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Original Research Article

Convectional Dressing versus Platelet Rich Plasma in the Management of Diabetic Foot Ulcers - A Prospective Comparative Study

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Abstract

Introduction: Diabetic foot ulcers are major medical issue that causes hospitalization and amputation in diabetics. Platelet rich plasma (PRP) is an effective method in the field of wound healing by supplying growth factors and diminishing inflammation. The preset study was aimed to evaluate the efficacy of platelet rich plasma dressing versus conventional dressing in the management of diabetic foot ulcers.

Material and Methods: Forty-eight cases diagnosed with diabetic foot ulcers between age group 41 to 65 years were randomly divided into two treatment groups i.e. group C with conventional dressing and group P with platelet rich plasma dressing. Cases were evaluated for the rate of wound contraction and reduction till 12 weeks. Ulcer characteristics and dimension was measured on every dressing.

Results: Ulcers on plantar aspect of foot (70.83%) were common in group C and on dorsal side of foot (54.1%) in group P. The mean duration of diabetes was 8.63 years and 9.37 years in group C and group P respectively. 91.66% cases in group P and 50% cases in group C showed complete healing by 5th week.

Conclusion: Platelet rich plasma dressing is safe and powerful tool for the management of diabetic foot ulcers as it enhances healing, reduce wound contraction, wound area of reduction and infection than conventional dressing.

Keywords: Platelet rich plasma method, Conventional dressing, Diabetic foot ulcers, Efficacy, management

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Introduction

Chronic wounds in diabetes mellitus are a major health challenge which destructs quality of life and disrupts social participation [1]. Diabetic foot is characterized by infection, ulceration or tissue desolation of foot region associated with neuropathy and peripheral artery diseases [2] Around 15% of diabetics possibly develop chronic wounds and around 25% of these probably undergo amputation of foot due to insufficient growth factors [3,4]. Devastating foot ulcers require an amputation; around 0.03% to 1.5% of diabetics require amputation and 88% of lower leg amputations have diabetic background [5,6]. In majority cases foot ulcers progressed to amputation and can be hampering with timely screening and adequate foot care [7].

The treatment goal of diabetic foot ulcer is to attain wound closure as much as possible. Ideal management choice for

diabetic foot ulcers should include wound debridement, infection control, pressure relief in wound area, and control of comorbidities [8]. Loss of balance between metalloproteinase and MMP inhibitors can cause foot ulcers non-healing for prolonged duration [9]. Several management options like physical therapies (high voltage pulsed current electrical stimulation, vacuum assisted closure, and negative pressure wound therapy) and growth factors (NGF, EGF, GCSF and VEGF) have been evaluated in the management of diabetic foot ulcers. These methods are effective in wound closure but have limitation in wound healing [10-12].

Platelet rich plasma method is an effective and reported successful outcome in the management of diabetic wound ulcers. Platelet rich plasma has high amount of growth factors which stimulates healing and also acts as barrier that prevent bacterial invasion in to wound [13] Several studies reported Platelet rich plasma method could quickly heal the ulcers than conventional methods [14,15]. With the limited literature availability at current area, the preset study was designed to evaluate the efficacy of platelet rich plasma dressing versus conventional dressing in the management of diabetic foot ulcers.

Materials and Methods

The present prospective randomized study was conducted in the Department of General surgery, Vydehi Institute of Medical Sciences and Research centre, Bangalore during November 2020 to March 2022. A total of 48 cases diagnosed with diabetic foot ulcers between 41 to 65 years of age, attending outpatient department and admitted to Department of General Surgery were recruited. Cases with type 1 and type 2 diabetes mellitus, with non-healing ulcers and willing to participate were included. Cases with cardiovascular complications, respiratory complications, osteomyelitis, small size lesions and history of skin grafting in the past were excluded. Written informed consent was obtained from all the study participants and study protocol was approved by institutional ethics committee.

The study participants were randomly divided into two study groups i.e. group C treated with conventional dressing method and group P managed with platelet rich plasma dressing. Ulcers were examined and wound measurements were recorded in their expanded direction. Before dressing, wound debridement was done and antiseptic solution was applied to control the local infection. Cases were evaluated for the rate of wound contraction and reduction till 12 weeks. Cases were advised to change dressing on every 4th day till 3 weeks. Later it was continued once in a week. Ulcer characteristics and dimension was measured on every dressing.

Collected data was analyzed by SPSS version 23.0. Descriptive statistics was used to present categorical variables in frequency and percentage. Unpaired student t test was used to compare the difference between two study groups. $p<0.05$ was considered as statistically significant.

