

# Role of Infection in Split Skin Grafting: A Clinico-bacteriological Study.

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**Research Article**

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## Abstract:

**Background:** Skin grafts have a time-honored and well appreciated place in the armamentarium of surgeons. Their ease of harvest, applicability and resilience make them reliable alternative for soft tissue coverage. The clinical outcome of skin grafting depends on various factors with infection being the most important one.

**Objectives:** This study was done to evaluate the presence of infection in pre and postoperative cases of split thickness skin grafting and to assess the graft uptake in infected and non-infected ulcers.

**Methods:** This was a prospective study comprising of 50 cases of split thickness skin grafting (SSG) done in patients ranging from 11 to 70 years. Patients were subjected to routine pre-operative evaluation including bacterial swab for culture. SSG was done after adequate wound bed preparation. Graft uptake was assessed on 5<sup>th</sup> postoperative day. Comparison of graft uptake in infected and non-infected ulcers was made and results analyzed with chi-square test.

**Results :** Out of 50 cases studied, 26% of patients had healing ulcer, 22 % had cellulitis, 16 % had traumatic ulcer, 10 % were diabetic ulcers, 8 % had scar secondary to burns, 4% keloid, 4% chronic ulcers, 6% bedsore & 4% Fournier's gangrene. Graft uptake was complete in 62% of cases, partial in 32% and graft was rejected in 6%. Graft loss was significant in infected ulcers (48.6%) as compared to non infected ulcers (7.7%).

**Conclusion:** This was a prospective study done to assess the role of infection in uptake of split thickness skin grafts. Our study showed that presence of infection pre-operatively in healing ulcers decreased the graft uptake. However the type of bacteria present was also important. Graft loss was more in ulcers infected with Pseudomonas and Streptococcus as compared to S. Aureus and other bacteria.

**Key words:** Split skin grafting (SSG), Graft loss, graft infection.

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## Introduction:

Split skin graft consists of the epidermis and variable amount of dermis. It is simple and quick for covering

large surface area of wounds with the advantage of reduced healing time and length of hospital stay along with minimal donor site morbidity [6]. It is an effective method of managing large ulcers of varied etiology.

Most of the prerequisites of successful skin grafting are known [7]. They are adequately vascularized recipient bed, a good graft, accurate approximation and immobilization of graft in relation to ulcer. Even when above prerequisites are met, graft may fail due to bacterial infection [8].

This study about skin grafting is to determine the infection rate, relationship between bacterial colonization of ulcer and skin graft healing and percentage of graft take.

## Methodology:

This study was conducted from patients sourced from Chigateri General Hospital and Bapuji Hospital attached to J.J.M. Medical college , Davangere, Karnataka, India admitted during the period from June 2009 to May 2011. Patients with the following inclusion and exclusion criteria were selected.

## Inclusion criteria:

1. All patients with healing ulcer of both sexes between 10 to 80 years.
2. Patients willing for surgery.

## Exclusion criteria:

1. Patients less than 10 years and above 80 years.
2. Patients unfit for surgery.
3. Patients who refused procedure.
4. Patients without correction of anaemia, peripheral vascular disease, venous incompetence.

Patients who fulfilled above criteria were interviewed and clinical examination was done based on a prepared questionnaire. Routine pre-op investigations were carried out. Swabs were taken from ulcer for all patients on admission, another 5 hours before skin grafting and third in postoperative period at 5 to 10 days. Swabs were sent for culture sensitivity and bacteria identified by standard techniques.

After complete evaluation of the patients pre-operatively, the wound bed was prepared for split skin grafting. This included debridement, regular

dressing till healthy granulation tissue covered the ulcer. In case of spreading cellulitis and extensive necrosis, appropriate antibiotics were administered by intravenous route, whereas for healing ulcers no antibiotic was given pre-operatively.

**Operative procedure:**

Split thickness graft was harvested from the thigh and suitably positioned onto the recipient site ulcer, secured with catgut sutures and covered with Vaseline gauze and dressed. The limb was immobilized with POP cast. Donor site was covered with Vaseline gauze and pressure bandage applied.

