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A PROSPECTIVE STUDY OF AUTOGENOUS PLATELET-RICH PLASMA (PRP) IN THE TREATMENT OF SECOND DEGREE DEEP BURNS

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ABSTRACT The relevance of Platelet Rich Plasma (PRP) to burn injury treatment was unclear. Different animal and clinical studies have proved the efficacy of platelet rich plasma to produce an intense inflammatory response leading to increase vascularity and fasten the healing rate via platelet derived growth factors. In other clinical study on deep dermal burn it has been proved that PRP promote graft takeup. Our study was aimed to determine the effect of PRP in second degree deep dermal burns. In our study of 15 patients, autologous platelet rich plasma treated second degree deep dermal burn areas got epithelialised faster and healed without hypertrophied scarring. It also reduced burn surface area to be skin grafted.

Platelet rich plasma should be considered in large scale studies in the treatment of deep dermal burns which may reduce operative treatments, hypertrophied scarring, infection, hospital stay and cost.

KEYWORDS :

INTRODUCTION

Platelet rich plasma is defined as a volume of the plasma fraction of autologous blood having a platelet concentration above baseline. Normal platelet concentration is 200,000 platelets/µl. Studies have shown that clinical efficacy of wound healing can be expected with a minimum increase of 4 times this base line (1 million platelets/µl).[1] It contains many growth factors, such as PDGF (Platelet-Derived Growth Factor),TGF-B (Transforming Growth Factor-B) & VEGF (Vascular Endothelial Growth Factor). It has been reported that a significant enhancement of bone & soft tissue healing takes place when PRP is used in cardiac surgery, bone, & in oral and maxillofacial surgery where it enhances the healing of the fresh sites.[2] Clinicians prepared & applied PRP to increase the early wound strength & regulate key cellular processes.[3]

PRP can be applied externally, added to implanted material (e.g. bone marrow) or injected directly into a lesion as a matrix for regeneration. As an immediate effect, PRP will provide more rapid haemostasis and tissue adhesion by forming a fibrin clot, similar to fibrin glue. As the amount of derived factors increase with the total number of platelets delivered to a site of injury, application of PRP increases the physiologic response to a trauma emulating and surpassing the "normal" deposition of growth factors and proteins. Advocates of PRP therapy therefore claim benefits that include increased tissue regeneration and a lower rate of infection, pain and blood loss.[4]

PRP has been reported to facilitate wound-healing in burns,[5] radio-therapy burns, cosmetic surgery,[6] plastic surgery,[7] dental surgery,[8-11] orthopaedic surgery and cardio-thoracic surgery.[12]

So far in different studies platelet rich plasma in the form of PRP-gel used in the treatment of ocular burn,[13] acute wound (including friction burn),[14] as fibrin sealant in split skin graft fixation,[15] in combination with adipose derived stem cells in leg ulcer and facial contour defect management has shown promising result.

The purpose of this study was to evaluate the effect of platelet rich plasma in the healing of second degree deep burn wound.

MATERIALS AND METHODS

Study design: Prospective study.

Study set-up: Department of General Surgery, Agartala Government Medical College and GB Hospital, Agartala, Tripura, India.

Study duration: August 2016 to July 2018 (2 Years).

Study population: Patients presenting with deep dermal burn at Agartala Government Medical College and GB Hospital, Agartala, Tripura, India.

INCLUSION CRITERIA: Patients 14 years and above presenting within 48 hours with 2nd degree deep dermal burn due to scald, flame or electric burn in multiple sites , who were willing to participate in the study.

EXCLUSION CRITERIA:

Patients with malignancy, systemic disease, compromised immune system, tobacco smoking

Study population: Patients presenting with 2nd degree deep dermal burn were considered.

Procedure & Data collection:

Measurement of the wound:-

Length and breadth were measured. Maximum 5% of the total surface was considered for study surface.

Saline dressing with topical antibiotic was done for both sides.

Platelet rich plasma (PRP) preparation:-

- 10ml venous blood aspirated with 10ml (21G needle) syringe, distributed in 1.5 ml of Anticoagulant Acid Citrate Dextrose (ACD) containing two vacutainer chambers .
- Sample was centrifuged at the rate of 3000 rpm for 10 minutes with phase separation of plasma above and red blood cell below.
- Plasma composed of platelet poor plasma (PPP) above and platelet rich plasma (PRP) below. By gentle aspiration with 23G spinal needle 40-50% of plasma from above which contains PPP was separated and discarded .
- Remaining plasma gently drawn and pumped back against the separation surface. It is done 2-3 times to mix as much platelet as possible from the surface. By gentle vortexing the plasma, high concentration of platelet was prepared for injection.

Injection of PRP: -The wounds were cleaned with normal saline. PRP was injected at six different sites of the wound, distributed in equal amount of volume. 4 intradermal injections at equal distance around the wound were given. Two subdermal injections were given at wound base at different sites .

Dressing with paraffin gauge was continued for both study and control sides.

Photographs as well as measurement of wound were recorded at admission, 2nd and 3rd week.

Tissue for histopathological examination to evaluate difference of epithelialisation was sent by incisional biopsy from both study and

control side by the end of second week. The results were compared and analyzed.

RESULTS AND OBSERVATION

15 patients were considered in the study period with second degree deep burn .

