

A Clinico-Pathological Study of Diabetic Foot with Special Reference to Role of Platelets Rich Plasma in Management of Diabetic Foot

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Abstract: ***Introduction:** Diabetes mellitus is one of the most deceitful diseases that affect more than 371million people all over the world in 2012; by 2030 this will rise to 552 million. Diabetic foot is a frequent site for complication in DM. Ulceration occurs as a result of trauma in the presence of neuropathy and/or peripheral vascular disease with infection as a secondary phenomenon following disruption of the protective epidermis. NS is isotonic and the most commonly used wound care solution due to lowest toxicity. PRP for enhancing wound healing was compared to conventional therapies. PRP enhances wound healing by either the barrier effect to prevent bacterial invasion into the wound or the growth factors stimulate wound healing. **Aim:** The aim of study will be a clinico-pathological study of diabetic foot with special reference to role of platelets rich plasma in management of diabetic foot. **Materials and Methods:** 90 patients with DIABETIC FOOT admitted to our institution between December2018 to July 2020 were enrolled. Patient data was collected from attending, general surgery outdoor patient department, casualty and inpatient departments, irrespective of gender background socioeconomic status. **Results:** The study population was divided into three group, which indicates PRP group, PPP group and NS group respectively. The higher incidence of DM foot occurred in the age group of 41 to 50 years (32.2%). Males (75.6%) were affected more than female. Our study revealed a statistically significant reduction in ulcer size, depth and higher wound healing rate in the PRP group when compared to the other two groups. **Conclusion:** Our study revealed a statistically significant reduction in ulcer size, depth and higher wound healing rate in the PRP group when compared to the other two groups. Therefore the application of platelet-rich plasma in the management of diabetic foot ulcer is effective in improving the local growth factors.*

Keywords: with DIABETIC FOOT, Platelet-rich plasma (PRP), Platelet-poor plasma (PPP)

1. Introduction

Diabetes mellitus (DM) is one of the most deceitful diseases that affect more than 371million people all over the world in 2012; by 2030 this will rise to 552 million. Diabetes mellitus has been known for centuries, although it has not been fully understood. The ancients first described diabetes, the cardinal features of a polyuric state were described in an Egyptian papyrus, —Ebers papyrusl dating from c. 1550 BCE. Diabetic foot is a frequent site for complication in DM. Ulceration occurs as a result of trauma in the presence of neuropathy and/or peripheral vascular disease with infection as a secondary phenomenon following disruption of the protective epidermis. ¹.India with approximately 42 million cases is ranked in the list of ten nations most affected with Diabetes. Among diabetes mellitus complication, Foot ulceration is the most common affecting approximately 15%. Foot problems in diabetic patients account for more hospital admissions than any other long-term complications of diabetes and also result in increasing morbidity and mortality. Patients with the diabetic foot can also have multiple diabetic complications and caring for such patients may require attention to many different areas. Normal saline is isotonic and the most commonly used wound care solution due to safety (lowest toxicity) and physiologic factors. In the recent studies, growth factors from Platelet Rich Plasma (PRP) used for enhancing wound

healing were compared to conventional therapies. Platelet-rich plasma (PRP) enhances wound healing by either the barrier effect to prevent bacterial invasion into the wound or the growth factors stimulate wound healing.

Aim

The aim of study will be a clinico-pathological study of diabetic foot with special reference to role of platelets rich plasma in management of diabetic foot.

Objectives of Study

In this prospective cohort study we intend to compare and obtain data on role of platelet rich plasma in diabetic foot healing

- To compare the pain intensity in test and control group
- To compare incidence of complication of diabetic foot ulcer among the test

2. Materials and Methods

All patients of DIABETIC FOOT presenting to the Surgery OPD or Casualty of SUBHARTI Hospital, referred from medical wards of SUBHARTI hospital OR referred from outside diagnosed as case of DIABETIC FOOT.

Type of study: Prospective and longitudinal study

Duration: - Duration of study will be from November 2018 to July 2020

Sample size: Sample size 90 cases.

Inclusion Criteria:

- 1) Type 1 or 2 diabetes controlled by either medication or insulin.
- 2) Presence of a foot ulcer for at least 4 weeks to be considered chronic.
- 3) According to University of Texas Treatment-Based Diabetic Foot

Classification System: ulcers included in this study are of grade 1A (wounds without tendon, capsule, or bone involvement, and also without associated infection or ischemia) or grade 1C (wounds without tendon, capsule, or bone involvement, and also, without associated infection but with ischemia). Patients with ischemia are allowed to be included but with ankle-brachial index (ABI) of greater than or equal to 0.6.

