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Original Research Article

Comparative study on management of diabetic ulcer with platelet-rich plasma and conventional dressing

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ABSTRACT

Background: About 15% of diabetic patients will develop a chronic ulcer, and about 25% of those will have to undergo foot amputation. Despite evidence of the effectiveness of autologous protein C (PC) in diabetic ulcers, efficacy and feasibility of this treatment in the general population remain unclear. Aim of the study was to compare the efficiency of management of diabetic ulcer with platelet-rich plasma (PRP) and conventional dressing.
Methods: A total of 40 patients who divided into two groups: group I comprising 20 patients received homologous platelet concentrate and group II comprising 20 patients received conventional wound dressing, and the results had statistically discussed.
Results: Out of total 40 patients, 20 received homologous platelet dressings, and the 20 patients received conventional moist wound dressings. 7 patients had operated for split skin grafting, 7 patients had 0-10% of the area covered with necrotic tissue, mean duration of hospital stay was 18 days, mean duration of wound debridement was 3 days and mean number of wound dressing was 6. In conventional wound dressing group, 15 patients had operated for split skin grafting, 4 patients had 0-10% of the area covered with necrotic tissue, mean duration of hospital stay was 39 days, mean duration of wound debridement was 18 days and mean number of wound dressing was 48.
Conclusions: Patients operated for split skin grafting, number of wound debridement, duration of hospital stay, and duration of wound debridement, necrotic tissue coverage was less in platelet group compared to the conventional wound dressing.

Keywords: Diabetes mellitus, Ulcer, Debridement, Granulation tissue

INTRODUCTION

About 15% of the diabetic population develop diabetic foot ulcers in their life time.[1,2] Among those population, almost 80% of the patients have both limb ischemia and peripheral neuropathy at the same time.[3,4] These together delay the healing process of diabetic foot ulcer eventually predisposing to a higher rate of complications such as cellulitis, osteomyelitis and sepsis.[5,6]

The standard management of the diabetic foot ulcers currently consists of surgical debridement followed by frequent dressing changes with strict glycemic control.[7] Even though the current treatment options are exhaustive, the rate of complications and thereby amputations remain at a peak.[8-10]

When the whole blood is separated by centrifugation into three layers via platelet-poor plasma, platelet-rich plasma (PRP) and the red blood cells (RBCs).[11] The PRP contains several hemodynamically active proteins that help in the process of wound healing.[12,13] Among these the notable ones are, platelet-derived growth factor, transforming growth factor-beta, vascular endothelial growth factor,

epidermal growth factor, fibrinogen and fibronectin.[14] Also, the platelet delta granules contain serotonin, histamine, dopamine, calcium and adenosine which act in adjunct to the above mention factor to fasten the wound healing.[15]

Given that there are numerous confounding variables involved with PRP use, there is a tremendous challenge in creating a standardized protocol for protein use. Therefore, the study aims to review the clinical outcome of the topical application of PRP among the patient with Diabetic foot ulcers and to analyze its superiority over the conventional methods of wound care.

Aim of the study was to compare the efficiency of management of diabetic ulcer with PRP and conventional dressing.

METHODS

A hospital-based randomized control study had done in the department of general surgery in KAPV, government medical college and hospital, Tiruchirappalli. Non-probability sampling method was used to collect data. About 40 patients with diabetic foot ulcers had enrolled in the study for a period of one-year from March 2019 to February 2020.

Inclusion criteria

The study included diabetic patients with chronic non-healing feet wound.

Exclusion criteria

The study excluded patients with severe cardiovascular disorders, hepatitis, human immunodeficiency virus (HIV) patients and immunocompromised patients. Socio-demographic and clinical data had recorded from all the patients after getting informed consent - the study comprised of 40 patients. The patients had randomly divided into two groups. Group I comprising 20 patients received homologous platelet concentrate and group II comprising 20 patients received conventional wound dressing. Size calculated using Epi lnfo 3 software and after analyzing the data of previous studies. Data were collected and analyzed using statistical package for the social sciences (SPSS) 21 software. Categorical variables were analyzed using Pearson chi square test. Continuable variables were analyzed using independent sample t test.

RESULTS

Out of a total 40 patients, 20 received homologous platelet dressings, and the 20 patients received conventional moist wound dressings. In platelet dressing group 13 patients were in age 35-55 years, 7 patients had age above 55years, and in conventional wound dressing group, 14 patients were in age 35-55 years, 6 patients had age above 55 years.

Table 1: Cross tabulation of age group with study group.

Age in years	Platelet dressing group		Conventional dressing group	
	Frequency	%	Frequency	%
35-55	13	65	14	70
>55	7	35	6	30

Out of a total of 40 patients, 20 received homologous platelet dressings, and the 20 patients received conventional moist wound dressings. In platelet dressing group, 6 patients were males, 14 patients were females, and in conventional wound dressing group, 7 patients were males, 13 patients were females.

Table 2: Cross tabulation of gender with study group.

Gender	Platelet dressing group		Conventional dressing group		P value
	Frequen-cy	%	Frequen-cy	%	
Male	6	30	7	35	0.736
Female	14	70	13	65	

Out of a total 40 patients, 20 received homologous platelet dressings, and the 20 patients received conventional moist wound dressings. In platelet dressing group, 7 patients had operated for split skin grafting, and in conventional wound dressing group, 15 patients had operated for split skin grafting.

