Cross-Leg Flaps in Reconstruction of Posttraumatic Lower Extremity Wounds in Era of Microsurgery: Institutional Experience in a Tertiary Care Centre

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Abstract: <u>Introduction</u>: Cutaneous injuries of the lower third of the leg and dorsum of the foot represent a great challenge for orthopedic and plastic surgeons. The cross-leg flap technique is a well-established method to cover soft tissue defects of lower extremity. <u>Objectives</u>: to review the utility of cross-leg flaps in reconstructive surgery of the lower extremity wounds. <u>Materials and Methods</u>: A retrospective study was carried out in Department of plastic surgery of a tertiary care teaching institute in Rajasthan. Case records of 50 cases who underwent cross-leg flap for trauma or burns from 2017 to 2019 were assessed using a semi structured questionnaire for collection of data. The location of defect in the leg, the indication for cross-leg flap, the type of cross-leg flap, and perioperative complications were noted. <u>Results</u>: Most patients were in the age group 40 to 50 years (52.0%). Eleven patients (22.0%) had defect in the lower one-third of leg, followed by 10 (20.0%) in the foot and ankle region. 30 patients underwent conventional cross-leg flap while 18 patients had distally based flap. Most common reported reason was the free flap failure (32.0%) followed by financial reasons (22.0%). All flaps survived and Four patients (8.0%) developed partial necrosis of the flap. <u>Conclusion</u>: Cross-leg flap is a safe and reliable alternative to free tissue transfer in certain situations of lower extremity trauma. Simplicity, reliability and low complication rates denote that cross-leg flap finds a definite place in reconstructive trauma surgery.

Keywords: cross leg flap, free flap, random pattern, microvascular

1. Introduction

Cutaneous injuries of the lower third of the leg and dorsum of the foot represent a great challenge for orthopedic and plastic surgeons. The poor vascularization and subsequent poor healing encountered in these regions demand detailed knowledge of the local anatomy to select the best surgical alternative for each patient. The free flaps are usually the first choice for soft tissue coverage in the distal leg. There continue to be, however, some clinical situations in which local fasciocutaneous and myocutaneous flaps are often not available. Occasionally, a free flap may also have failed because of technical errors or damaged vasculature. In these situations, a cross-leg flap is the best choice. The inclusion of fascia in the cross leg flap makes length-to-breadth ratio 3: 1 perfectly safe. This allows much greater area of skin to be transferred with much more freedom of leg position.^{1,2}

The cross-leg flap technique is a well-established method to cover soft tissue defects of lower extremity with exposed joints, tendons, bone, and metal hardware.³ Cross-leg flap options include fasciocutaneous flaps, perforator fasciocutaneous flaps, perforator plus flaps, myocutaneous flaps, posterior tibial artery flap, and sural artery flap. The use of cross-extremity flap is particularly useful in situations, where free tissue transfer cannot be employed and local methods cannot be used because of the extent of zone of injury as a result of a crushing injury.⁴

The cross-leg flap dates back to 1854, when it was described by Hamilton to cure a chronic ulcer and after that it was successfully used for soft tissue coverage in the distal leg, especially during Second World War. After the introduction of microsurgery in 1970, pedicled cross-extremity flaps for lower limb wound coverage were replaced by free flaps, but in the aforementioned scenarios the cross-leg flap still has its role.⁵

With the advent of fasciocutaneous flaps described by Ponten in 1983, the cross leg flaps have been raised safely and easily with 1:3 to 1:3.5 width to length ratio.³ Several authors have advocated routine use of external fixators in maintaining the position of cross leg and ease of nursing care and post operative wound management.⁴

Cross leg flaps have always found an important place in the surgeon's armamentarium in reconstructive surgeries of the lower limb even in the era of micro and supermicrosurgery.⁶ Surgeons have long sought an alternative to the cross-leg flap. because Apart from the discomfort for the fixation period and the long stay in hospital, there was concern about the incidence of necrosis, the potential for venous thrombosis in the splinted limbs, the risk of later breakdown from trauma to the insensitive flap, and the cosmetic deformity.⁷

Although alternatives have been found in recent years such as free flap, propellar flap and muscle flaps covered with split-skin grafts, but these techniques also have their limitations. This present study was carried out to review the utility of cross-leg flaps in reconstructive surgery of the lower extremity wounds in a tertiary care institute of Rajasthan.

