

Comparative Study on with and Without Tourniquet in Split Thickness Skin Grafting

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Abstract

Background: Loss of skin has a direct bearing on the various facets of health of the individual, hence, restoration of the skin 'loss' becomes an objective of paramount importance, which can be accomplished by various means, However, split skin grafting is the most commonly employed procedure because of its ease, better 'take' even in adverse conditions, ability to cover large areas and the possibility of re-harvesting from donor site. Tourniquet is used following exsanguination to produce a relatively bloodless operative field. **Aims and Objectives:** To compare the effectiveness of split-thickness skin grafting under tourniquet as compared with split-thickness skin grafting without tourniquet. **Materials and Methods:** The cases for the study were taken from 100 subjects admitted to K.R. Hospital attached to Mysore medical college and research institute, Mysore during the study period from June 2016 to May 2017. All split-skin grafting of the extremities (arms and legs) were included in study, whereas Graft sites of less than 2cm in greatest diameter, subjects who may require a combination of grafts (split-thickness and full thickness grafts), Children below the age of 12 years, Graft sites where pneumatic tourniquet will be difficult, subjects with Deep Venous Thrombosis and Peripheral Vascular Disease were excluded from study. **Results:** Of the 50 subjects who were randomized in the Tourniquet group, 2 (4%) subjects had to undergo re-grafting due to displacement of the graft, but on the overall outcome the tourniquet group held the advantage over Non-Tourniquet group in

terms of Lower intra operative loss of blood (p 0.034) and lower incidence of seroma formation (p 0.026). While the Non tourniquet method had a lesser operating time (p 0.04) as compared to tourniquet. **Conclusion:** Split thickness Skin grafting done under the application of tourniquet held advantage over grafting without the application of tourniquet in terms of lesser intra-operative blood loss, lesser incidence of seroma formation under the graft.

Keywords: Skin Grafting; Tourniquet; Split Thickness Skin Grafting; Pneumatic Tourniquet.

Introduction

Skin covers the entire external surface of the human body, representing the largest single organ, loss of skin has a direct bearing on the various facets of health of the individual, hence, restoration of the skin 'loss' becomes an objective of paramount importance, which can be accomplished by various means. Skin grafts are used in a variety of clinical situations, such as traumatic wounds, defects after oncologic resection, burn reconstruction, scar contracture release, congenital skin deficiencies, hair restoration, vitiligo, and nipple-areola reconstruction [1,2,3].

In 1929, Brown et al. established their technique of split-thickness skin grafting, and they differentiated between full-thickness, intermediate-thickness, and epidermal (Thiersch) grafts, pointing out the advantages and disadvantages of each. These fundamental principles of skin grafting still hold true today [4,5].

Split-thickness skin grafting is a widely used reconstructive technique for the replacement of damaged or missing skin caused by burns, trauma, surgical resection for cancer, and chronic wounds. Split-thickness autografts are harvested by excising

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the epidermis and part of the dermis, leaving a donor-site wound that can vary in thickness [6].

The word tourniquet was derived from the French word *tourner* which means "to turn." Earliest known usage of tourniquet dates back to 199 BCE-500 CE. It was used by the Romans to control bleeding, especially during amputation [7]. These were narrow straps made of bronze, using only leather for comfort [8]. There are numerous advantages of this, including establishing a clear operating field, reducing overall blood loss, and reducing the risk of microemboli at the time of release [9].

We present a new method of harvesting split thickness skin grafts using tourniquet and compare it with Split-Thickness Skin grafting without Tourniquet with respect to Percentage of graft 'take', Intra operative Blood Loss, Time taken for the procedure, Incidence of graft complications, Patient comfort with regards to Pain Post procedure [10].

Methods

After obtaining institutional ethical committee approval. A prospective open label randomized single centre study was conducted among 100 subjects admitted to K.R. Hospital attached to Mysore medical college and research institute, Mysore during the study period from June 2016 to May 2017. All split-skin grafting of the extremities (arms and legs) were included in study, whereas Graft sites of less than 2cm in greatest diameter, subjects who may require a combination of grafts (split-thickness and full thickness grafts), Children below the age of 12 years, Graft sites where pneumatic tourniquet (Figure 2) will be difficult, subjects with Deep Venous Thrombosis and Peripheral Vascular Disease were excluded from study.

