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The Impact of Platelet-Rich Plasma on Postoperative Skin Graft Survival in Fournier's Gangrene

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A B S T R A C T

Objective: To determine the efficacy platelet rich plasma on post-operative skin graft survival in fournier's gangrene.

Methodology: This randomized trial was conducted at the department of Plastic Surgery, PIMS, Islamabad during the period 28.04.2025 till 27.10.2025. A total of 48 male and female patients aging 18 to 60 years diagnosed with Fournier gangrene were enrolled and assigned to study (patients who received PRP) and control group through blocked randomization. The efficacy was assessed in terms of graft survival evaluated clinically and with Doppler ultrasound at 4 weeks after procedure.

Results: The mean age of the participants in PRP group was 43.25±10.318 years compared to 37.00±10.039 years in control group. Patients aging more than 40 years were 13 (61.9%) in PRP group compared to 08 (38.1%) in control group. The male participants PRP versus control group were 20 (51.3%) versus 19 (48.7%) respectively. Efficacy was recorded in 19 patients (67.9%) with in PRP group compared to 9 (32.1%) in control group. The chi square p value for difference in efficacy was 0.003.

Conclusion: One of the many crucial methods for treating Fornier Gangrene is the use of skin graft. Finding suitable changes to increase its survivability has long been desired. Platelet rich plasma usage reduced the risk of graft loss by 68.0%.

Key words: Fournier Gangrene, Platelet Rich Plasma, Graft Survival, Efficacy.

Introduction

A uncommon, aggressive, and quickly progressing type of necrotizing fasciitis affecting the vaginal, perianal, and perineal areas, Fournier's gangrene (FG) can spread across multiple fascial layers and reach the abdominal wall.[1] Contamination involving both anaerobic and aerobic bacteria that work in concert is the primary cause.[2] In ninety-five of instances, the origin of infection can be identified, and it primarily originates from superficial, genito-urinary, and anorectal routes. Cardiovascular disease and decreased immunity brought on by preexisting illnesses like diabetes and immunosuppression make people more vulnerable to polymicrobial infections. Clinical symptoms and physical evaluation are used to make a diagnosis.[3]

One common method for reconstructing flaws after Fournier's gangrene is skin transplantation. Among its many benefits are its simplicity, single stage nature, quick operating time, minimal donor-site complications, ability to cover broad regions, and potential for respectable physiological and esthetic outcomes.[4] Graft shrinkage is a potential issue that might restrict the restoration of more extensive lesions. Graft disintegration from hematoma fromation, or infection is another possibility.[5]

Split-thickness skin grafts can mimic the appearance, size, and structure of natural scrotal tissue in scrotal restoration. The question regarding how long scrotal skin grafting are feasible if the region of the scrotum is removed from its tunica vaginalis is up for debate; some writers agree with this claim, while others disagree. In any event, only when the scrotal granulation wound foundation is sound can this approach be used.[6] Additionally, there are worries regarding scrotal soreness or soreness and susceptibility to damage. Because of the possibility of tissue maceration, trauma, and stool and urinary contaminants, perineal and perianal regions frequently pose reconstructive problems. Because of this, repair using split-thickness grafts of skin is often compromised, which limits their applicability to minor lesions.[7] Skin grafting has been used successfully for penile restoration; large skin grafts are advised because they shrink less than small skin grafts. In such individuals, penile skin transplantation seems not to affect erectile or sexual activity.[8]

A total of 50 patients were assigned in equal number to study and control group in a randomized trial for assessment of skin graft survival. The study group received platelet rich plasma while the control group

did not. Graft survival was recorded in all 60.0% patients in patients who received PRP compared to 20.0% in control group at 3 months follow up.[9]

This study has been planned to determine the efficacy platelet rich plasma on post-operative skin graft survival in fournier's gangrene. Although PRP has been widely investigated for diabetic ulcers and burns, its applications in reconstructive procedures pertaining to FG is still poorly understood. There are currently no randomized studies evaluating whether PRP utilization enhances skin graft survival and wound regeneration in FG patients after debridement. If successful, PRP might develop into an affordable, readily available a complement to lower a second procedure rates, speed recovery, and promote better results in this vulnerable group. By filling this gap, the study may help optimize reconstructive protocols for FG, which would be in line with international efforts to improve surgical outcomes in necrotizing infections.