Exclusion Criteria

- 1) Patient's blood vessels are no compressible for ABI testing.
- 2) ABI of less than 0.6.
- 3) Evidence of gangrene in ulcer or on any part of the foot.
- 4) History of peripheral vascular repair within 30 days of randomization.
- 5) Patient has radiographic evidence consistent with diagnosis of acute Charcot foot.
- 6) Patient has known or suspected osteomyelitis.
- 7) Ulcer size area (length-width) of less than 2 cm².
- 8) Diabetic foot ulcers that are clinically infected.
- 9) Patients having symptoms or signs suggesting general infection (fever, foot pain, hotness, and redness around the ulcer).
- 10) Ulcers that had exposed tendons, ligaments, or bone.
- 11) Patient who is currently receiving or has received radiation or chemotherapy within 3 months of randomization.
- 12) Screening serum albumin level of less than 2.5 g/dl.
- 13) Screening hemoglobin (Hb) of less than 10.5 mg/dl.
- 14) Screening platelet count of less than 100×10⁹/l.
- 15) Patient undergoing renal dialysis, has known immune insufficiency, liver disease, active cancer, nutritional, hematologic, collagen vascular disease, rheumatic disease, or bleeding disorders.
- 16) Patient having inadequate venous access for blood draw.
- 17) Patients who did not complete their follow-up protocol.

Platelet-rich plasma and platelet-poor plasma preparation

Less than 20 ml of venous blood will draw from the patients into a tube containing an anticoagulant, to avoid platelet activation and degranulation. Then the blood will centrifuge, the first centrifugation is called soft spin (1000 rpm) for 7–10 min which allows the blood separation into three distinct layers: At the bottom of the tube, the red blood corpuscles (RBC) constitute 55% of total volume. At the top of the tube, the acellular plasma layer is mainly made up of circulating plasmatic molecules and is low in platelets. It is designated PPP and constitutes 40% of the total volume.

Using a sterile syringe, the PPP, PRP, and some RBCs will transfer into another tube without an anticoagulant. This tube underwent a second centrifugation (3000 rpm) for 10 min called hard spin. This allowed the platelets (PRP) to settle at the bottom of the tube with very few RBCs. The acellular plasma (PPP) (80% of the volume) will found on the top. Most of the PPP will be taken with a syringe and the remaining PRP left in the tube. At the time of application, the remaining PRP mixed gently with calcium chloride 10% (0.1 ml) in a Petri-dish and left to rest for 10–15 min until the gel formed.

Dressing protocol: PRP group (30 patients): The PRP will apply to the ulcer followed by Vaseline gauze and then sterile dressing. PPP group (30 patients): PPP will apply to the ulcer followed by Vaseline gauze and then sterile dressing. NS Group (30 patients) The NS will apply to the ulcer followed by Vaseline gauze and then sterile dressing.

The frequency of change of dressing twice weekly. The dressing protocol will perform for up to 12 weeks or stopped whenever healing occurred.

3. Results

The study participants were divided into three groups; such as PRP group (group A), PPP group (group B) and NS group (group C). The mean age in Group A, Group B and Group C were 57.57±11.18, 51.83±10.59 and 54.57±12.46, respectively. There were no significant differences between the study groups based on the age group and the P-value (0.158) obtained is not statistically significant. In our study, 68(75.6%) were males, and 22(24.4%) were female patients. In all the three groups, males were predominantly higher. The mean duration of diabetes mellitus (in years) among the study population was found to be 5.97±0.83, 6.63±0.95 and 6.48±0.92 in group A, group B and Group C respectively. The mean duration of ulcer (in days) among the study population was found to be 85.87±14.18, 80.23±14.58 and 80.03±12.91 in group A, group B and Group C, respectively. Among the study groups, the size of ulcer (in cm) was measured on Day 0, Day 28, Day 56 and Day 84. There was a significant association between the study group, and the size of the ulcer as the P-value obtained was statistically significant. Among the study groups, the depth of ulcer (in mm) was measured on Day 0, Day 28, Day 56 and Day 84. There was a significant association between the study group, and the depth of ulcer as the P-value obtained was statistically significant. Among the study groups, the types of wound discharge were observed on Day 0, Day 28, Day 56 and Day 84. There was a significant association between the study group and the wound discharge on Day 28 and Day 56 as the P-value obtained was statistically significant.

