

Reconstruction of Post Burn Contracture Knee: Evaluation of Outcome of Releasing Procedures

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Abstract: Post burn contracture of knee joint is one of the common problems of lower limb burn. . It impairs the lower limb function and presents cosmetic defects. Severe contracture of knee is a challenge for proper reconstruction. 20 patients were treated from January 2018 to December 2019 with age range from 8 to 50 years. 10 patients were included in release with split skin grafting (group A) and 10 patients in medial & lateral flaps along with split skin grafting (group B). The range of pre-operative extension deficit was 48 to 110 degree in group A. In group B the range of pre-operative extension deficit was 50 to 110 degree. Mean value of Immediate postoperative extension deficit remaining was 19.6 in group A and 6.9 in group B. Total number of stretching was 20 in group A and 6 in group B. Medial and lateral flaps in comparison to split skin grafting alone gave a better outcome in severe post burn contracture of knee joint with minimum number of post operative stretching.

Keywords: Severe post burn contracture; Split skin grafting; Flaps; Knee joint stretching

INTRODUCTION:

Post burn contracture of knee joint is one of the common problems of lower limb burn. Mild contracture can be managed with splinting or Z-plasty release. Mild to moderate knee contracture up to 45° can be managed with Z-plasty, V-Y plasty or incisional release with split skin grafting. However total knee contracture or severe contracture of knee is a challenge for proper reconstruction. Although release with skin grafting [1], and local flap cover are the acceptable procedures in severe knee contractures. Due to exposure of solid structures like tendons and nerves some difficulties arise to get adequate release of joint by any one of these procedures. In this condition multiple settings of postsurgical stretching of the joint is required to get optimum result. Bilateral local flaps with skin grafting were a good procedure in severe contracture. The bilateral flaps were medial and lateral flaps of popliteal area, used to cover exposed tendons, nerves and bones. The non exposed raw areas were covered with split skin grafting. This could reduce or avoid several settings of knee stretching with better surgical outcome. This article will evaluate the outcomes of reconstruction of severe post burn contracture knee with two flaps (medial & lateral) along with split skin grafting and compare our results with that of split skin grafting alone.

ANATOMY:

Popliteal fossa is bounded superomedially by semitendinosus, semimembranosus, gracilis and Sartorius tendons. Superolaterally this is bounded by biceps femoris tendon, inferomedially by medial head of gastrocnemius, and inferolaterally by lateral head of gastrocnemius. The popliteal vessels and tibial nerve and common peroneal nerve cross the fossa deep to the popliteal (deep) fascia. Short saphenous vein, posterior cutaneous nerve of thigh, posterior division of medial cutaneous nerve of thigh and peroneal communicating nerve pass through the fat layer superficial to the popliteal fascia [2]. The arterial network of genicular arteries supplies the knee joint. Normal passive range of movement (ROM) knee is 130° – 140°. [3] [4]

CLASSIFICATION OF POST BURN CONTRACTURE:

Ogawa and Pribaz [5] classified contractures in 3 groups: linear, broadband, and circumference. Dougherty et al. [1] described two forms of knee contractures, (a) medially or laterally with unburned skin posteriorly, (b) contracture of the entire popliteal area. VM Grishkevich et al. [6] classified anatomically contracture into three categories : edge, medial, and total. Hudson et al. [7] divided them into mild and severe type by less or greater than 50% ROM of any joint of extremity on the basis of their much experience in this field.

PATIENTS AND METHODS:

This is a hospital based randomized prospective study of 20 patients with total post burn knee contracture attending in the department of Plastic Surgery, Gauhati Medical College & Hospital from January 2018 to December 2019. Ethical clearance was taken from Institutional Ethics Committee. The patients with contracture of the entire popliteal area, contracture with broad band and total knee contracture with extension deficit more than 45° were included in this study. Mild to moderate degree of contracture (less than 45°) were not included. Patients with malignancy over the contracture and Diabetes Mellitus were also not included from this study. The patients were divided into two groups according to procedures. Patients with surgical release and split skin grafting were included in Group A. The patients with surgical release with two flaps (medial & lateral) along with split skin grafting were included in Group B. 10 patients in group A and 10 patients in group B were studied. The surgery was performed after 6 months of burn injury when the scar became supple. In case of bilateral knee involvement surgery was performed earlier (before 6 months) [8]. Surgical procedures to the patients were performed in alternate groups (group A, group B, group A, ...). The extension deficit of the affected

