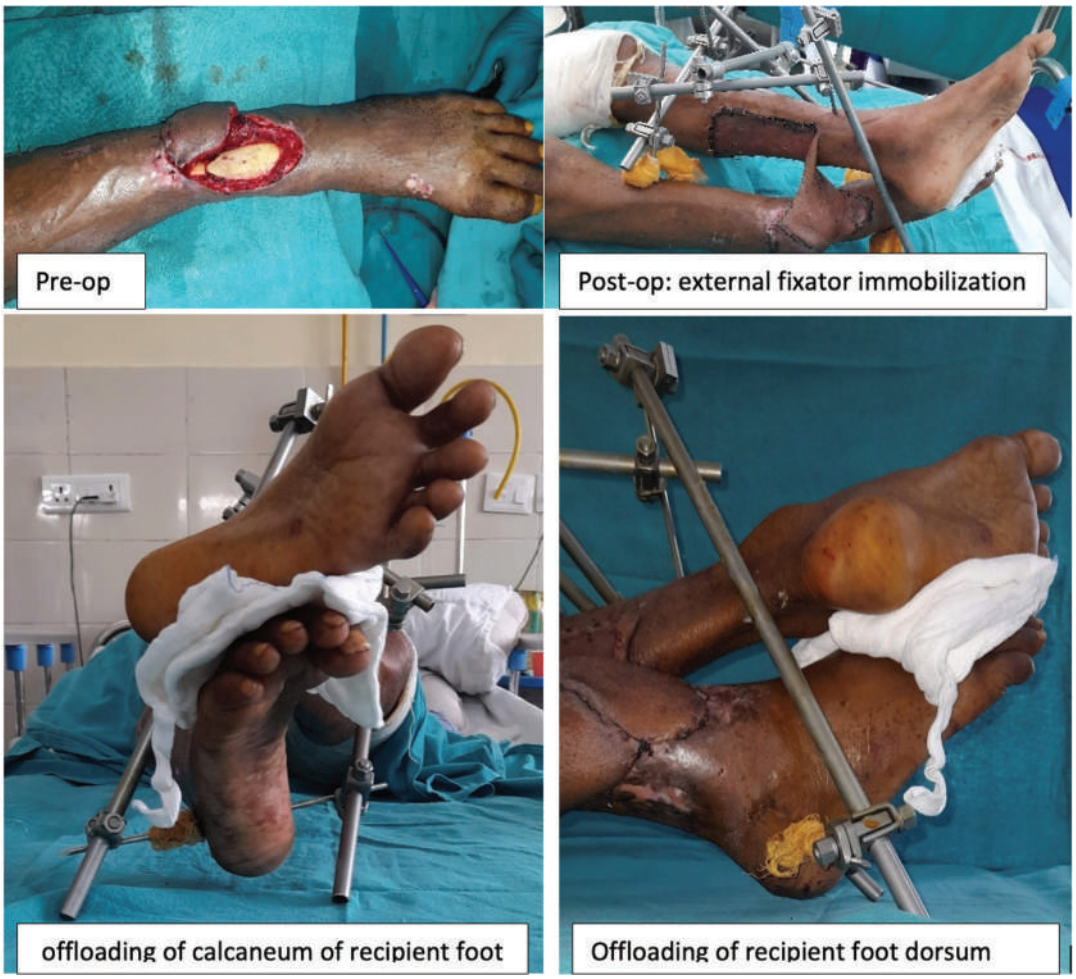

Figure 3: Case 3, pre-op, post-op status.

DISCUSSION

Even in this era of microsurgery, cross leg flap is relevant with its indications. Mostly, it is a salvage flap[2] nowadays. Still, in certain conditions it can be the primary flap for reconstruction, like in single artery limb, compromised patients.[3,5] Whatever may be the indication, cross-leg flap creates a unique situation. It has well-known downsides including prolonged immobilization of limbs in an awkward position and restriction of motion for at least 3 weeks, increased risk of pressure ulcers[6] and stiffness of joints.[6] The location of these pressure ulcers in cross-leg patients has varied from usually predisposed sites like calcaneal to malleolar area, trochanter to sacral area. The calcaneal area of the recipient leg has to bear an additional weight of the donor leg, besides the weight of external fixators or POP itself during immobilization. The skin there is thus under increased and constant pressure between the bed surface and the calcaneum. Inability to move joints further adds to the compromised care of the skin. Besides these unusual sites like the dorsum of the foot and the ankle have also been witnessed. The skin on dorsum of the ankle and the foot, too is pressed between the bone beneath and the donor leg, depending on the position of immobilization. The cumulative result is increased tendency to develop pressure ulcer at vulnerable points over pelvis and lower limbs, such as the calcaneal area and uncommon sites like dorsum of foot and ankle. Upper half of the body being mobile, pressure points as the occiput, the scapular areas and the elbow joints are not at increased risk. Pressure ulcer atanysite in cross-leg flaps increases the burden on healthcare system and attendants. Their treatment is more cumbersome due to the position of legs, lack of adequate space and poor care of skin in cross-leg flaps. Prevention of these ulcers decreases the cost of treatment and allows earlier ambulation of the patient and return to a normal life. Thus, preventive management of these ulcers or even reduction in their incidence is very important in the efficient management of these patients. It can be achieved by using various methods for offloading.

For cross-leg flaps, there has been discussion in the literature regarding the indications, types of flaps, orientation of the flaps, methods of immobilization, duration of immobilization and complications like flap necrosis, and suture dehiscence.[5,7] Etiology and general management of stiffness of joints and pressure ulcers have also been discussed. Various means of offloading of pressure points have been described for many conditions. These can be broadly categorized into non-surgical and surgical means of off-loading. Descriptions about non-surgical means of offloading in cross-leg flaps are numerous.

