Original Article

Dressing on Burn Wound

Efficacy of Platelet Rich Plasma Application in Comparison to Conventional Dressing Therapy in Partial Thickness Burn Wound

1. Ehmer-Al-Ibran 2. Masood Hussain Rao 3. Maria Khan 4. Farrukh Hasan 5. Raaziyah Abdul Khaliq 6. Syeda Zehra

1. Asstt. Prof. of Burns, DUHS, Karachi 2. Principal Research Officer, PMRC Research Centre, DMC, Karachi 3. PG Student, DUHS, Karachi 4. Medical Director, Vice President of South Asian Association of Transfusion Medicine 5,6. PG Students, DUHS, Karachi

ABSTRACT

Objective: To determine the efficacy of Platelet Rich Plasma application in comparison to conventional dressing therapy in partial thickness burn wound

Study Design: Comparative analytical study

Place and Duration of Study: This study was carried out at Department of Burns, Civil Hospital Karachi from March 2011 to January 2013.

Materials and Methods: A comparative analytical study was conducted to determine the efficacy of Platelet Rich Plasma application in comparison to conventional dressing therapy in partial thickness burn wound at Department of Burns, Civil Hospital Karachi. All the admitted patients of either sex having age between 20-40 years, victims of fire and scald burn, having partial thickness burn with 10-30% of TBSA involved. Patients were divided into two groups on random basis. In group "A", Platelet Rich Plasma (PRP) application was given with three day gap between two applications until full recovery of the wound. While in group "B" conventional dressing therapy was adopted till full recovery of wound.

Results: All 30 patients of group A, selected for PRP application, were recovered maximally within 18 days (6 therapies with a gap of 3 days). Whereas in other 30 cases, of group B selected for conventional dressing therapy, it took minimum 21 days or more for complete recovery. Hence recovery was found slow in conventional dressing therapy as compared to PRP and it is statistically significant at P,0.05.

Conclusion: Platelet-rich plasma application in non-healing deep partial and full thickness burn wound accelerate the wound healing as compared to conventional dressing therapy and is very effective in preparing healthy beds for grafting and provides 100% graft take.Now it is up to the Burns surgeon to select it for rapid results to save time and cost with availability of more beds in Burn Centre.

Key Words: Platelet Rich plasma, Burns, Conventional dressing, wound healing.

INTRODUCTION

Burn injuries occur as a result of fire and hot water or liquid (scald burn). It may lead to extensive damage to skin surface and also its depth, depending on the intensity of heat delivered to the skin and time of contact. As a result of damage to the skin surface, the protective function gets compromised and results in the exposure of the sub-epithelial skin layers. It depends upon the depth of injury which immediately comes in contact with the external environment specially the micro-organisms like bacteria, fungi, yeast, virus etc. that cause infection on the burnt surface, initially confined to the wound surface but as pathological events progress deeper down they may invade the circulation (bacteremia). If not stopped, further progress leads to septicemia, septic shock and finally death of the patient. In order to avoid these complications, early healing of wound and coverage of damaged skin surface in deeper injuries is necessary to decrease the chances of above mentioned life threatening consequences.

Platelet Rich Plasma has attained a significant importance in facilitating wound healing in many fields of surgery. According to many health workers platelets[1,2] and natural sources of growth factors [3,4,5] play a fundamental role in homeostasis and healing as well[6]. They also release chemotactic factors[7,8] and induce proliferation of fibroblasts and endothelial cells for neo-angiogenesis hence they have a significant effect on minimizing wound infection which is very effective in wound healing[9] in superficial burn wounds and also equally important in providing early well vascularized healthy granulation tissue for resurfacing deep wounds by grafting.

We have all the studies from abroad and no work has been done in Pakistan so far. After studying the results obtained from work done by Marquez-de-Aracena[10], Kazakook[11] and Knighton,[12] etc, we want to apply PRP on burn wounds to get a comparative analysis in partial thickness burn wound.

