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COMPARISON OF PLATELET-RICH PLASMA DRESSING VERSUS PLACENTAL EXTRACT GEL DRESSING IN THE MANAGEMENT OF DIABETIC FOOT ULCER AND ITS OUTCOME

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Introduction: This study addresses the growing healthcare challenge of diabetic foot ulcers (DFUs), a severe complication of diabetes mellitus, by comparing the effectiveness of platelet-rich plasma (PRP) dressing versus placental extract gel dressing. These ulcers can lead to significant morbidity, including amputations, thereby affecting patients' quality of life.
Objective: To compare the efficacy of PRP dressing versus placental extract gel dressing in the management of DFUs, using the Bates-Jensen Wound Assessment Scale for outcome measurement.
Methodology: A randomized control trial was conducted at the Institute of General Surgery, Madras Medical College, and Rajiv Gandhi Government General Hospital, Chennai, involving 84 patients with diabetic foot ulcers. Patients were randomly assigned to two groups: Group A received placental extract gel dressing, and Group B received PRP dressing. The study followed strict inclusion and exclusion criteria, with a comprehensive analysis plan using IBM SPSS Statistics software for data analysis.
Results: The study found significant differences in wound healing rates between the two groups. All patients in the PRP dressing group (Group B) achieved complete wound closure, while none in the placental extract gel dressing group (Group A) did. Furthermore, the reduction in the Bates-Jensen Wound Assessment Scale score was greater and faster in the PRP dressing group, indicating a more efficient healing process.
Conclusion: PRP dressing demonstrates a significant advantage over placental extract gel dressing in promoting the healing of diabetic foot ulcers, as evidenced by higher wound closure rates and improved Bates-Jensen Wound Assessment Scale scores. This therapeutic approach shows promise in the management of DFUs, contributing to better patient outcomes and reduced complications.

Keywords - diabetic foot ulcers, DFUs, platelet-rich plasma, PRP dressing, placental extract gel dressing, Bates-Jensen Wound Assessment Scale, wound healing

Introduction

Diabetes mellitus has become one of the biggest healthcare challenges of the 21st century, manifesting as the most common metabolic disorder across the general population. It is characterized by hyperglycemia resulting from absolute or relative insulin deficiency, which in turn disturbs carbohydrate, fat, and protein metabolism [1]. As a lifelong disease, diabetes mellitus leads to chronic complications due to microvascular and macrovascular damage, with foot ulcers being among the most common and severe manifestations. The term diabetic foot refers to surgical lesions of the foot in diabetic patients, with approximately 15% of individuals with diabetes developing foot ulcers at some point in their lives [2].

A chronic diabetic foot ulcer is a leading cause of amputation, significantly impacting the patient's quality of life due to its chronic and recurrent nature. This condition not only inflicts physical suffering but also exerts a profound psychological and socioeconomic toll on affected individuals [3]. The conventional treatment paradigm for diabetic ulcers encompasses diabetic control, infection management, high-pressure remission, and various dressing techniques. The cornerstone of these treatments is the debridement of the wound, which includes the removal of necrotic tissue, calluses, and fibrous tissue to decrease the bacterial load of ulcers, even in the absence of overt infection [4].

Emerging therapies for the treatment of diabetic foot ulcers include negative pressure wound therapy, placental gel, platelet-rich plasma, hyperbaric oxygen therapy, and laser therapy. This study focuses on two innovative methods: the use of placental extract gel and platelet-rich plasma dressing. Placental extract gel is rich in epidermal growth factor (EGF) and fibroblast growth factor (FGF), which are known to stimulate collagen synthesis, accelerate neoangiogenesis, and enhance epithelization. Conversely, platelet-rich plasma dressing is comprised of fibrin, fibronectin, vitronectin, and platelets, which upon degranulation release multiple growth factors that promote wound healing [5].

The aim and objective of this research is to compare the efficacy of platelet-rich plasma dressing versus placental extract gel dressing in the management of diabetic foot ulcers, specifically assessing the outcomes in terms of wound healing as measured by the Bates-Jensen Wound Assessment Scale. This comparison will be conducted within the Institute of General Surgery at Madras Medical College and Rajiv Gandhi Government General Hospital, offering a unique opportunity to evaluate these treatments in a clinical setting and contribute valuable insights into the optimal management strategies for this challenging and prevalent condition.

Methodology

This study was conducted at the Institute of General Surgery, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai, to assess the efficacy of platelet-rich plasma dressing versus placental extract gel dressing in the management of diabetic foot ulcers. A randomized control trial design was utilized to offer a structured comparison between the two treatment modalities.

Study Design and Population

A randomized control trial methodology was employed, focusing on patients with diabetic foot ulcers admitted to MMC&RGGGH. The study was carried out over a period of one year, with a total sample size of 84 patients. These patients were randomly divided into two groups: Group A (42 patients with odd inpatient numbers) received placental extract gel dressing, and Group B (42 patients with even inpatient numbers) received platelet-rich plasma dressing.