Preoperatively in culture positive cases appropriate

**Results:**

Patients between the age of 10 and 80 years were included in this study. Highest incidence was 24% in the age group of 21-30 years, followed by 22% in the age group of 31-40 years.

**Table 1 : Diagnosis**

	No. of patients	Percentage
Bed sore	3	6
Burns scar	4	8
Cellulitis	11	22
Chronic ulcer	2	4
Diabetic ulcer	5	10
Fournier's gangrene	2	4
Healing ulcer	13	26
Keloid scar	2	4
Traumatic ulcer	8	16
Total	50	100

antibiotic was given as a stat dose 1 hour before surgery and continued till the 5<sup>th</sup> post operative day. However, in culture negative cases a broad spectrum antibiotic was administered 1 hour before surgery and continued postoperatively up to the 5<sup>th</sup> post operative day.

On fifth post operative day, graft was inspected to assess the uptake and at regular intervals thereafter.

Most patients were discharged from hospital only with stable appearing graft, well-healed donor site and regained full mobility. Patients were followed up at regular intervals for 3 months.

**Table 2 : Pre-Operative Infection**

	No. of patients	Percentage
E.coli	3	6
Coagulase -ve Staph	1	2
Klebsiella	5	10
No Growth	13	26
Pseudomonas	10	20
S. Aureus	13	26
Streptococcus	5	10
Total	50	100

**Table - 3 : Treatment**

	No. of patients	Percentage
Debridement + SSG	19	38
Scar Excision + SSG	6	12
Fasciotomy + SSG	4	8
Ortho Fixation + SSG	3	6
SSG only	18	36
Total	50	100

**Table 4 : Post-Operative Complications**

	No. of patients	Percentage
Absent (A)	39	78
Hematoma (H)	3	6
Seroma (S)	8	16
Total	50	100

**Table 5 : Graft Uptake**

	No. of patients	Percentage
Complete	31	62
Partial	16	32
Failure	3	6
Total	50	100

**Table 6 : infection and graft uptake**

Pre-op Infections		Graft Uptake			Total	Chi-square	P-value
		Complete	Partial	Rejected			
Growth	No.	19	15	3	37	6.90	P=0.03 Significant
	%	51.4%	40.5%	8.1%	100%		
No growth	No.	12	1	0	13		
	%	92.3%	7.7%	0	100%		
Total	No.	31	16	3	50		
	%	62%	32%	6%	100%		

**Table 7 : Type Of Infection And Graft Uptake Cross:**

Infection		Graft Uptake			Total	Chi-square value	P-value
		Complete	Partial	Rejected			
Coagulase -ve s.aureus	No.	0	1	0	1	28.1	P=0.005 Significant
	%	0%	100%	0%	100%		
E.coli	No.	2	1	0	3		
	%	66.7%	33.3%	0%	100%		
Klebsiella	No.	4	1	0	5		
	%	80.0%	20.0%	0%	100%		
NG	No.	12	1	0	13		
	%	92.3%	7.7%	0%	100%		
Pseudomonas	No.	3	6	1	10		
	%	30.0%	60.0%	10.0%	100%		
S. Aureus	No.	10	3	0	13		
	%	76.9%	23.1%	0%	100%		
Streptococcus	No.	0	3	3	5		
	%		60.0%	40.0%	100%		
Total	No.	31	16	3	50		
	%	62.0%	32.0%	6.0%	100%		

Among the 50 patients selected for this study, 35 patients (70%) were male and 15 (30%) were female patients.

Out of 50 patients studied 31 cases (62%) presented with ulcer, 10 patients (20%) presented with swelling of the affected part which later developed into ulcer, 6 patients (12%) presented with scar secondary to burns or keloid and 3 patients (6%) presented with injury causing ulcer.