However, literature regarding surgical means of off-loading at usual locations in cross-leg flaps is few. Similarly, materials regarding pressure ulcer at unusual locations and their surgical prevention in association with cross-leg flaps has been deficient.

Non-surgical methods include air mattress, padded dressing, pillows, head rings etc. Air mattress is empirically used when available in our institute. Padded dressing, pillows, head rings, air-filled or water filled gloves are used for the calcaneal offloading. For dorsum of the foot depending on the space available, gauze pads can be used. These methods, though useful, require regular periodic check and replacement. These are not very stable methods. Patient's legs slip down when they are sleeping. Change in position of pillow can hamper venous return from the flap if the legs become more dependent. Also, they may work for calcaneal area but not for the dorsum of foot as we found out in our study. One of our patients (Case 2)developed pressure ulcer on the calcaneal area with a padded dressing used for off-loading. The same patient also developed pressure ulcer over calcaneal area, even after pillows, water-filled gloves were used. Case 1 patient developed pressure ulcer over the dorsum of foot when only non-surgical methods of off-loading were used. On the other hand, Case 3 patient who had surgical offloading and adjunctive non-surgical off-loading did not develop pressure ulcer at any site. Also care of patients post operatively was much easier in patient with surgical offloading than other patients. thus non-surgical methods have been insufficient in preventing pressure ulcers at all vulnerable points and in all positions of immobilization.

Surgical method of offloading has been described in literature for management of diabetic foot, osteomeylitic leg, neuropathic leg wounds, burn wounds and in trauma of lower limbs.[7-10] This has been achieved with various additions or modification in the design of the immobilization by external fixators. Some of them have been kickstand modification[11,12] and SALSA stand.[13] All these structures lift the calcaneal area off the resting surface by a few *cm* and keep the heel hanging in air. This results in relief of pressure on the calcaneal area and also allows free air circulation around it and provides adequate space for skin care. Pressure ulcer over the calcaneal area is thus prevented.

In cross-leg flap management, external fixators have been used for immobilization. Some surgeons have used modifications in external fixators for off-loading the calcaneal area, e.g., the Hoffman transfixation equipment,[4] Resur®-Splint[14] (an adjustable device made of steel to obtain rigid immobilization of plaster of Paris),[15] Cross-Ilizarov external fixator.[16] This has resulted in reliable and better care of the calcaneal area and prevention of pressure ulcers over this highly predisposed area. All these have been cumbersome, requiring the arrangement of rods, pins and clamps or specialized structures. Notable among above mentioned methods is a common use of external fixators for this purpose. Interestingly, provisions for the prevention of pressure ulcers over uncommon areas such as the dorsum of the recipient's ankle and foot have not been discussed in the available literature except for use of dressing. As already stated, this location is still vulnerable to pressure ulcer due to the skin on the dorsum of foot getting crushed between the tarsal/metatarsal bones of the recipient foot and the heel of the donor leg.

In the present study, external fixation was done with pins, rods and universal joints for Case 1 and Case 3. It was used only for immobilization in Case 1 and resulted in pressure ulcer at the dorsum of ankle/foot of the recipient leg and calcaneal area of the donor leg. In Case 3 it was modified for immobilization as well as surgical off-loading of usual as well as unusual sites for pressure ulcer. For preventing pressure ulcer on the calcaneal area, side rods of increased length were used to lift the external fixator framework in the air by a few centimetres. This resulted in the heel/calcaneal area being held hanging in the air with adequate offloading and preventing calcaneal area pressure ulcer. To prevent pressure ulcer over dorsum of the recipient's ankle and foot, one more modification was incorporated. The fixation of horizontal bars was done to the vertical rod, taking care to create adequate space between the donor leg's foot and the recipient leg's foot. This avoided direct contact between the two feet, allowed air flow between them, and permitted skin care of the two surfaces. The ultimate outcome was no pressure ulcer over the dorsum of ankle/foot of the recipient leg. No special instrument or design was used to achieve surgical off-loading of vulnerable areas. No additional cost was borne by the patient besides that for pins, rods, bars and universal joints. The availability of space for movement also helped in providing physiotherapy services for mobility of the ankle joints and thus decreasing their stiffness. At the same time, the knees, which were not part of surgical immobilization with external fixators too could also be serviced with physiotherapy, decreasing their stiffness too.

The external fixators can be used with minimal modifications and judicious placements innovatively in individual cases of cross-leg flaps to achieve immobilization as well as surgical offloading of all potential sites of pressure ulcers. It should be tried in all possible cases of cross-leg flap for the benefit of the patient, attendants, and healthcare system.

CONCLUSIONS

Cross-leg flaps are easier to do but cumbersome to manage. Planning is very important not only in designing flap to cover the defect but also in preventing the potential complications while managing the flap post-operatively. It is especially for complications like pressure ulcers, which is due to inappropriate positioning of the limbs during immobilization.

Calcaneal area, sacrum and trochanteric areas are well known predisposed locations for pressure ulcer development. Dorsum of foot and ankleis an unconventional location for pressure ulcer. Due to forces and conditions produced by immobilization dorsum of foot and anklebecomesa potential site for pressure ulcer development.

Out of box thinking and innovative use of external fixators is important in prevention of pressure ulcers in cross leg flap. They have been used for surgical offloading of the heel/calcaneal area to prevent pressure ulcer in other indications. The same external framework can be arranged in intelligent ways by adjusting their rods, pins, bars and universal joints for surgical offloading usual as well as unusual sites. It is immensely rewarding for the treating surgeon, his team as well as the patient. Non-surgical offloading is a valuable adjunct to surgical offloading.

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