knee of each patient was measured with Goniometer when knee is extended maximum without pain. The preoperative findings of extension deficit, location of scar, quality of scar, presence of raw area/ulcer were documented. Patients were put for surgery in prone position under spinal anaesthesia or general anaesthesia in children. In group A, the knee contracture is released as much as possible making releasing incision with fish tail at both ends [9]. Circulation of the distal part of the limb was checked constantly during maximum release and stopped the release before appearance of solid structures. A fatty layer would remain over the tendons and nerves. Skin graft was harvested from the opposite thigh and applied over the whole postsurgical defect. In group B, medial and lateral random pattern flaps were made. Then contracture was adequately released. Here tendons and nerves would be exposed. Release was stopped just before disappearance of feeling of pulsation of dorsalis pedis artery of foot. The medial and lateral flaps were used to cover the exposed tendons and nerves. The remaining non-exposed postsurgical defects proximal and distal to the flaps were covered with split skin grafting. The degree of extension achieving after surgery was measured in all patients. After proper bandaging, the joint was immobilized in this position with plaster of paris. Small window was kept to look at the flaps. Postoperative dressing was done on 6th, 10th, 13th postoperative days. Then patients were put for stretching of joint under short general anaesthesia on OPD basis who were needed. Ten to 14 degree further extension was achieved in one stretching. Stretching was done weekly with good splinting till the achieving normal knee joint extension. The patients were discharged with proper follow up. Physiotherapy of knee joint was performed after 21 days or after completion of stretching. Scar therapy was advised for 6 months. Use of knee joint splint was advised regularly for 3 months. Then compression bandage and night splint for 6 months. Assessment was done during follow up period. A visual analogue scale (VAS) [10]. was used to quantify the pain with a score from zero to ten. Postoperative complication like skin loss, flap necrosis, infection and donor site deformity were assessed. . Immediate postoperative knee extension gaining and remaining deficit was measured with Goniometer. Number of postoperative knee stretching in patients in both groups was recorded. Period of absence from work from day of surgery, period of dressing, sensation of flap, sensory recovery of grafted skin, and stiffness of knee joint were assessed. Quality of scar, reduction of scar and re-contracture/residual deformity was also assessed.

Aesthetic assessment was performed, based on general appearance, contour of popliteal area, colour of operated area, condition of scar. These observations were made by an independent observer.

RESULTS:

20 patients were included in this study with age range from 8 to 50 years. There were 12 male and 8 female patients; on right side in 9 patients and on left side in 11 patients. Duration of burn was 5 months to 6 years. Non healing ulcers were found in 4 patients, 3 patients in group A and 1 patient in group B. The range and mean value of pre-operative extension deficit was 48 to 110 degrees and 88.1 degree in group A. In group B the range and mean value of pre-operative extension deficit was 50 to 110 degree and 87.0 degree. Mean value of Immediate postoperative extension deficit remaining was 19.6 in group A and 6.9 in group B. Total number of stretching was 20 in group A and 6 in group B. The results were shown in Tables 1, 2, & 3; and Figures 1, 2, 3 & 4.

Table 1 Assessment of preoperative and postoperative knee extension angle and number of stretching treated with split skin graftings (group- A)

Sl. no	Preoperative extension deficit (in degree)	Postoperative extension gain on day of surgery (in degree)	Postoperative deficit remain	No. of stretching done (=20) to achieve normal knee joint extension	Mean value of postoperative deficit before the start of stretching
1	85	60	25	2	19.6 degree
2	48	48	0	0	
3	75	60	15	1	
4	110	80	30	3	
5	80	60	20	2	
6	104	80	24	3	
7	100	82	18	2	
8	84	65	19	2	
9	105	78	27	3	
10	90	72	18	2	

Table 2 Assessment of preoperative and postoperative knee extension angle and number of stretching treated with medial and lateral flaps along with skin graftings (group- B)

Sl.no	Preoperative extension deficit (in degree)	Postoperative extension gain on day of surgery (in degree)	Postoperative deficit remain	No. of stretchings done (6) to achieve normal knee joint extension	Mean value of postoperative deficit before the start of stretching
1	100	90	10	1	6.9 degree
2	110	96	14	1	
3	50	50	0	0	
4	100	88	12	1	
5	65	65	0	0	
6	105	93	12	1	
7	70	70	0	0	
8	96	87	9	1	
9	72	72	0	0	
10	102	90	12	1	