Pre-operative

The subjects were randomly distributed into 2 groups each with 50 subjects each and an informed and written consent was taken.

Tourniquet Group

Once the anaesthesia was administered the blood pressure was measured and the 'Limb occlusion pressure' was calculated. An esmarch bandage (Figure 1) was then applied to the recipient limb after raising the limb to achieve exsanguinations. A cuff of appropriate size was then applied to the limb after taking necessary precaution and the cuff was inflated

to the calculated LOP. As soon as the cuff was inflated the timer was started and the esmarch bandage was removed. The recipient site was then prepared at the same time taking note of how much blood was lost by way of using a standard sized absorbable gauze pieces of size 5x5 cms. The graft(s) was then harvested from the selected donor sites and then carefully placed to the recipient area. Once the graft was placed compression bandages were applied carefully. The cuff was then deflated with taking note of the time and the limb is kept in an elevated position for about 10 minutes and then shifted out of the theatre.

Non-Tourniquet Group

Once the patient was anaesthetised the donor area was prepared with keeping a record of blood loss. The graft is then harvested and carefully placed on to the recipient area. Once placed dressing were applied and the patient was then shifted out of the theatre. The intra operative timings were recorded from the time the anaesthesia was administered till the time the dressings were applied.

Post Operative Period

The donor site dressings were opened on the 5th post operative day. The grafted site was assessed for the area of Graft take, area of Rejection, Incidence of hematoma / seroma on 3rd post operative day. After the first inspection of the wound was done the graft site was inspected once again after a period of 3 days.

Descriptive statistics, chi-square or Fischer exact test and Pearson correlation coefficient were used to analyse the results.

Result and Discussion

The average age of study subjects in the Non tourniquet group was 51.9±6.5 years while in the tourniquet group was 49.18±4.4 years. Study included a total of 70 male and 30 female subjects, Of which 34 male and 16 female constituted the non tourniquet group at 68% and 32% respectively. While the tourniquet group constituted of 36 male and 14 female subjects which was at 72% and 28% respectively.

A total of 19 subjects had wounds in the upper extremities and 81 subjects in the lower extremities. 8% (4 subjects) had wounds in their arms and 92% (46 subjects) had wounds in their legs or feet in the non tourniquet group. While 30% (15 subjects) had wounds in their arms and 70% (35 subjects) had wounds in their legs or feet in the tourniquet group.

Diabetes Mellitus was the commonest cause of ulcer formation a total of 42 subjects were found to be diabetic, 28 subjects had a predisposing history of cellulitis, 18 subjects were having previous history of burns, 10 subjects had history of trauma which resulted in the ulcer and 2 of them had venous ulcers.

Swab cultures which were sent 48 hrs prior to the surgery revealed *Staphylococcus* species as the most common organism isolated from the recipient site wherein a total of 23 swabs were positive. 11 (22%) subjects in non tourniquet and 13 (26%) subjects in tourniquet group. Next was *Klebsiella* species where a total of 9 swabs were positive. 7 (14%) subjects in non tourniquet and 2 (4%) patients in tourniquet group. 8 swabs were positive for *Pseudomonas* species. 6 (12%) subjects in non tourniquet and 2 (4%) subjects in tourniquet group. 3 (9%) swabs isolated *Streptococcus* species in only the tourniquet group. 3 (9%) and 1 (2%) subjects in non tourniquet and tourniquet swabs isolated both *Klebsiella* and *Pseudomonas* species. 1 (2%) subjects in both groups showed swabs cultures of *Pseudomonas* and *Staphylococcus* species. 1 (2%) subjects in both groups showed swabs cultures of *Klebsiella* and *Staphylococcus* species.

The mean operating time in Non tourniquet was at 32.28 minutes, the mean operating time in tourniquet



Fig. 1: Esmarch bandage

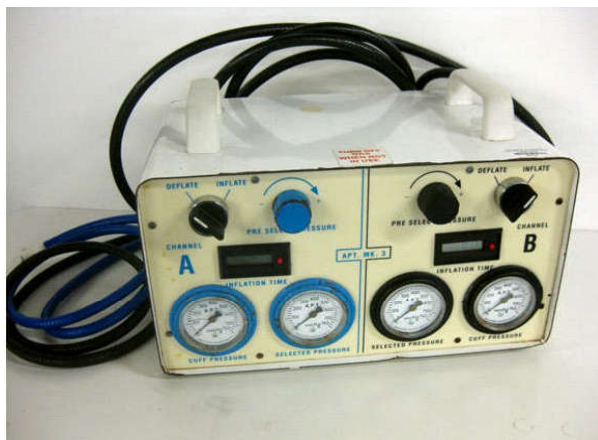


Fig. 2: Electronic pneumatic tourniquet

group was at 54.36 minutes, statistical difference between the 2 groups was $p = 0.04$.