In this study group, out of the 50 patients, 12 patients (24%) had Diabetes Mellitus, 6 patients (12%) had hypertension and 1 patient (2%) had chronic kidney disease. In rest of the patients no associated systemic disease was present. Diabetes mellitus was the most common comorbidity identified.

13 out of 50 cases (26%) were diagnosed as healing ulcer, 11 cases (22%) had cellulitis, 8 cases (16%) diagnosed as traumatic ulcer, 5 cases (10%) were diabetic ulcers, 4 cases (8%) of burns scar, 2 cases (4%) of keloid, 3 cases (6%) of bed sore, 2 cases of chronic ulcers(4%) and 2 cases of Fournier s gangrene (4%) were included in this study.

**Discussion:**

A wide range of factors are believed to adversely influence skin graft uptake. Hematoma or shearing movements, inadequate compliance, deficient blood supply, presence of microthrombi in blood vessels, local fibrin deficiency in wound bed are examples.4

Infection is one of the significant causes of failure of skin graft. This is a prospective study done to assess

the outcome of split thickness skin grafting in infected and non infected ulcers.

The present study analyzed 50 patients between the age of 10 and 80 years who were treated with split thickness skin grafting for various reasons. 23 out of 50 patients were in the age group of 21-40 years with the average age being 39 years. There were 35 male and 15 female patients in this study.

In literature, there are limited studies analyzing the effect of bacteria on skin graft healing [1].In our study 31 out of 50 patients (62%) presented with an ulcer over the affected part. 20% presented with swelling which subsequently formed an ulcer. Other causes included injury (6%), scar (12%).

After clinical assessment and necessary investigations, patients were diagnosed to have the following etiological factors leading to soft tissue defect which necessitated coverage with skin graft. Healing ulcer was present in 13 out of 50 patients (26%). 11 patients were diagnosed to have cellulitis (22%). Other causes for soft tissue loss included traumatic ulcers (16%), diabetic ulcers (10%), scars due to burns (8%), keloid(4%), bed sores (6%), chronic ulcers (4%) and founrier’s gangrene (4%). In the study by Unal et al, the etiology of tissue defects included traumatic (36.6%), donor site defects (39.7%), burns (14.5%) (refer table no 1)-.

**Role of infection:**

All cases were subjected to bacterial culture pre and post operatively. Pre operatively the most common

bacteria isolated in this study was Staphylococcus Aureus seen in 13 out of 50 cases (26%). The next highest incidence was that of Pseudomonas seen in 10 / 50 cases (20%). Streptococcus was detected in 5 / 50 cases (10%). Other organisms isolated were E.coli (6%), Klebsiella (10%), coagulase negative Staphylococci (2%). In 13 out of 50 cases (26%) no bacterial growth was detected (refer table no-2).

In the study by Unal et al<sup>4</sup>, the most common organism isolated was Pseudomonas spp ( 58.1%), followed by S.aureus (16.1%), Enterobacteriaceae (9.7%), Enterococci and Acinetobacter (3.2%).

In a recent review by Edwards-Jones and Greenwood<sup>5</sup>, it has been reported that the most common pathogens isolated from burns wound were S.aureus (75%), P. aeruginosa (25%), Streptococcus (20%) and various Coliform bacilli (5%).

In a study by Gjodsbol et al [1] (2006), S. aureus was detected in 93.5% of the investigated ulcers followed by Enterococcus faecalis (71.7%), Pseudomonas (52%), Coagulase negative Staphylococcus (2.7%) proteusp (41.3%) and anaerobic bacteria (39.1%).

According to Gilliland et al [2] S. aureus was detected pre operatively in 33% of cases, Pseudomonas in 9 % while no growth was found in 34%.

In our study most frequently isolated bacteria was S.aureus (26%) followed by Pseudomonas (20%) which is similar to other studies. No correlation was found between the etiological factor for ulcer and the organism isolated.