In this study, the development of granulation tissues was observed on Day 0, Day 28, Day 56 and Day 84. There was a significant association between the development of granulation tissue and the study groups as the P-value obtained was statistically significant. Among the study population, the pus culture was done on Day 0, Day 28, Day 56 and Day 84. The pus culture reports obtained on Day 28 and Day 56 had a significant association with the study groups as the P-value obtained was statistically significant.

In our study, the number of debridement performed was compared with the study groups. There was a significant association between the number of debridement and the study groups as the P-value obtained was statistically significant. The mean Platelet (in 1000/mm³) in Group A, Group B and Group C were 245.40±50.33, 265±49.60 and 248.60±46.45. There were no significant differences between the study groups based on mean platelet count, and the P-value (0.254) obtained is not statistically significant. In this study, the mean RBS (in mg/dl) was observed on Day 0, Day 28, Day 56 and Day 84. There was a significant association between mean RBS (in mg/dl) and the study groups on Day 84, as the P-value (<0.001) obtained was statistically significant. In this study, the mean HbA1c was observed on Day 0 and Day 84. There was no significant difference between mean HbA1c, and the study groups as the P-value obtained was not statistically significant. In our study antibiotics were prescribed according to the culture sensitivity reports on Day 0, Day 28, Day 56 and Day 84. There was a significant association between the study groups and the antibiotic prescribed on Day 28 and Day 84 as the P values obtained were statistically significant.

4. Discussion

Most of publications apply PRP only on the wound but we apply both activated PRP and PPP. PRP enrich the wound by multiple growth factors for cell migrations and neo-angiogenesis while PPP contains nutrients for healing². Several reports have been published demonstrating the significance of autologous PRP for the treatment of diabetic foot ulcers³.

The mean age of presentation in Group A, Group B and Group C were 57.57±11.18, 51.83±10.59 and 54.57±12.46, respectively. The higher incidence occurred in the age group of 41 to 50 years (32.2%). In all the three groups males (75.6%) were affected more than females (22.4%). This is in concordance with the studies conducted by *Prakasam N et al*⁴, concludes that age and sex are insignificant in correlation with the rate of healing of diabetic foot ulcers. The size of ulcer (in cm) was found to be progressively reduced in group A from Day 0 to Day 84. This is similar to a study conducted by *Babaei et al*⁵, which reports that there was wound size reduction in patients after four weeks following treatment with PRP. The depth of the wound was found to be significantly decreasing in Group A patients when the other two groups are considered. Most of the wounds healed within the estimated time of healing (12 weeks); all these cases showed more than 50% healing after the first 4 weeks with group A (PRP). These results were confirmed by *Gelf et al*⁶. In our study, it was found that patients in group A developed healthy granulation tissue when observed on Day 28 and Day 56. Our study revealed a statistically significant reduction in ulcer size, depth and higher wound healing rate in the PRP group when compared to the other two groups. This is in line with the study conducted by *Chicharro et al*⁷, which hypothesizes that regenerative capacity of GFs in PRP helps shorten the recovery time for wounds. *Saad et al*⁸, compared the results of both PRP and PPP on ulcer healing and showed that healing in PRP group was faster (P < 0.005) than PPP. Our results were agreed with *Lone et al*⁹, who used PRP to treat

DFUs. They showed that 62.85% patients developing granulation tissue by the end of second weeks and 77.78% patients reached 100% granulation at the end of the 3rd week. In our study, the ulcers were classified according to the Wagner ulcer classification system. Majority of the study participants (65.6%) had grade 1 ulcers, followed by 34.4% had grade 2, 27.8% had grade 3, and 4.4% had grade 4 ulcers. On the basis of the last 10 years of research, the results of the systematic review with meta-analysis published by *Carter et al*¹⁰, suggest that PRP therapy can positively impact wound healing and associated factors such as pain and infection in both chronic and acute cutaneous wounds. In this study, majority of the patients (41.1%) underwent debridement twice, and in 6.7% of the cases, no debridement was performed. The antibiotics prescribed to the patients were according to the culture sensitivity reports obtained. The generalization of the results is limited because of the smaller sample size.

5. Conclusion

In this study, majority of the patients (41.1%) underwent debridement twice, and in 6.7% of the cases, no debridement's were performed. The antibiotics prescribed to the patients were according to the culture sensitivity reports obtained. The generalization of the results is limited because of the smaller sample size.

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