2. Materials and Methods

A retrospective study was carried out in Department of plastic surgery of a tertiary care teaching institute in

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Rajasthan. Before commencing the study, approval from institutional ethical committee was taken. Case records of 50 cases who underwent cross-leg flap from 2017 to 2019 for trauma or burns in last 3 years, were assessed using a semi structured questionnaire for collection of data. The location of defect in the leg, the indication for cross-leg flap, the type of cross-leg flap, and perioperative complications were noted.

Surgical procedure: Case records of all 50 patients were reviewed. The pattern of cross-leg flap to be used was decided based on the location of the defect. When the defect was on the upper, or middle one-third of the leg, operative surgeons used the traditional cross-leg flap, based anteromedially. When the defect involved the lower one third or ankle and dorsum of the foot, they preferred using the distally based, posterior tibial artery perforator cross-leg flap. Hand-held Doppler was used to mark out the perforator preoperatively. With an exploratory incision the perforator was identified. When the defect is in the upper one-third and more medially located, superiorly based flap (based on the perforator of the posterior tibial artery) provides better inset than a conventional cross-leg flap and hence was the flap of choice. When raised as traditional anteromedially based random pattern flap, they raise it in a 1:1 ratio, and when as axial, in a 1:3 width to the length ratio. External fixator was used to position the legs in appropriate position as it increases the ease of postoperative care, allows proper cleansing of the wound, and allows knee and ankle mobilization. Donor site was skin grafted and dressed with bolster dressing. Flap insetted on three sides in a tension-free manner keeping the bridging segment as short as possible. Adequate space was left between two legs to provide free circulation of air to keep the area dry.

Statistical analysis: Collected data was coded, enter in Microsoft excel 10.0 and analyzed using SPSS trial version 16.0. Results are expressed in frequency and percentages.

3. Results

Total 50 cases who underwent cross leg flaps, were reviewed in present study based on case records available in the hospital. Most patients were in the age group 40 to 50 years (52.0%) followed by in the age group of 30 to 40 years (16.0%). Two patients (4.0%) were under the age of 10 years. Four patients (8.0%) were above the age of 50 years. Out of 50 patients, 74.0% were males and 26.0% were females (Table 1). Location of wounds and type of flap done to cover the wound of the patients are depicted in table no 2. Eleven patients (22.0%) had defect in the lower one-third of leg, followed by 10 (20.0%) in the foot and ankle region. 16 patients (32.0%) had combinations of wounds involving multiple parts of the leg. Out of 50 patients, total 30 patients underwent traditional anteromedial based cross-leg flap while 18 patients had distally based flap and 2 patients underwent proximally based flaps (Table 2). Reasons for which cross-leg flap were preferred over free flap, are depicted in table no 3. Most common reported reason was the free flap failure (32.0%) followed by financial reasons (22.0%). Seven cases (14.0%) had comorbid condition. Four cases (8.0%) were with peripheral vascular disease while six (12.0%) were found with associated vascular injuries or single vessel limb with the other divided vessels too close to the site of injury for a primary anastomosis to be possible. Table 4 depicts the complications occurred after cross-leg flap in patients. All flaps survived in present study and none of our patients underwent amputation after cross-leg flap. Four patients (8.0%) developed partial necrosis of the flap and managed with readvancement of the flap. Two patients (4.0%) had minor infections which were managed with local dressing. None of the patients developed any pressure sore.