Results

Table 1: Demographic variable of study participants

Demographic variables	Group C (n=24)	Group P (n=24)	p-value
	Frequency (%)	Frequency (%)	
Age (In years)			
41-50	03 (12.5%)	05 (20.83%)	0.568
51-60	13 (54.16%)	15 (62.5%)	
>60	08 (33.33)	04 (16.67%)	
Gender			

Male	18 (75%)	15 (62.5%)	0.584
Female	06 (25%)	09 (37.5%)	
Duration of diabetes (Mean±SD) (In years)	8.63±2.68	9.37±4.78	1.056
Origin of condition			
Traumatic	18 (75%)	20 (83.33%)	0.237
Spontaneous	06 (25%)	04 (16.67%)	
Place of ulcer			
Plantar side	17 (70.83%)	11 (45.83%)	0.680
Dorsal side	07 (29.17%)	13 (54.1%)	
Details of anti-diabetic drugs			
Oral intake	10 (41.67%)	11 (45.83%)	1.275
Injection	14 (58.33%)	13 (54.17%)	

Table 2: Details of wound contraction and surface reduction among study participants

Wound contraction/ reduction	Group C	Group P	p-value
	Frequency (%)	Frequency (%)	
Rate of healing			
1st week	02 (8.33%)	05 (20.83%)	0.001
2nd week	02 (8.33%)	06 (25%)	
3rd week	03 (12.5%)	07 (29.16%)	
5th week	05 (20.83%)	04 (16.67%)	
8th week	08 (33.33%)	02 (8.33%)	
10th week	04 (16.67%)	-	
Wound contraction			
<5	02 (8.33%)	-	0.0218
5.1-15	21 (87.5%)	02 (8.33%)	
15.1-25.0	01 (4.17%)	21 (87.5%)	
>25	-	01 (4.17%)	
Wound area of reduction (mm^2)			
<15	19 (79.17%)	01 (4.17%)	0.001
15.1-26	02 (8.33%)	02 (8.33%)	
>26	-	21 (87.5%)	

Discussion

Diabetic foot ulcers are devastating clinical condition that ruins quality of life of patients which accounts 15% of all diabetic cases. Certain methods are available to reduce the rate of amputation and reduce diabetic foot ulcers in diabetes cases. The present study was designed to evaluate the efficacy of platelet rich plasma dressing versus conventional dressing in the management of diabetic foot ulcers. In present study, majority participants were between 51-60 years (54.16% in group C & 62.5% in group P) of age followed by >60 years (33.33% in group C & 16.67% in group P) and 41-50 years (12.5% in group C % 20.83% in group P) in both study groups. The mean difference of age was statistically not significant (p=0.568). Frequency of male participants was more than females. Traumatic caused ulcers (75% in group C & 83.33% in group P) were common than spontaneous acquired ulcers (25% in group C & 16.67% in group P). Ulcers on plantar aspect of foot (70.83%) were common in conventional group and it was common on dorsal side of

foot (54.1%) in platelet rich plasma dressing group. Majority cases were under insulin intake among both the groups. The difference of origin of condition, place of ulcer and anti-diabetic medication between study groups was statistically not significant (p>0.05). A study by Abd El-Mabood *et al*., on PRS versus conventional dressing for diabetic foot ulcers included cases with ages ranged from 31 to 66 years with a mean of 49±5.06 years with more male participants (62.5%). The mean duration of diabetes was 10.3±2.3 years [16]. In present study, the mean duration of diabetes was 8.63 years and 9.37 years in group C and group P respectively. A study by Agarwal A *et al*., on PRP versus convention dressing for diabetic foot ulcers found majority ulcers in mild foot region followed by fore foot [17]. Prakasam N *et al*., found majority of wound on sole of foot with mean duration of diabetes was 9.35±1.59 years [18].

In conventional dressing group, 87.5% of cases showed wound contraction between 5.1 to15 mm^2 and 79.17% showed wound reduction below 15mm^2. In platelet rich plasma group, 87.5% of cases showed wound contraction between 15.1 to 25 mm^2 and 87.5% showed wound reduction above 26 mm^2. This difference between two study groups was statistically significant (p<0.05) (Table 2). Swathika R *et al*., reported average rate of healing per week was 0.83 sq.cm in normal dressing and 5.49 sq.cm in PRP dressing group (p<0.001) [19]. Velayutham S *et al*., found a mean percentage of wound contraction was 34.4% in PRP dressing group and 13.5% in conventional dressing group [20].