Table 3 Postoperative findings

Assessment:	Group- A : (10 patients)	Group- B: (10 patients)
Post operative pain (pain scale)	Range= 0-5; mean=3	Range=2-6; mean=4
Period of dressing (days)	Range=18-30 days	Range=15-25 days
Period of absence from work (days)	Range=30 -60 days	Range=30 to 50 days
Sensation of grafts/flaps	Recover at 3 months	Present from 1 st day
Complication	Graft loss in 2 patients	Graft loss in 1 patient
Stiffness (10-20 degree limitation of ROM)	3 patients	1 patients
Residual deformity/ re-contracture	0 patient	0 patient
General appearance	Good=6 patients, fair=3, bad=1	Good=6 patients, fair=4, bad=0
Contour of back of knee	Satisfactory=5 patients, unsatisfactory=5	Satisfactory=8 patients, unsatisfactory=2
Colour	Satisfactory=4 patients, unsatisfactory=6	Satisfactory=8 patients, unsatisfactory=2
Scar	Satisfactory=5 patients, unsatisfactory=5	Satisfactory=7 patients, unsatisfactory=3



Fig. 1 Post burn knee contracture with 48 degree extension deficit and non-healing ulcer over the scar treated with release and split skin grafting. a, preoperative picture; b & c, intra-operative pictures; d immediate postoperative picture with split skin graft; e & f, postoperative results at 6 months. No stretching was required in this patient.



Fig. 2 Severe post burn knee contracture of three patients treated with release and split skin grafting. a & b, pre & post-operative pictures with 90 degree extension deficit with one knee stretching, there was a small raw area as a complication treated with re-grafting; p & q, pre & post-operative pictures with 110 degree extension deficit with 3 stretching; y & z, pre and post-operative pictures with 100 degree extension deficit with 2 stretching.