MATERIALS AND METHODS

This comparative analytical study was carried out from March 2011 to January 2013 at Burns Centre, Civil Hospital, Karachi. We have selected 60 patients suffering from fire and scald burn resulting in partial thickness burn. We excluded electrical, chemical and fire burn of superficial and deep thickness. We have also excluded smokers, diabetics, hypertensive and patients with other cardiac problems and also pregnant women.

We have divided these patients into two groups. Group A was treated by PRP while Group B was treated by conventional dressing therapy.

Platelet concentrate was achieved by extracting platelets from one pint of whole blood. Donor should be healthy, free of communicable blood-borne disease, ABO compatible and should have normal values of complete blood picture on lab test evaluation. Platelet is extracted by CRYOFUGE (centrifuge machine) made by JOVAN (France). The extracted platelets are suspended in 50-100ml plasma in transfusion bag having 3-5 times the concentration as compared to whole blood.

Before each application of PRP in Group A, the patient was shifted to Operation Theater. The wound was carefully examined and if any slough or dead tissue was found that was removed by desloughing or debridement. All procedures are done under strict aseptic conditions. If slough or dead tissue is not found then the wound is washed with NaCl. Before application, the platelet extract received from the blood bank in the transfusion bag is mixed with $CaCl_2$ which is present in a separate syringe provided by the blood bank. As a result of this mixing, the platelets degranulate and start releasing growth factors. The activated PRP is then applied over the wound surface and within 10 minutes the wound is covered with sterile dressing. It is left for 3 days because the activity of the platelet borne factors is supposed to be maximum during this period. So we plan next application after 3 days.

In Group B, thirty patients were selected for giving treatment with conventional dressing therapy. Dressing is done in Operation Theater under sterile conditions. The wound was examined, and washed with normal saline. The dead and devitalized tissues are removed and non-adhesive dressing is done by 1% silver sulphadiazine and then dressing is done. Initially the dressing change depends upon the soakage, the condition wound and the half life of the topical anti bacterial cream.

These procedures were adopted till the completion of wound healing. During this period, the wound was observed for the presence of infection, time of infection eradication from wound, changes in pain perception, total time of wound healing and time of hospital stay during treatment.

RESULTS

According to the analysis of the data, we have selected 60 patients suffering from fire and scald burn resulting in partial thickness burn. These patients were divided into two groups through systematic random sampling. Out of these, 29 (48.3%) patients who were suffering with 10-19%, only 5 (17.0%) required debridement, where as in 31 patients with 20-30 % of burn, 22(71.0%) required debridement which was done. Over all 27 (45.0%) patients requiring debridement (Table 1)

All 60 patients selected for this study were divided in two equal groups. Group A was selected for PRP application and its effects on wound healing were observed and Group B was treated by conventional dressing therapy. All selected patients had partial thickness burn wounds of fire and scald burns, categorized on the basis of history and clinical examination before application of PRP (Group A) and dressing (Group B).

Table No.1: Patients with % of burn requiring debridement

S. No	No. of Patients	% of Burn	Debride-ment not done	Debride-ment done	Total
1.	29	10-19	24	5	29
2.	31	20-30	9	22	31
Total:	60		33	27	60

Table No.2: Epithelization time of burn wound and no of PRP applications

No of patients	PRP applications with a 3 day gap	Total no of days of therapy
16	Three (3)	9
9	Four (4)	12
5	Six (6)	18
Total : 30	Maximum 6 therapy	Maximum 18 days for full recovery.

Table No.3: Epithelization of burn wound with conventional dressing method

No. of patients	Duration of dressing
16	21-30 days
11	31-40 days
3	>40 days
Total : 30	

PRP application was given in Group A (30 patients) at a gap of three days between two consecutive applications to achieve maximum effect of PRP which lasts for three days. 16 out of 30 (53.4%) showed epithelization after 3 applications with a 3 day gap in between every application i.e. 9-day therapy. 9 out of 30 (30%)

showed epithelization after 4 applications, 3 days apart i.e. 12 days therapy and 5 out of 30 (16.7%) showed proper epithelization after 6 applications i.e. maximum 18 days required for complete healing. (Table 2).