Table 3: Cross tabulation of skin grafting with study group.

Skin grafting	Platelet dressing group		Conventional dressing group		P value
	Frequen-cy	%	Frequen-cy	%	
No	13	65	5	25	0.011
Yes	7	35	15	75	*

Out of a total 40 patients, 20 received homologous platelet dressings, and the 20 patients received conventional moist wound dressings. In platelet dressing group 7 patients had 0-10% of the area covered with necrotic tissue and in conventional wound dressing group, 4 patients had 0-10% of the area covered with necrotic tissue.

Out of a total 40 patients, 20 received homologous platelet dressings, and the 20 patients received conventional moist wound dressings. In platelet dressing group mean duration of hospital stay was 18 days, the mean duration of wound debridement was 3 days and mean the number of wound dressing was 6 and in conventional wound dressing mean duration of hospital stay was 39 days, mean duration of

wound debridement was 18 days and mean number of wound dressing was 48.

Table 4: Cross tabulation of necrotic tissue with study group.

Necrotic tissue		Platelet dressing group		Convention-al dressing group		P value
Day	%	Freque-ncy	%	Freque-ncy	%	
1	76-100	15	75	14	70	0.081
	51-75	2	10	6	30	
	26-50	3	15	0	0	
3	76-100	0	0	11	55	0.001
	0-10	1	5	1	5	
	51-75	16	80	7	35	
	26-50	3	15	1	5	
5	76-100	0	0	7	35	0.012
	0-10	7	38	4	20	
	51-75	3	16	6	30	
	26-50	8	44	3	15	

Table 5: Comparison study parameters between groups.

Content	Platelet dressing group	Conventional dressing group	P value
Duration of hospital stay	18.95±8.59	39.85±18.78	0.002
No. of wound debridement	3.50±2.03	18.45±13.53	0.001
No. of wound dressing	6.203±.28	48.30±22.06	0.001

DISCUSSION

Wound dressings have evolved from the status of providing to the raw surface, absorbing exudates and controlling local infection by local medications to the level of giving adequate environment promoting wound healing. This has achieved by modern wound dressing agents which promote granulation tissue formation.

PRP exhibited two essential roles in wound healing. Firstly, gel fibrin formed a barrier to prevent bacteria contamination into the wound bed. Secondly, the growth factors from platelets triggered wound healing and balanced the matrix metalloproteinases (MMP) and MMP inhibitors. PRP contains at least seven growth factor including epidermal growth factor, platelet-derived growth factor, transforming growth factor-beta, vascular endothelial growth factor (VEGF), fibroblast growth factor, insulin-like growth factor, and keratinocyte growth factor. Many of these growth factorshaveessential roles in wound healing, PRP stimulates the expressions of type I collagen in dermal fibroblasts, and increase the expression of gastrointestinal (GI) cycle regulators, type I collagen to accelerate wound healing. In fact, after two weeks treated with PRP, 100% diabetic foot ulcers (DFUs) developed granulation tissue.

In our current study, most of them were in the age group of 35-5 years, and proportion rate was higher in females compared to males. Hirase et al (mean of 58.4 years) and Tripathi et al also report a predominance of older age individuals in their study population.[16,17]

Necrotic tissue coverage means the duration of hospital stay, mean duration of wound debridement and mean no of dressing was less in platelet dressing group compared to the conventional wound dressing. P value is less than 0.001 indicates that it is statistically significant. Various studies have clinically proven that administration of PRP dressings achieve a faster healing rate and much shorter healing times, better wound closure, lesser adverse effects such as maceration and contact dermatitis, minimal chances of infections, and lesser reopening of wounds.[16-20]

Crovetti et al study was focused on 80 diabetic wounds.[21] Patients were divided into two groups: group A received conventional ordinary dressing (N=40, 50%) and group B received PRP dressing (N=40, 50%). The mean follow-up period was 12 weeks. The estimated time of wound healing was 12 weeks for 82.5% of the patients in group A and 97.5% of the patients in group B; the PRP group was foundto be more effective with fewer complications, less infection, exudates, pain, and failed healing: 17.5, 12.5, 32.5, and 2.5% versus 27.5, 42.5, 62.5, and 17.5% in group B, respectively. The highest healing rate was observed for both groups at the fourth week, but it was better for the PRP group (group B): 0.89±0.13 versus 0.49±0.11 cm2/week in group A.

Sunil et al conducted a study on 50 patients of chronic non-healing ulcers who were grouped into two groups-PRP and conventional dressing group of 25 patients each. PRP group showed better results in term of healing rate and required significantly less number of dressings for wound closure.[22]

Vickie et al in their study, 24 patients with non-healing ulcers of different etiologies were treated with single dose of subcutaneous PRP injections along with topical application of PRP gel under compassionate use.[23] The mean age was 62.5±13.53 years and 24 weeks follow up period was used in the study. All the patients showed signs of wound healing with reduction in wound size, and the mean time duration to ulcer healing was 8.2 weeks. There were 5 fold increases in the platelet concentrate in the final PRP product obtained using the rapid point-of-care device, and the average platelet dose administered to the patients was 70.10×10.[24]

Limitations

Larger sample size with longer follow-up may give more details of the improvement.

CONCLUSION

From this study, we concluded that patients operated for split skin grafting, number of wound debridement, duration of hospital stay, duration of wound debridement, necrotic tissue coverage was less in platelet group compared to the conventional wound dressing.

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