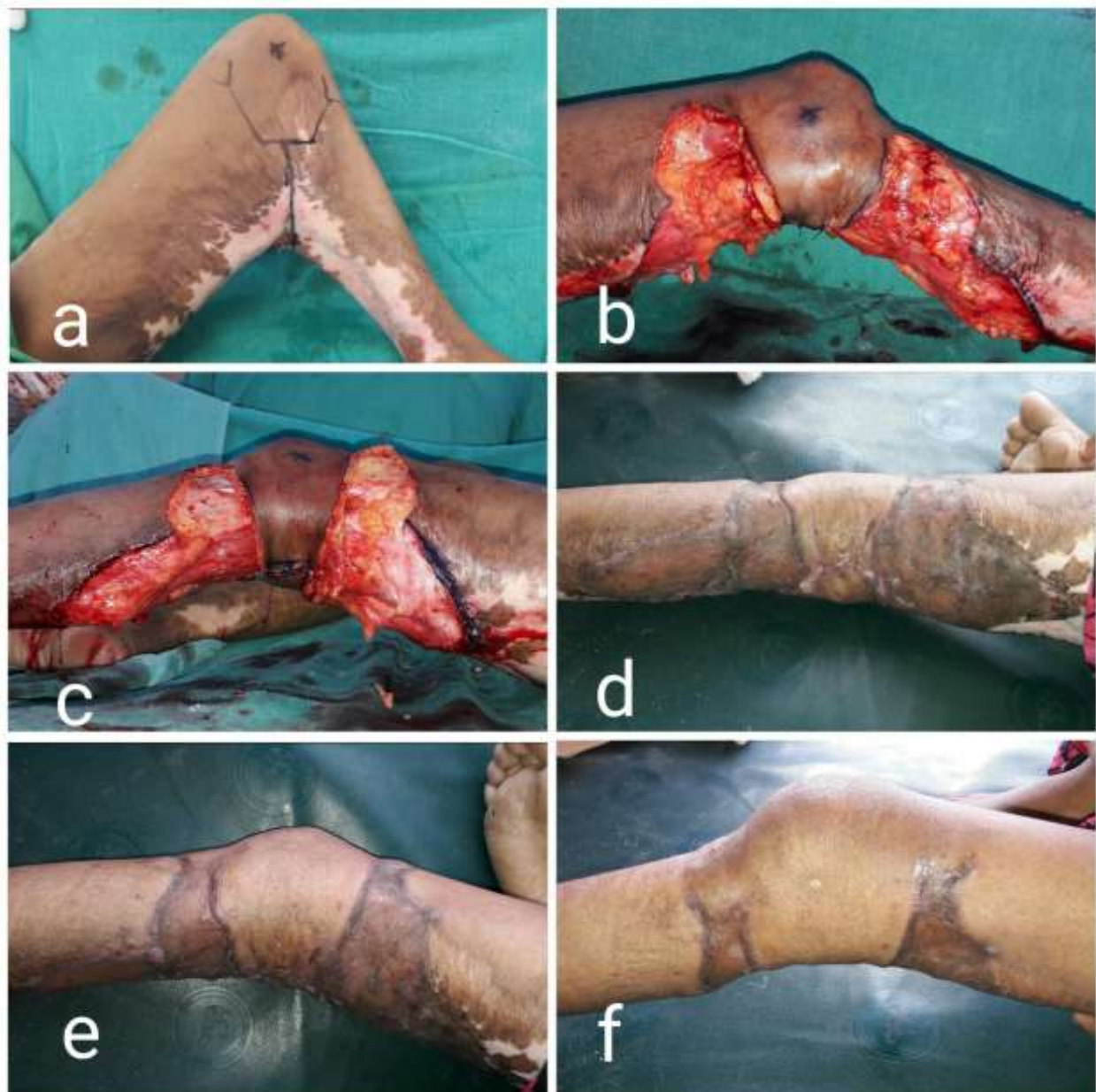


Fig. 3 Severe post burn contracture with 100 degree extension deficit treated with medial & lateral flaps along with split skin grafting with one knee stretching. a, pre-operative picture; b & c, intra-operative pictures, (flaps covered the tendons & nerves exposed area, split skin graft covered other non-exposed areas); d & e, post-operative pictures at 3 months; f, postoperative pictures at 6 months with satisfactory result.