In conventional dressing method Group II dressing was done by 1% silver sulphadiazine and wound was covered by Gamgee dressing, 16 out of 30 (53.3%) patients took 21-30 days, 11 out of 30 (36.7%) took 31-40 days , 3 out of 30(10.0%) patients took more than 40 days to show proper epithelization (Table 3)

The results of these two groups were compared to get an idea regarding the efficacy of PRP in rapid wound healing and it was found that Platelet Rich Plasma application in comparison to conventional dressing therapy in partial thickness burn wound which is statistically significant at P<0.05 (Table 4)

Table No.4: Comparison of epithelization of burn wound treated with PRP and with conventional dressing method

No. of days	No. of patients fully recovered with PRP	No. of patients recovered with conventional dressing method
<10	16 (53.3%)	0
11-20	14 (46.7%)	0
21-30	__	16 (53.3%)
31-40	__	11 (36.7%)
>40	__	3 (10.0%)

DISCUSSION

Fire and scald burn are common in burn cases and rapid recovery is the main issue in partial thickness burn wounds. We have designed a study to compare the efficacy of PRP with conventional dressing methods in partial thickness burn wound. Partial thickness burn wound specially in fire and scald burn have an advantage of healing spontaneously nearly within 3 weeks, provided all protocols of sterilization are followed, otherwise if partial thickness burn wound gets infected, the depth of the wound may extend deep down and the partial thickness burn may turn into deep partial thickness wound where the healing takes a longer time and most of the healing occurs by formation of fibrous tissue which ends up in hypertrophic scar, keloid or contracture formation. As far as effect of PRP on burn wound is concerned, few studies are present so far, Marquez-de-Aracena et al (2007)[10] applied PRP on ten Ocular burn patients and got very good results regarding fast and excellent healing. According to him, he got very good corneal healing after application in eye suffering from chemical burn involving the cornea. He also observed minimal post burn scarring after sub-conjunctival injection of PRP.

According to Kazakos K et al (2008)[11] it is very effective in partial thickness burn wounds. No study was found on PRP application in Burn patients of higher % of body surface area involvement.

Many workers used it in deep wounds as Ganco et al[3] showed faster epithelization of chronic lower extremity ulcers where he found appropriate results. Knighton DR et al[12] also showed successful treatment of non-healing wounds after application of PRP.

In our study, the comparison clearly showed that the conventional dressing method takes twice longer time as in Group B the average healing time was 21 days to >40 days as compared to Group A where the average healing time was 9 days to maximum 18 days which definitely affects the duration of hospital stay.

The other advantage of PRP application in Group A as opposed to Group B is the decrease in pain, rapid control of infection and hence faster epithelization.

A broad majority of workers used PRP on small area of burn wounds so mostly they used autogenous PRP in their studies like Martinez Zapata[13] was in favor of autogenous PRP, but in our study we had to apply PRP on a larger % of body surface area so it was not possible to use autogenous PRP. Other factors also contributed to make it impossible such as the patients admitted in our hospital belong to very low socio-economic class and their health status is also very low at the time of admission and after admission, G.I. upset due to exposure to micro-organisms, heavy antibiotic therapy, systemic infection, intolerance to food intake, non-availability to food supplements leading to low caloric intake lead to a decreased hemoglobin making it impossible to use autogenous PRP.

The quantity of PRP required for single application for burn wound between 10-30% of body surface area needs 2 pints of blood for extraction of platelets. We have to consult blood bank and use donated blood therefore we cannot avoid chances of allergic reactions so this is a drawback of not using autogenous PRP. But its advantages over conventional dressing such as decrease in duration of healing time, decrease in pain, infection and hospital stay are more convincing for its use in partial thickness burn wounds.