#### **Treatment given:**

In our study, for all healing ulcers with healthy granulation tissue, split thickness skin grafting (SSG) was done which included 18 out of 50 cases (36%). In cases of cellulitis and heavily infected ulcers where extensive necrosis and slough was present, debridement was done under anaesthesia followed by regular dressing and SSG (19/50, 38%). In case of burns and keloid, excision of scar was done followed by SSG to cover the raw area (6/50,12%), ortho fixation (6%) and fasciotomy (8%) for others (refer table no-3).The presence of infection in ulcers secondary to cellulitis and diabetic ulcers was higher when compared to other etiological factors.

#### **Graft uptake and infection:**

In the present study 31 out of 50 cases showed complete uptake of graft (> 95 % of graft area taken). Partial uptake (40 – 90 % of graft taken) was seen in 16 out of 50 cases and graft was rejected in 3 out of 50 cases.

All cases were inspected on the 5 POD, to assess graft uptake. Theoretically, any graft loss in this stage could be related to inadequate vascularity, insufficient mobilization, dissecting hematoma or graft infection.

A loss due to seroma or hematoma is evident as a visible collection of clotted blood underneath the graft. In our study post-op complications of hematoma was seen in 3/50 cases (6%), seroma in 8/50 (16%) while 39/50 (78%) showed no evidence of any such

complications (refer table no-4).

There was no statistically significant correlation between the presence of seroma / hematoma post operation and the graft uptake in this study (p value =0.6).

In case of graft loss due to infection, the usual picture is lysis of the graft either partially or totally (refer Table 5).

Comparing the presence of infection with graft uptake, our study showed that 92.3% of ulcers without any bacterial growth detected pre-operatively had complete uptake of graft and 7.7 % of them had partial uptake while in the infected group, only 51.4 % had complete uptake and 40.5% had partial uptake (refer table no-6).

In the Gilliland et al [2] study, percentage of graft take was 90% in cases of no bacterial growth while uptake was 67 % in cases of ulcers infected with staphylococcus & 40% in those with Pseudomonas.

In earlier studies number of organisms has been claimed to be critical but results were not related to bacterial type. But more recent analyses suggest that the type of bacteria present is more important.

In the study by Hogsberg et al<sup>3</sup> only 33.3 % of ulcers with Pseudomonas aeruginosa were healed by 12 week follow up while 73.1 % of ulcers without Pseudomonas aeruginosa healed by the same time.

In the Gjodsbol et al [1] study beta-hemolytic streptococci and pseudomonas were reported to cause skin graft failure. Unal et al [4] found that pseudomonas spp were found to increase the overall re-operation rate, incidence as much as 4.2 times (p<0.05). Among all bacteria, S.pyogenes is notorious for being the most dangerous species causing graft lysis.

In our study, among the ulcers infected with S.aureus, 76.9% showed complete uptake while 23.1% had partial uptake. In case of pseudomonas infection only 30% had complete uptake while 60% of them had partial uptake and 10% showed graft rejection. In the presence of Streptococcus, none of the cases showed complete uptake, 60% showed partial uptake and 40% showed graft rejection. In cases of Klebsiella and E.coli infection, graft uptake was complete in 80% and 66.7% respective (Refer Table-7).

Present study showed a statistically significant correlation between the type of bacteria and graft uptake with Pseudomonas, Streptococcus and S.aureus being the most frequent causes for graft loss.

Gilliland et al [2] emphasized the relationship between skin graft take & bacterial growth from ulcers both pre-operatively & post-operatively. In our study, post-operatively culture were positive in 11 out of 50 cases (22%) while 39 out of 50 (78%) did not yield any growth. Among the post-op infections most frequently isolated organism was S.aureus followed by Pseudomonas. The decreased incidence of post-op infection can be explained by the administration of broad spectrum antibiotics. However, in this study

there was no significant correlation between presence of infection post-operatively & graft uptake.

### Conclusion:

Present study showed that presence of infection pre-operatively in healing ulcers decreased the graft uptake. However the type of bacteria present was also important. Graft loss was more in ulcers infected with Pseudomonas and Streptococcus as compared to S. Aureus and other bacteria.

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