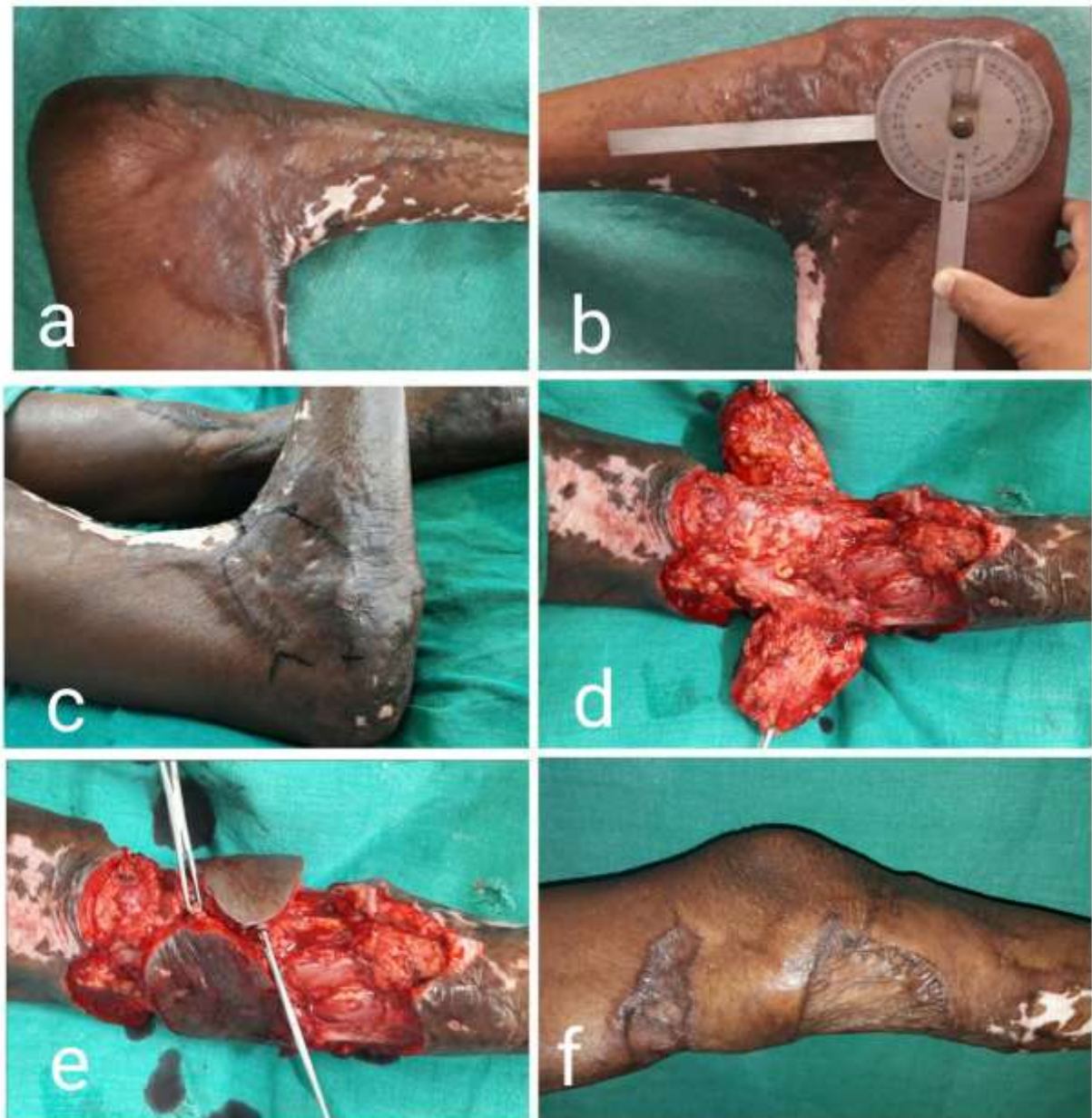


Fig. 4 Severe post burn knee contracture with 102 degree extension deficit treated with medial & lateral flaps along with split skin grafting with one stretching. a,b & c, preoperative pictures with Goniometer and marking; d & e, intra-operative pictures showing medial & lateral flaps; f, post-operative pictures at 6 months with acceptable result.

DISCUSSION:

20 patients were treated in a period of two years. 10 patients were treated with split skin grafting alone, and 10 patients with medial & lateral flap along with split skin grafting in severe post burn knee contracture. In this study pain score was found higher in flaps surgery. It was due to more stretching in flap surgery. Period of dressing and duration of absence from work after the day of surgery was found almost same in both procedures. I observed skin graft loss in 2 patients in split skin graft procedure and one patient in flap procedure. Those raw areas due to graft loss were treated with skin grafting. Sensation was recovered at 3 months in grafted area. Sensation on flaps was intact after surgery. There was no contracture of knee joints in both groups during the follow-up period. Victor MG et al [6] found contracture after skin grafting surgery in 8 patients out of 58 patients. Stiffness of knee during flexion (10-20 degree limitation of ROM) was found in 3 patients in procedure of skin grafting alone and 1 patient in flap procedure at 2 months. The stiffness was improved with proper physiotherapy within 6 months. Dougherty et al [1] showed successful result with medial & lateral flaps in severe contracture when there was unburn skin in popliteal area. I found satisfactory outcome with burn scar in popliteal area. General appearance of the knee joint was found same in both procedures. Contour of popliteal area was found satisfactory in 8 patients in flap procedure and 5 patients in skin grafting alone. The medial and lateral flaps gave the better form of the back of knee than skin grafting alone. Flaps showed the better colour matching of the operated area. 8 patients in flap procedure and 4 in skin grafting alone showed the satisfactory result in colour matching. Satisfactory scar was found more in flaps procedure (7patients) than skin grafting alone (5 patients). Maximum 82 degree of contracted knee joint could be released at one setting of skin grafting alone whereas maximum 96 degree could be achieved in flap procedure. Mean value of extension deficit remaining after surgery was **19.6 degree** in skin grafting alone whereas only **6.9 degree** was found in flap procedure. Total **20 numbers** of

stretching of knee joint after surgery were required in all patients with skin grafting alone and only **6 stretchings** were done in flap procedures.

CONCLUSION:

Post burn contracture of knee joint is one of the common problems of lower limb burn. It impairs the lower limb function and presents cosmetic defects. Medial and lateral flaps gave a better outcome in comparison with split skin grafting alone in severe post burn contracture of knee joint with minimum number of post operative stretching.

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Ethical approval was obtained from the Institutional Ethics Committee.

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