The mean number of 5x5cms gauze pieces (absorbable) used during the non tourniquet procedure was at 6.5. While under tourniquet it was at 3.2, statistical difference between the 2 groups was $p = 0.034$. The post operative pain at the graft site in non tourniquet group averaged at 3.8 on the Visual Analogue Scale (VAS) and 4.04 in the tourniquet group. P value was at 0.304 which show no statistical significance.

The average in the non tourniquet group was 68.44 cm² and in the tourniquet group was at 84.32cm². The average graft take was 93.46%, in the non tourniquet group and 96.32% in the tourniquet group, where 6.54% was the average area rejected in non tourniquet and 3.68% in tourniquet group.

The most common complication encountered in both groups was displacement, which was observed in 12 subjects, seroma formation was observed in 8 subjects, 6 (12%) subjects in the non tourniquet group and 2 (4%) subjects in the tourniquet group developed seroma. Which was observed to be statistically significant with p value (0.026).

Graft Failure was observed in 2 subjects each in tourniquet and non tourniquet groups. The average time the tourniquet was applied was 34.24 minutes. Majority of study subjects (38 i.e. 76 %) had tourniquet applied in 31-40 minutes range.

The average limb occlusion pressure was 171.48 mm of Hg. The highest limb occlusion pressure measured was 202 mm of Hg. The average limb occlusion pressure in the upper limbs was 158.82 mm of Hg. The average limb occlusion pressure in the lower limbs was 168.24 mm of Hg.

Conclusion

Split thickness Skin grafting done under the application of tourniquet held advantage over grafting without the application of tourniquet in terms of lesser intra-operative blood loss, lesser incidence of seroma formation under the graft.

References

1. Shimizu R, Kishi K. Skin graft. Plastic surgery international. 2012 Feb 6;2012.
2. Ratner D. SKIN GRAFTING: From Here to There** Portions of this article were previously published in Johnson TM, Ratner D, Nelson BR: Soft tissue reconstruction with skin grafting. J Am Acad Dermatol

- 27:151, 1992, and Ratner D, Skouge JW: Surgical pearl: The use of free cartilage grafts in nasal alar reconstruction. *J Am Acad Dermatol* 1997;36:622; with permission. *Dermatologic clinics*. 1998 Jan 1;16(1):75-90.
3. Mutalik S, Ginzburg A. Surgical management of stable vitiligo: a review with personal experience. *Dermatologic surgery*. 2000 Mar 1;26(3):248-54.
 4. Blair VP, Brown JB. The use and uses of large split skin grafts of intermediate thickness. *Plastic and Reconstructive Surgery*. 1968 Jul 1;42(1):65-75.
 5. McDOWELL FR, Valone JA, Brown JB. Bibliography and historical note on plastic surgery of the nose. *Plastic and Reconstructive Surgery*. 1952 Sep 1;10(3):149-85.
 6. Albsoul-Younes A, Younes NA, Badran DH. Topical phenytoin ointment increases autograft acceptance in rats. *Saudi medical journal*. 2006 Jul 1;27(7):962.
 7. Noordin S, McEwen JA, Kragh Jr CJ, Eisen A, Masri BA. Surgical tourniquets in orthopaedics. *JBJS*. 2009 Dec 1;91(12):2958-67.
 8. Desmouliere A, Redard M et al: Apoptosis mediated decrease in cellularity. Granulation to scar *Am J Pathol*, 1995;146:56.
 9. Mountcastle VB, Powell TPS. Neural mechanisms subserving cutaneous sensitivity *Bull Johns Hopkins Hosp*, 1980;105:201-232. Zaias N embryology of human nail *Arch Dermatol* 1963;87:37-53.
 10. Lavker RM, Sun TT 1982 Heterogeneity of epidermal basal keratinocytes: morphological and functional correlations. *Science* 215:1239-1241.
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