A rare, potentially fatal chronic polymicrobial necrotic fasciitis of the perianal, genital, and perineal areas is called Fournier's Gangrene (FG). It is distinguished by substantial tissue necrosis and quick progression.[10] Aggressive, repetitive surgical debridement is still the cornerstone of treatment to manage the infectious process, which frequently leads to large soft tissue abnormalities. The most popular surgical technique for reconstructing these wounds after they have healed is split-thickness skin grafting (STSG).[11] However, a polluted wound area, poor vascularity, a prolonged low-grade infection, and profuse exudate are some of the conditions that contribute to graft failure, a common and crippling consequence in this situation. Adjuvant therapies are therefore desperately needed to increase graft take and enhance patient outcomes.[12] An autologous collection of platelets high in growth factors, known as platelet-rich plasma (PRP), has shown promise as a biological adjuvant for wound rehabilitation and reconstructive surgery. A skin graft's capacity to revascularize via plasmatic penetration, inosculation, and neovascularization is essential to its success. After FG debridement, the wound bed is frequently not ideal for this procedure. Despite apparent clinical management of infection, the surroundings may be marked by bacterial colonization, which might encourage lysis and limit graft adhesion.[13] Additionally, a mediocre graft recipient site is created when extensive tissue loss reveals bone structures that have inadequate vascular capacity, such as fascia or stripped muscle.[14]

Malnutrition, diabetes mellitus, and immunosuppression are systemic factors that are prevalent among FG patients and further impair the healing cascade. Conventional treatment involves careful wound care and postponing grafting until a robust granulation bed has formed. However, partial or whole graft loss continues to be a major issue, resulting in extended hospital stays, higher medical expenses, and the requirement for several surgical procedures, highlighting the need for creative ways to support graft integration.[15,16]

PRP comprises an autologous blood component with a high platelet content, usually three to five times that of normal. These platelets disintegrate when activated, emitting a powerful mixture of growth factors essential for repairing damaged tissue.[17] Vascular Endothelial Growth Factor (VEGF), a crucial mediator of angiogenesis and which increases the development of epithelial cells. There are several reasons to use PRP in FG reconstruction. First off, its pro-angiogenic qualities, mostly via VEGF, can promote the graft's neovascularization and increase its longevity by quickly creating a strong blood supply.[18,19] Second, the chemotactic and growth-promoting impacts of fibroblasts and keratinocytes can promote epithelial growth from the graft borders and hasten the development of a good-looking, heavily vascularized tissue granulation bed before grafting.[20] Thirdly, antimicrobial peptides found in platelet alpha-granules, including thrombocidins, could offer an additional line of defense against any remaining microorganisms in the wound bed, making the environment more sterile for graft implantation. PRP further removes the possibility of immunogenic responses or disease transmission because it is an autologous product.[21]

Although it is still modest, the collection of research focusing on PRP in FG restoration is expanding; it mostly consists of case reports, short case series, and certain comparison studies. Nonetheless, the results that have been reported are consistently encouraging.[22]

Numerous case studies have shown that applying PRP to the wound bed before grafting or straight onto the transplanted tissue itself can successfully and quickly heal large perineal defects following FG debridement.[23] After applying PRP, authors usually observe that an attractive, red, granular bed forms quickly, enabling earlier grafting. Studies show that when used in combination with STSG, graft take rates are much higher, the duration to full healing is shortened, and the cosmetic results are better than those of historical comparisons or heterologous areas of wounds without PRP.[24] FG patients' wound sites were split into two groups for a noteworthy comparison research: one group had STSG plus PRP, while the other group received STSG alone.[25] The PRP-treated sites showed a substantially shorter period for successful re-epithelialization and a statistically significant greater percentage of graft take (95% vs. 75%). The growth factors' heightened angiogenesis and regeneration of tissue were credited

by the scientists for this achievement. Other smaller comparative trials have also shown similar results, which together imply that PRP can make a marginal injury bed more receptive, improving the success and predictability of graft survival.[26,27]