4. Discussion

The present study was carried out among 50 cases using case records to review the utility of cross-leg flaps in reconstructive surgery of the lower extremity wounds in a tertiary care teaching institute of Rajasthan state. Microsurgical free flap is now a well-established procedure in the reconstruction of severely damaged lower extremities. However, successful result depends on the availability of suitable vessel with healthy vascular wall and adequate size for microvascular anastomosis.⁸

Free flaps cannot be used in patients with major lower extremity injury with axial vessel damage and a history of previous trauma and thrombosis of vessels. Failed previous free flap presents special problems in reconstruction. Locally diseased arterial tree, recipient vessel not available on exploration, and general condition of the patient not permitting long-standing surgery forms other contraindications for free flap. In these situations, the crossleg fasciocutaneous flap can be a good alternative to reconstruct the defects. Hence, the cross-leg flap becomes a valuable option in the aforementioned conditions.⁸

In present study, Out of 50 patients, total 30 patients underwent traditional anteromedially based cross-leg flap while 18 patients had distally based flap and 2 patients underwent proximally based flaps. Most common reported reason was the free flap failure (32.0%) followed by financial reasons (22.0%). 14.0% cases had comorbid conditions ruling out prolonged surgery. All flaps survived in present study and none of our patients underwent amputation after cross-leg flap. Only 8.0% cases developed partial necrosis of the flap. None of the patients developed any pressure sore.

Morris et al. reported 94% success rate in the series of 165 flaps with conventional cross-leg flap, and by incorporating the fascia, the success rate approaches nearly 100%. Some degree of necrosis occurred in almost half of them. Thrombo-embolic complications were rare. The long-term results were good with a low complication rate.⁷

Reisler et al reported that patient underwent initial meticulous debridement and negative pressure wound therapy. Subsequently, the wound defect was covered with a medially based fasciocutaneous perforator cross-leg flap, based on the posterior tibial artery perforators. The patient resumed normal gait and activity without any stiffness of joints related with the flap or external fixator.⁴

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In the series of 56 patients with lower extremity trauma, Lu et al describe the use of cross-leg flap as the first choice flap in preference to free flap.⁹

Cross-leg flaps remain a useful and highly reliable tool for the reconstruction of difficult wounds of the lower limb.¹⁰ It offers the possibility of salvaging limbs that are otherwise non-reconstructable. Cross-extremity flaps function as a nutrient flap for the distal limb even though the pedicle has been divided.¹¹ It is a backup procedure in an urgent situation and supplies a large quantity of skin. Advantages of cross-leg flap include ease of dissection, versatility, shorter operating time, minimal donor site morbidity, and replacement of like tissue with little or no need for secondary revision.¹²

5. Conclusion

The present study highlights that the cross-leg flap is a safe and reliable alternative to free tissue transfer in certain situations of lower extremity trauma. With its simplicity, reliability and low complication rates, cross-leg flap finds a definite place in reconstructive trauma surgery.