Length and breadth of wound in both case and control in centimetre scale on admission and by second week were compared. Maximum dimension (length) reduction divided into four groups <25%, 25-50%, 50-75%, 75-100%.

Among cases, 6 patients had reduction <25%, followed by 3 patients 25-50% , 5 patients 50-75%, 1 patient 75-100%.

Among control group, by end of 2nd week, 7 patients had reduction <25%, followed by 4 patients 25-50%, 3 patients 50-75%, 1 patient 75-100%.

By 3rd week, length and breadth of both case and control areas were measured. Maximum dimension (length in cm) compared for both the groups with the measurements of the day of admission.

Among case group, 11 patients had maximum reduction of wound size (75-100%), followed by 2 patients <25%, 2 patients 25-50%.

Among control group, 5 patients had 75-100% recovery followed by 5 patients 50-75%, 4 patients 25-50%, 1 patient <25%.

By the end of 2nd week, when we compared maximum dimension reduction between case and control groups, 6 PRP treated areas had healing > 50% whereas 4 control areas had >50% healing. On an average 43% of case area was in the stage of early healing in comparison to 29.5% of control area.

By the end of 3rd week, 11 of PRP treated areas were healed in comparison to 5 untreated areas.So 78% of case area healed in comparison to 65% of control area.

On histopathology by 2nd week , 11 of PRP treated areas had epithelialisation in comparison to 4 control areas.

Percentage of maximum dimension reduction by 2nd week

% of maximum dimension reduction by 2nd week	Case	Control
<25	6	7
25-50	3	4
50-75	5	3
75-100	1	1

Percentage of maximum dimension reduction by 3rd week

% of maximum dimension reduction	case	Control
<25	2	1
25-50	2	4
50-75	0	5
75-100	11	5

Epithelialisation completed by 2nd week

Case	control	Total
11/15	4/15	15/30

DISCUSSION

In this prospective study of autogenous platelet-rich plasma (PRP) in the treatment of 15 second degree deep burns who were admitted in the Burn ward of Department of General Surgery, GB Hospital, Agartala, between August 2016 and July 2018, maximum dimension reduction of 50-75% occurred in 5 cases followed by 3 patients 25-50%, and only one case got fully epithelialised by 2nd week.

By 2nd week in an average 43% among case group and 29.5% among control group got healed completely; which is comparable to that results shown by Hao et al as 75% and 62% respectively.

By 3rd week in an average 78% among case group and 65% among control group got healed completely in comparison to the study done by Hao et al where it was 88% and 73% respectively. P value by paired T-test was (0.000), which was statistically significant.

Among case group 11 out of 15 (73%) healed by 18 +/- 2 days, where as among control group 5 out of 15 (33%) healed by 18+/-2 days.

By 3rd week 11 out of 15 case groups healed completely, where as only 5 out of 15 of control group healed completely.

By 2nd week histopathology done by taking biopsy from both case and control area for epithelialisation. Among 15 cases 11 responded by epithelialisation with dense fibroblasitc proliferation (73%) and among 15 control area 4 only got epithelialised (4/5=26%).

2nd degree deep dermal burns due to flame or contact are unlikely to heal within 3 weeks period and early excision and grafting is done to avoid hypertrophied scarring related to delayed healing. Platelet Rich Plasma may be used in these cases.

Hao T et al (2010) shown in their study of platelet rich plasma gel following tangential excision of second degree deep burn to produce faster healing in comparison to control area . Our study gives faster healing in the PRP injected area too, with less chances of developing hypertrophied scar.

Although we did not quantify the increased production of collagen tissue and neovascularisation among case and control group in histopathological examination, it can be included in future study to produce better out comes.

Amount of blood drawn was 10 ml from which around 3 ml of PRP could be obtained. As a result in small burn surface area 0.5 ml of PRP could be given to each site. If more blood is collected to produce more amount of PRP, it can cover larger area and would give us better results .

CONCLUSION

This study was conducted in the Department of General Surgery, Agartala Government Medical College and GB Hospital, Agartala for a period of 2 years (August 2016 to July-2018) in 15 patients admitted with second degree deep burn to determine the effect of platelet rich plasma injection produced from their own blood.

43% of PRP injected burn area got healed in comparison to 29.5% of control group area by 2nd week. 78% of PRP injected area got healed by 3rd week in comparison to 65% of control group. That shows significant difference (p value 0.000)

Among case group 11 out of 15 (73%) healed by 18 +/- 2 days, where as among control group 5 out of 15 (33%) healed by 18+/-2 days.

After PRP injection 73% areas got epithelialised in comparison to 26% of non injected areas at the end of 3rd week.

Hence, in our study autologous platelet rich plasma helped the second degree deep dermal burn areas to get faster epithelialisation and healed without hypertrophied scarring. It also reduced burn surface area to be skin grafted.

Our study gathered a small group of burn victims after consideration of inclusion and exclusion criteria. We need larger group of patients to conduct this clinical trial to give more conclusive reports regarding this unexplored aspect of burn care.

In future trial we need to provide more amount of PRP for larger burn area. Counts of platelet in PRP should be included to find how many folds of concentration have been achieved.

During histopathological assessment of PRP injected tissue quantification of fibroblast, collagen, and neo-vascularisation as well as immune-histochemical study should be included.

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