Agarwal A *et al*., reported that the size of lesion was reduced from 4.1 mm to 1.2 mm by 8th week in PRP group, where as in conventional group, size of lesion was reduced from 4.2 mm to 2.6 mm by eighth week [17]. Prakasam N *et al*., observed a higher rate of healing at six to eight weeks in PRP group [18]. Salem A *et al*., on 73 diabetic cases to evaluate the efficacy of platelet rich plasma (PRP) dressing and balanced moist dressing, found that cases in PRP group showed complete healing by the end of 3rd week, but balanced moist group required about 8 weeks for healing (p<0.05) [21]. Saad *et al*., reported that ulcer healing was significantly faster in the platelet rich plasma dressing for chronic diabetic foot ulcers than platelet poor plasma dressing. The mean healing time for PRP dressing was 11.5 weeks (Range 8-18 weeks) and for platelet poor plasma dressing was 17 weeks (range 14-20 weeks) (p<0.005 [22]. Crovetti G *et al*., found the estimated time of wound healing was 12 weeks for 82.5% of cases in conventional dressing group and 97.5% of cases in PRP dressing [23]. Kulkarni SR *et al*., reported the mean time for ulcer healing was 2.74 weeks in PRP group and 5.22 weeks in conventional dressing group (p<0.001) [24]. Tran T *et al*., reported that 100% of ulcers completely healed after seven weeks in PRP dressing [25]. Ramakrishna RG *et al*., reported that the time taken for complete ulcer healing was 3.68 weeks in PRP dressing and 6.02 weeks in conventional dressing [26]. However, in current study, 22 (91.66%) cases showed remarkable healing by 5th week in platelet rich plasma dressing group. But, it was 12 (50%) cases in conventional dressing group.

A study by Abd El-Mabood *et al*., reported that PRP dressing fastens healing, diminishes infection rates and reduces amputation rates for diabetic foot wounds than conventional dressing [16]. Several studies reported that the platelet rich plasma dressing was good choice in the management of chronic diabetic ulcers [17-29]. The present study was limited to small sample size and cases with large sized ulcers. Further studies are required to analyse various biological management methods in alliance for diabetic foot ulcers.

Conclusion

In conclusion, platelet rich plasma dressing is safe and powerful tool for the management of diabetic foot ulcers as it

enhances healing, exudates and reduces infection than conventional dressing. It is an effective and suggestible tool in the management of long term, and recurrent diabetic foot ulcers.

References

1. Jeffcoate W, Bakker K.World Diabetes Day: footing the bill. Lancet. 2005; 359:1527.
2. Schaper NC, Apelqvist J, Bakker K. The international consensus and practical guidelines on the management and prevention of the diabetic foot. Curr Diab Rep. 2003; 359:475-9.
3. Apelqvist G, Ragnarson U, Persson J, Larsson J. Diabetic foot ulcers in a multidisciplinary setting. An economic analysis of 1ry healing and healing with amputation. J Int Med. 1994; 235:463-471.
4. Loot MA, Kenter SB, Au FL. Fibroblasts derived from chronic diabetic ulcers differ in their response to stimulation with EGF, IGF-I, bFGF and PDGF-AB compared to controls. Eur J Cell Biol. 2002; 81:153-160.
5. Lazzarini PA, Hurn SE, Fernando ME, *et al*. Prevalence of foot disease and risk factors in general inpatient populations: a systematic review and meta-analysis. BMJ Open. 2015; 359: e008544.
6. Alvarsson A, Sandgren B, Wendel C, Alvarsson M, Brismar K. A retrospective analysis of amputation rates in diabetic patients: can lower extremity amputations be further prevented? Cardiovascular diabetology. 2012; 11: 18.
7. Singh N, Armstrong DG, Lipsky BA. Preventing foot ulcers in patients with diabetes. JAMA. 2005; 359:217-28.
8. Vickie R. Driver, Jason Hanft, Carelyn P. Fylling. A prospective, randomized, controlled trial of autologous platelet-rich plasma gel for the treatment of diabetic foot ulcers. Ostomy wound management. 2006; 52(6):68-87.
9. Muller M, Trocme C, Lardy B, Morel F, Halimi S, Benhamou PY. Matrix metalloproteinases and diabetic foot ulcers: the ratio of MMP-1 to TIMP-1 is a predictor of wound healing. Diabetic medicine: a journal of the British Diabetic Association. 2008; 25: 419-426.
10. AM Lone, MI Zaroo, BA Laway, NA Pala, SA Bashir, A Rasool. Vacuum-assisted closure versus conventional dressings in the management of diabetic foot ulcers: a prospective case-control study. Diabetic foot & ankle. 2014; 5.
11. RM Stoekenbroek, TB Santema, DA Legemate, DT Ubbink, A van den Brink, MJ Koelemay. Hyperbaric Oxygen for the Treatment of Diabetic Foot Ulcers: A Systematic Review. European journal of vascular and endovascular surgery: the official journal of the European Society for Vascular Surgery. 2014.
12. M Cruciani, BA Lipsky, C Mengoli, F de Lalla. Granulocyte-colony stimulating factors as adjunctive therapy for diabetic foot infections. The Cochrane database of systematic reviews. 2013; 8:CD006810.
13. Hirase T, Ruff E, Surani S, Ratnani I. Topical application of platelet-rich plasma for diabetic foot ulcers: a systematic review. World J Diabetes. 2018; 9:172-9.
14. MJ Martinez-Zapata, AJ Marti-Carvajal, I Sola, JA Exposito, I Bolibar, L Rodriguez, J Garcia. Autologous plateletrich plasma for treating chronic wounds. The Cochrane database of systematic reviews. 2012; 10: CD006899.
15. DL Villela, VL Santos. Evidence on the use of plateletrich plasma for diabetic ulcer: a systematic review. Growth factors. 2010; (Chur: Switzerland). 28, 111-116.
16. Abd El-Mabood, El-Sayed A, Ali HE. Platelet-rich plasma versus conventional dressing: does this really affect diabetic foot wound-healing