References

- Calhoun JH, Gogan WJ, Beraja V, Howard RJ, Oliphant JR. Dynamic axial fixation for immobilization of crossleg flaps in chronic osteomyelitis. Ann Plast Surg. 1989;23:354–6
- [2] Barclay TL, Sharpe DT, Chisholm EM. Cross-leg fasciocutaneous flaps. Plast Reconstr Surg. 1983;72:843–7.
- [3] Ponten B. The fasciocutaneous flap. Its use in soft tissue defects of lower leg. Br J Plast Surg. 1981;34:215.
- [4] Reisler T, Buziashvili D, Liu FC, Datiashvili RO. Revisiting the Fasciocutaneous Perforator Cross-Leg Flap. Eplasty. 2016;16:ic16.
- [5] Long CD, Granick MS, Solomon MP. The cross-leg flap revisited. Ann Plast Surg. 1993;30(6):560–3.
- [6] Kamath BJ, Varghese T, Bhardwaj P. Tips and techniques: a modified cross leg flap for large triangular defects of the foot and ankle. Foot Ankle J 2008;1(8):5
- [7] Morris AM, Buchan AC. The place of the cross-leg flap in reconstructive surgery of the lower leg and foot: a review of 165 cases. Br J Plast Surg 1978;31(2):138– 142
- [8] Agarwal P, Raza H. Cross-leg flap: Its role in limb salvage. Indian J Orthop. 2008;42(4):439–443.
- [9] Lu L, Liu A, Zhu L, Zhang J, Zhu X, Jiang H. Cross-leg flaps: our preferred alternative to free flaps in the treatment of complex traumatic lower extremity wounds. J Am Coll Surg 2013;217(3):461–471
- [10] Hodgkinson DJ, Irons GB. Newer applications of the cross-leg flap. Ann Plast Surg 1980;4:381-90.
- [11] Landra AP. Salvage of a seriously injured lower limb with a musculo-cutaneous cross-leg flap. Br J Plast Surg 1982;35:40-2.
- [12] Hudson DA, Millar K. The cross-leg flap: still a useful flap in children. Br J Plast Surg 1992;45:146-9.

Table 1: Demographic characters of the patients (n = 50)

Characters	Variables	Number	Percentage
Age groups	< 10 years	2	4.0%
	10-20 years	3	6.0%
	20-30 years	7	14.0%
	30-40 years	8	16.0%
	40-50 years	26	52.0%
	> 50 years	4	8.0%
Gender	Male	37	74.0%
	Female	13	26.0%

Table 2: Location of wounds and type of flap done to cover the wound of the patients (n = 50)

Location of wounds (Anatomical territory of leg involved)	Traditional cross leg flaps(antero- medially based)	Distally based flaps	Proximally based flaps	Total		
Upper 1/3	4 (13.3%)	0 (0.0%)	0 (0.0%)	4 (8.0%)		
Middle 1/3	7 (23.3%)	1 (5.6%)	1 (50.0%)	9 (18.0%)		
Lower 1/3	4 (13.3%)	7 (38.9%)	0 (0.0%)	11 (22.0%)		
Foot and ankle	0 (0.0%)	10 (55.6%)	0 (0.0%)	10 (20.0%)		
Combination of defects	15 (50.0%)	0 (0.0%)	1 (50.0%)	16 (32.0%)		
Total	30 (100%)	18 (100%)	2 (100%)	50 (100%)		

*Figures in parenthesis indicate parentage

Table 3: Reasons reported for cross-leg flap in preference to free flap (n=50)

Reasons mentioned in case records	Number	Percentage	
free flap failure	16	32.00%	
Comorbid conditions ruling out prolonged	7	14.00%	
surgery	/	14.00%	
Peripheral vascular disease/smoker	4	8.00%	
poor arterial flow in recipient	3	6.00%	
Associated vascular injury	6	12.00%	
Financial	11	22.00%	
Previously done free flap	1	2.00%	
Patients under 10 years of age	2	4.00%	

Table 4: Complications after cross-leg flap (n=50)

Complications reported	Number	Percentage
Partial necrosis	4	8.00%
Infection	2	4.00%
Cosmetic	3	6.00%
Pressure sore	0	0.00%

Case 1: A 25-year-old male presented with trauma of the right foot. As this patient did not have appropriate recipient vessels size intraoperativly close to the zone of the trauma, it was decided to perform cross-leg flap to cover the critical area of the wound. Conventional cross-leg flap was done.







Case 2: A 39-year-old male presented with unstable scar on the leg . He had been operated previously for post-traumatic leg wound by split skin graft. As the entire area was scarred, dissecting for a recipient vessel was difficult and unsafe. Hence cross-leg flap was done.









Case 3: A 23-year-old male presented with lower one-third avulsion injury. Latissimus dorsi free flap was done at the first stage to cover the wound. But, the flap did not survive. Hence, the flap was debrided and conventional cross-leg flap was done to salvage the limb

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