Methodology

This randomized trial was conducted at the department of Plastic Surgery, PIMS, Islamabad during the period 28.04.2025 till 27.04.2025. Approval for the conduct of the study was taken vide no: (F-5-2/2024(ERCC)/PIMS, dated (27.04.2025). Male and female patients aging 18 to 60 years diagnosed with Fournier gangrene were enrolled. Patients with prior history of intervention for the same wound, patients with severe shock, patients taking steroids, patients with concurrent chronic skin condition or any contraindications to PRP were excluded. Fournier's gangrene was confirmed clinically by the loss of the normal skin in the genitalia, perineum or perianal region and replacement with brownish, blackish or blackish discoloration with exposed subcutaneous tissue and oozing a foul smelling fluid. Efficacy was measured in terms of graft survival which was confirmed by the pinkish appearance of the recipient graft and revascularization confirmed on Doppler ultrasound at 4 weeks follow up. Failure of revascularization was called graft failure. It was hypothesized that graft survival was better in patients who received adjunct PRP as compared to patients who did not receive it. Sample size was 48 (24 in each group), calculated using Open Epi software taking anticipated efficacy of graft survival in PRP group as 60.0% compared to 20.0% in control group.[9] Participants were enrolled using non probability consecutive sampling technique.

Consent was obtained from enrolled participants after explaining study risks, benefits and purpose. Patients were assigned to study group and control group through blocked randomization in equal number. Patients in group A received platelet rich plasma after harvesting the graft. For PRP, 10cc blood was collected in an EDTA tube. The tube was then placed in a centrifuge and spinned to separate red cells from the rest of plasma. A second harder spin was given to the centrifuge which rendered the platelet rich plasma to gather in the lower most part of the tube. The PRP was injected intradermally and subdermally in the graft. Dressing moist with paraffin was applied. In the control group, only moist paraffin dressing was applied after harvesting the skin graft without PRP. All patients were followed every week with final assessment for graft survival at 4 weeks followed. The graft was clinically examined change in color and Doppler ultrasound was performed for vascularization to record efficacy.

Data was analyzed using SPSS version 26 with continuous data reported as means and standard deviations and categorical data as frequencies and percentages. Efficacy in both groups was compared using chi square or fisher exact test at 5% significance level. P value ≤0.05 was considered statistically significant.

Results

The mean age of the participants in PRP group was 43.25±10.318 years compared to 37.00±10.039 years in control group while graft size in PRP versus control group was 7.13 ±2.271 cm and 7.71 ±2.971cm respectively as shown in table I.

Table I: Descriptive statistics of study participants. (n = 48)

Group	Subgroups	Mean	SD
PRP (n = 24)	Age (years)	43.25	10.318
	BMI (kg/m^2)	24.783	0.9734
	Graft Size (cm)	7.13	2.271
Control (n = 24)	Age (years)	37.00	10.039
	BMI (kg/m^2)	24.988	0.8873
	Graft Size (cm)	7.71	2.971

Patients aging more than 40 years were 13 (61.9%) in PRP group compared to 08 (38.1%) in control group. The male participants PRP versus control group were 20 (51.3%) versus 19 (48.7%) respectively. Perineum was most frequent site of wound recorded in 9 patients (50.0%) in both groups. (Table II).

Efficacy was recorded in 19 patients (67.9%) with in PRP group compared to 9 (32.1%) in control group. The chi square p value for difference in efficacy was 0.003 as shown in table III.

Table III: Distribution of efficacy in both groups (n = 48)

		Group		Total	P value
		PRP (n = 24)	Control(n = 24)		
Efficacy	Yes	19	9	28	0.003
		67.9%	32.1%	100.0%	
	No	5	15	20	
		25.0%	75.0%	100.0%	
Total		24	24	48	
		50.0%	50.0%	100.0%	