outcomes? The Egyptian Journal of Surgery. 2018;37(1):16-26.
17. Agarwal A, Majumdar A. Conventional Ordinary and PRP in Management of Diabetic Foot Ulcer- A Comparative Study. Acad. J Surg. 2019;2(2):37-39.
18. Prakasam N, Prabakar MS, Reshma S, Loganathan K, Senguttuvan K. A clinical study of platelet rich plasma versus conventional dressing in management of diabetic foot ulcers. Int Surg J. 2018; 5:3210-6.
19. Swathika R, Manuneethimaran T, Balaji SK, Nitesh N. A comparative study on effect of platelet rich plasma vs conventional dressing in healing rate of chronic diabetic ulcers. Biomedicine. 2021; 41(4): 849-854.
20. Velayutham S, Velayutham P. A comparative study on the efficacy of platelet rich plasma vs conventional wound dressing in diabetic foot ulcers. Int Surg J. 2019; 6:1574-7.
21. Salem A, Tawfik AM. Role of Platelet Rich Plasma in Treatment of Diabetic Foot Ulcers. Surgical Science. 2016; 7:272-277.
22. Saad Setta H, Elshahat A, Elsherbiny K, Massoud K, Safe I. Platelet-rich plasma versus platelet-poor plasma in the management of chronic diabetic foot ulcers: a comparative study. Int Wound J. 2011;8(3):307-12.
23. Crovetti G, Martinelli G, Issi M. Platelet gel for healing cutaneous chronic wounds. Transfus Apher Sci. 2009; 30:145-51.
24. Kulkarni SR, Chawla A. Study of efficacy of platelet rich plasma dressing in management of chronic non healing leg ulcers. J. Evolution Med. Dent. Sci. 2019;8(16):1307-1310.
25. Tran T, Le P, Pham P. Diabetic foot ulcer treatment by activated platelet rich plasma: a clinical study. Biomedical Research and Therapy. 2014;1(02):37-42.
26. Ramakrishna RG, Venkata RM, Inamdar P. A comparative study between platelet rich plasma and conventional dressing in chronic non healing leg ulcers. Int Surg J. 2020; 7:751-6.
27. Ullah A, Jawaid S I, Qureshi P *et al*. Effectiveness of Injected Platelet-Rich Plasma in the Treatment of Diabetic Foot Ulcer Disease. Cureus. 2022;14(8): e28292.
28. Virendra Nanaji Zambare, Prasanna Gambhir Jawale. Comparative study on management of diabetic foot ulcer with platelet-rich plasma and conventional dressing. Med Pulse International Journal of Surgery. 2021; 18(3): 54-57.
29. Srivignesh KK, Lakkanna S, Usharani R, Hemanth SG. Autologous platelet rich plasma dressing versus normal saline dressing in management of diabetic foot ulcers. International Journal of Scientific & Engineering Research. 2020;11(2): 922-930.