Inclusion Criteria:

- Patients diagnosed with diabetes mellitus, aged between 20 to 70 years.
- Patients presenting with Grade 1 or 2 ulcers, as classified by Wagner’s classification, with ulcer areas ranging between 5cm^2 and 10cm^2.
- Patients who had undergone post-debridement wound care.

Exclusion Criteria:
- Patients younger than 18 years or older than 70 years.
- Platelet count below 140,000 per microliter or hemoglobin levels below 8g/dl.
- Current treatment with anti-coagulant therapy.
- Presence of septic shock, osteomyelitis, wounds resulting from vascular insufficiency, malignant disease in a wound.
- Patients undergoing treatment with corticosteroids, immunosuppressive drugs, or chemotherapy.
- Individuals with serious pre-existing cardiovascular, pulmonary, or immunocompromised conditions.

Sampling Method

The sample size was determined based on a study by Shailendra Pal Singh et al. during 2013-15, which found the proportion of patients with complete healing of the ulcer at 7 days to be 18%, and 82% at the end of 28 days after PRP treatment. Using these proportions, a sample size of 42 for each group was calculated with a 10% attrition rate, power of 80%, an alpha error of 5%, and a 95% confidence interval, employing OpenEpi V3.02 software.

Ethical Considerations

The study commenced after receiving approval from the ethical and research committee of MMC. Informed consent was obtained from all participants who met the inclusion criteria, ensuring they understood the study's nature in their local language.

Treatment Protocols
- **Group A:** Patients received placental extract gel dressing. The ulcers were first cleaned with normal saline, followed by the application of the placental extract gel on the wound surface. The wounds were then covered with pads and roller bandages, with daily dressing changes and wound healing assessment.
- **Group B:** Patients were treated with platelet-rich plasma. This involved drawing 10-15 ml of the patient's blood, followed by centrifugation to separate the plasma and platelet layers. The platelet-rich plasma was then injected into the wound site. PRP dressings were administered biweekly for 4 weeks, with subsequent wound healing assessments.

Data Analysis

Data collected from the study were analyzed using IBM SPSS Statistics software, version 23.0. Descriptive statistics, including frequency and percentage analyses, were used for categorical variables, while mean and standard deviation were utilized for continuous variables. The significance of differences between the groups was determined using the Unpaired sample t-test for continuous variables and the Chi-Square test for categorical data. Fisher's Exact test was employed for 2×2 tables with expected cell frequencies less than 5. A probability value of .05 was considered statistically significant in all analyses.

Results

This section presents the results of a randomized controlled trial comparing the efficacy of platelet-rich plasma (PRP) dressing versus placental extract gel dressing in managing diabetic foot ulcers (DFUs). The study was conducted at the Institute of General Surgery at Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai, India, from September 2019 to August 2020. Eighty-four patients were enrolled and randomly allocated to two groups:
- **Group A:** Received placental extract gel dressing (n = 42)
- **Group B:** Received PRP dressing (n = 42)

Baseline Characteristics

There were no statistically significant differences in baseline characteristics between the two groups, including:
Age: The distribution of age groups across both groups was similar (p = 0.340).
Gender: The proportion of male and female patients was comparable in both groups (p = 0.165).

Wound Characteristics
While baseline characteristics were comparable, the study revealed significant differences in specific wound characteristics between the groups:
Wagner's grade: A statistically significant difference was observed in Wagner's grade (a classification system for DFUs) between the groups (p = 0.038). Group A had a higher proportion of Grade I ulcers (26.2%) compared to Group B (7.1%).
Doppler study: The distribution of Doppler flow results (biphasic vs. normal) differed significantly between groups (p = 0.046). Group A had a lower percentage of patients with biphasic flow (26.2%) compared to Group B (90.5%).
Ulcer site: The location of the ulcer (dorsal vs. plantar) showed a highly statistically significant association with the treatment groups (p = 0.006). Group A had a higher proportion of dorsal ulcers (38.1%) compared to Group B (11.9%).

Treatment Outcomes
The primary outcome of the study focused on wound healing rates, and the results demonstrated a clear advantage for the PRP dressing group:
Wound healing: There was a highly significant difference in wound healing rates between the groups (p = 0.002). All patients in Group B (100%) achieved complete wound closure, while none in Group A (0%) did.
Wound closure: Interestingly, no statistically significant difference was observed in the type of wound closure (spontaneous vs. split-thickness skin grafting) between the groups (p = 0.243).

Laboratory Parameters
The study also evaluated potential differences in baseline laboratory parameters between the groups: Hemoglobin: Hemoglobin levels remained comparable between the groups (p = 0.829). Platelet count: Platelet counts did not differ significantly between the groups (p = 0.973). Ulcer area: The initial ulcer area showed no significant difference between the groups (p = 0.972).