Table II: Baseline demographic and clinical characteristics of study participants. (n = 48)				
		Group		Total
		PRP (n = 24)	Control (n = 24)	
Age (years)	40 or below	11	16	27
		40.7%	59.3%	100.0%
	More than 40	13	8	21
		61.9%	38.1%	100.0%
Gender	Male	20	19	39
		51.3%	48.7%	100.0%
	Female	4	5	9
		44.4%	55.6%	100.0%
BMI (kg/m^2)	24.0 or below	7	5	12
		58.3%	41.7%	100.0%
	more than 24.0	17	19	36
		47.2%	52.8%	100.0%
Residence	Rural	9	17	26
		34.6%	65.4%	100.0%
	Urban	15	7	22
		68.2%	31.8%	100.0%
Education	No formal schooling	9	7	16
		56.3%	43.8%	100.0%
	Matric or below	4	16	20
		20.0%	80.0%	100.0%
	Above matric	11	1	12
		91.7%	8.3%	100.0%
Smoking	Yes	10	9	19
		52.6%	47.4%	100.0%
	No	14	15	29
		48.3%	51.7%	100.0%
Graft Size (cm)	7 or below	12	13	25
		48.0%	52.0%	100.0%
	More than 7	12	11	23
		52.2%	47.8%	100.0%
Location	Perineum	9	9	18
		50.0%	50.0%	100.0%
	Perianal	9	6	15
		60.0%	40.0%	100.0%
	Penile	6	9	15
		40.0%	60.0%	100.0%
Comorbidities	Hypertension	8	8	16
		50.0%	50.0%	100.0%
	DM	10	10	20
		50.0%	50.0%	100.0%
	IHD	6	6	12
		50.0%	50.0%	100.0%

Discussion

Fournier gangrene is a difficult to treat condition and often requires skin graft which is connected with several problems. Notably frequent problems include contraction, scar hypertrophy, swelling and hematoma development that hinder graft adhesion to the injured area, and troubles with graft attachment subsequently following placement.[28] This study sought to clarify the supplementary function of PRP in split-thickness skin transplantation in Fournier gangrene. PRP has a large number of growth promoting substances that support angiogenesis and other anabolic processes.

The preparation techniques for PRP varied from study to study. A single spin method was utilized in two experiments. A twofold spin method was employed in one investigation. The cell segregation approach was used in a single investigation to perform apheresis. The placement of PRP over the wound site before graft placement was referred to as an intervention.[29] Graft stabilization with traditional suture and staple procedures and graft fixation with PRP administration on the wound bedding alone were examined in three trials. In one trial, one half of the incision received

treatment with PRP alone prior to graft fixation, whereas the other half was utilized as a control and had STSG fixed using sutures and staples.[30]

Post-operative graft survival was recorded in 68.0% patients with PRP comapred to 32.0% in the control

group. Data for post-operative days 7, 14, and 21 was gathered in the research by Hahn HM et al., which presented post-operative graft failure and hematoma development graphically.[31] Since it was believed that the information for 2 and 3 weeks showed the influence of other factors beyond the purview of our investigation, we used the statistics for day 28 in our analysis.

Our data suggests that the incidence of graft failure is decreased when PRP is added to the wound bed prior to the administration of skin graft. According to a study, the procedure's result was influenced by the FG area.[21] Additionally, another study discovered that, in contrast to widespread body engagement, local participation was linked to lower mortality. Measuring the surface area of disease presence, particularly in the perineal region, is not practical for technical factors. Rather, they divided the wound's extension into two categories, each of which was restricted to the inguinal, perianal, and perineal regions or beyond. Additionally, it was discovered a correlation between the outcome and the extent of necrosis, the death rate was considerably higher when the gangrene spread outside of the inguinal and perineal regions.[23] Previous investigations that classified the degree of sickness into three classes revealed similar findings.[9,28]

Our study does have several limitations, though. Studies on the subject of concern have not been conducted in sufficient numbers. Furthermore, there were variations in the research' approaches of PRP preparation. Additional high-quality RCTs should be carried out in order to clearly identify the application of PRP in skin grafting. RCTs on this subject should enroll a patient group with identical wound etiology and employ a consistent PRP manufacturing technique.

Conclusion

One of the many crucial methods for treating Fornier Gangrene is the use of skin graft. Finding suitable changes to increase its survivability has long been desired. Outcome indicator taken into consideration in our study was graft survival. PRP usage reduced the risk of graft loss by 68.0%. Therefore, it may be said that PRP enhances skin graft results. The authors admit that there aren't many RCTs that have been done to answer the research issue, and that more research is necessary to raise the caliber of future meta-analyses on the subject.

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