CONCLUSION

According to our study results, Platelet-rich plasma application in non-healing deep partial and full thickness burn wound accelerate the wound healing as compared to conventional dressing therapy and is very effective in preparing healthy beds for grafting and provides 100% graft take. Now it is up to the Burns surgeon to select it for rapid results to save time and cost with availability of more beds in Burn Centre or to use the conventional dressing therapy according to the condition of the patient.

REFERENCES

1. Everts PA, Brown C, Hoffman JJ, Schonberger JP, Box HA, Van Zundert A, et al. Platelet-rich plasma and platelet gel: a review. J Extra Corpor Technol 2006;38(2):174-87.

2. Henderson JL, Cupp-CL-Ross EV, Shick PC, Keefe MA, Wester DC, et al. The effects of autologous platelet gel on wound healing. Ear Nose Throat J 2003; 82(8): 598-602.
3. Ganio C, Tenewitz FE, Wilson RC, Moyles BG. The treatment of chronic non healing wounds using autologous platelet-derived growth factors. J Foot Ankle Surg 1993; 32(3):263-8.
4. Sammartino G, Tia M, Marenzi G, Di Lauro AE, D'Agostino E, Claudio PP. Use of autologous Platelet Rich Plasma (PRP) in periodontal defect treatment after extraction of impacted mandibular third molars. J Oral Maxillofac Surg 2005; 63: 766-70.
5. Cervelli V, Gentile P, Grimaldi M. Regenerative surgery: use of fat grafting combined with platelet-rich plasma for chronic lower-extremity ulcers. Aesthetic Plast Surg 2009; ISBN/ISSN 1432-5241(Electronic): doi:10.1007/s00266-008-9302-z.
6. Eppley BL, Woodell JE, Higgins J. Platelet quantification and growth factor analysis from platelet-rich plasma: implications for wound healing. Plast Reconstr Surg 2004;114(6): 147e-59e.
7. Pierce G, Mustoe TA, Altrock BW, Deuel TF, Thomason A. Role of platelet-derived growth factor in wound healing. J Cell Biochem 1991;45: 319-26.
8. Eppley BL, Pietrzak WS, Blanton M. Platelet-rich plasma: a review of biology and applications in plastic surgery. Plast Reconstr Surg 2006; 118 (6):147e-59e.
9. Pietrzak WS, Eppley BL. Platelet rich plasma: biology and new technology. J Craniofac Surg 2005; 16(6):1043-54.
10. Marquez-de-Aracena R Montrero-de-espinosa I, Munoz M, Pereira G. Subconjunctival application of plasma platelet concentrate in the treatment of ocularburns. Preliminary results. Arch Soc Esp Oftalmol 2007; 82(8):475-81
11. Kazakos K, Lyras DN, Verettas D, Tilkeridis K, Tryfonidis M. the use of autologous PRP gel as an aid in the management of acute trauma wounds. Injury 2008; ISBN/ISSN 1879-0267 (Electronic); doi:10.1016/j.injury.2008.05.002.
12. Knighton DR, Ciresi KF, Fiegel VD, Austin LL, Butler ET. Classification and treatment with autologous platelet derived wound healing factors (PDWHF). Ann Surg 1986; 204(3):322-30
13. Martinez-Zapata MJ, Marti-Carvajal A, Sola I, Bolibar I, Angelo Exposito J, Rodriguez L, et al. Efficacy and safety of the use of autologous plasma rich in platelets for tissue regeneration: a systematic review. Transfusion 2009; 49(1):44-56.

Address for Corresponding Author:
Dr.Ehmer-Al Ibran,
Assistant Professor, Dept. of Burns,
Dow University of Health Sciences,
Civil Hospital, Karachi,
Mobile: 0333-2262820
Email: dr.ehmer@yahoo.com