BJS Bates-Jensen Wound Scoring
The BJS score, which assesses various wound healing parameters like size, granulation tissue, and inflammation, was employed to monitor wound healing progress over time. The findings revealed: Overall decrease in BJS score: Both groups exhibited a decrease in BJS score over the study period, indicating wound improvement. Significantly greater reduction in Group B: The reduction in BJS score was consistently greater and faster in the PRP dressing group, reaching statistical significance at Day 7 (p = 0.0005), Day 14 (p = 0.0005), Day 21 (p = 0.001), and Day 28 (p = 0.018).

Discussion
A surgeon intends to heal a wound successfully without any complications. Dressing of the wound aids in wound healing by keeping the wound moist and additionally prevents infection, an allergic reaction and skin maceration [6]. DFU is prevalent all over the world creating a substantial economic burden on a small-scale level (patient and family) as well as on a large-scale level (society). Diabetic patients are prone to develop wound in the lower limb resulting in DFU. Risk factors include old age, poor glycaemic control, tobacco usage and comorbidity such as hypertension, obesity, atherosclerosis. Microvascular, macrovascular complications ultimately result in hemodynamic disturbance and peripheral ischaemia leading to ulceration. The present study was carried out to evaluate the

effectiveness of PRP and placental extract gel to promote healing of diabetic foot wound, preventing infection, reduces exudates and risk of amputation.

In a study done by S. P. Singh et al. observed in a total of 55 patients were recruited to the study, 29 patients applied PRP and 26 were in the control group, there as significant percent improvement in mean wound score and percentage $p<0.0001$ [7]. Complete healing occurred in a mean of 36.7 days compared with 60.6 days in the control group. Periasamy et al observed in a total of 114 cases of diabetic ulcers in which 41 cases of PRP applied, duration of stay was less than 10 days for 1 case, 10-20 days for 38 cases and 20 days or more for 2 cases. Whereas for 73 cases of saline dressings, none had a duration of stay less than 10 days, 18 cases of 10 – 20 days, 55 cases of 20-30 days. These results showed a shorter duration of hospital stay with PRP dressings [8].

The present study, to compare the efficacy of platelet-rich plasma dressing versus placental extract gel dressing in the management of diabetic foot ulcer and its outcome concerning wound gauging by Bates-Jensen Wound Assessment Scale in Institute of General Surgery at Madras Medical College and Rajiv Gandhi Government General Hospital. In this study, patients aged above 60 years were most affected around 39.3% with male preponderance. The site of ulcer, more in plantar surface 61.9% in group A and 88.1% in group B than the ulcer in the dorsal surface.

We observed both the group of patients the process of wound healing is assessed with the BJS in the sequence of day 0, 7, 14, 21, 28. As compared, the rate of wound healing with the groups, on day 7,14,21 in the group shows of mean 37.3, 28.8, 21.4 respectively, in group b shows mean of 33.4, 24.2, 18.1. On the 28th day, while comparing it depicts high statistically significant differences between the group a and b, in group b where PRP dressing applied for shows that better rate of granulation tissue was achieved and 73.8%of the wound were spontaneously closed and, in the group, a where the placental extract gel dressing applied 61.9% were spontaneously closed.

Conclusion

In recent years the PRP therapeutic process has been used with considerable advances in tissue regeneration therapy appears to be a promising agent in the management of DFU. In this study, there was more rapid healing of ulcer insignificant percentage (73.8%) and improvement in wound score in the group using PRP compared with using placental extract gel application. Lack of confounding factors such as patient's nutrition, activities, level of adherence to their medical treatment can be considered as a limitation of this study.

Table 1 - Comparison between Wound closure with Groups

			Groups		Total	χ 2 - value	p-value
			Group A	Group B			
Wound closure	Spontaneous	Count	26	31	57	1.365	0.243 #
		%	61.9%	73.8%	67.9%		
	SSG	Count	16	11	27		
		%	38.1%	26.2%	32.1%		
Total		Count	42	42	84		
		%	100.0%	100.0%	100.0%		
# No Statistical Significance at p > 0.05 level							

Table 2 - Comparison of Ulcer area with Groups by Unpaired t-test

Variable	Groups	N	Mean	S.D	t-value	p-value
Ulcer area	Group A	42	78.1	11.9	0.035	0.972 #
	Group B	42	78.0	13.3		
# No Statistical Significance at p > 0.05 level						

Table 3 - Comparison of BJS bates Jensen wound scoring with Groups by Unpaired t-test

Variable	Groups	N	Mean	S.D	t-value	p-value
Day 0	Group A	42	47.0	3.3	0.506	0.614 #
	Group B	42	46.6	3.6		
Day 7	Group A	42	37.3	4.4	3.806	0.0005 **
	Group B	42	33.4	5.1		
Day 14	Group A	42	28.8	5.0	4.121	0.0005 **
	Group B	42	24.2	5.1		
Day 21	Group A	42	21.4	4.4	3.513	0.001 **
	Group B	42	18.1	4.1		
Day 28	Group A	42	17.7	4.0	2.430	0.018 *
	Group B	33	15.7	3.1		
** Highly Statistical Significance at $p < 0.01$,* Significant at $p < 0.05$ and # No Statistical Significance at $p > 0.05$						

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