Evaluation of autologous and homologous platelet rich plasma as a surgical wound healing promoter in rabbits

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ABSTRACT
The present study compared the efficacy of autologous and homologous platelet rich plasma (PRP) as a surgical wound healing promoter in rabbits. Sixteen adult healthy rabbits were divided into two groups i.e. A & B. Group A was treated with autologous platelet rich plasma (APRP) and group B was treated with homologous platelet rich plasma (HPRP). Both groups were operated for skin grafting (auto grafting) at two (PRP treated experimental and control) sites. Clinical evaluation of PRP was performed by using macroscopic (edema, exudation, coloration, temperature, cosmetic appearance and healing status) and microscopic (acute inflammation, fibroblast proliferation and granulation tissue proliferation) parameters. The healing status, coloration and cosmetic appearance of APRP treated group were more satisfactory than HPRP treated group. APRP group also showed less inflammation, edema and more granular tissue proliferation as compared to HPRP group. It was concluded that autologous PRP is an efficient surgical wound healing promoter in rabbits.

Key words: Platelet rich plasma, Rabbit, Skin grafting, Wound healing.

INTRODUCTION
Skin graft healing is a complex process that involves inflammation, tissue proliferation, granulation, epithelialization and remodeling of the wound site. During the last few years, a lot of work has been done in the realm of wound healing. In this context, the latest advancement is the use of platelet rich plasma (PRP) and this technique has gained momentum as a bed-side procedure of regenerative surgery. Platelet rich plasma (PRP) is a rich concentration of platelets in small volume of plasma that promotes healing of soft tissues in a variety of surgical procedures (Lee, 2016). It acts as cell adhesion molecules for osteogenesis induction, bone matrix, connective tissue and epithelial migration. Different studies have been conducted earlier to test the efficacy of a wide array of injectable agents as healing promoter but the PRP injection has been proved as the most appropriate healing promoter for different musculoskeletal conditions (Del et al. 2012).

Despite frequent use of PRP related healing a limited data is available about the efficacy of PRP in skin grafting. Moreover, there is a dire need to compare the efficacy of autologous and homologous PRP that has not been reported yet.

The present study was designed to evaluate the efficacy of platelet rich plasma as a surgical wound healing promoter.

MATERIALS AND METHODS
Sixteen adult healthy rabbits were equally divided into two groups A and B. Both groups were caged separately at Pet Centre, University of Veterinary and Animal Sciences, Lahore, Pakistan.

All the rabbits in groups A and B were operated for skin grafting (auto grafting) at 2 different levels on the body. One site was designated as experimental site (right flank region) and the other site (left flank region) was designated as the control site. Left and right lateral scapular area were decided as full thickness graft donor sites. The experimental site was treated with autologous PRP in group A and homologous PRP in group B. The control site was not treated with PRP.

Autologous and homologous PRP preparation was performed through double centrifugation of coagulated whole blood as a standard technique (Akhundov et al. 2012) and it was either readily used or stored at 2-4°C for 48 hours. Rabbits were anaesthetized intramuscularly using ketamine-xylazine cocktail as 5% ketamine @ 35mg/kg IM + 2% xylazine @5-10mg/kg IM for 35-90 minutes surgical anesthesia.

After pre-surgical preparations a 2×2 inches full thickness skin graft was harvested from the flank region in each rabbit. Another 1.5×1.5 inches full thickness skin flap was harvested from the lateral scapular region to create a defect. Skin graft was sized and treated to cosmetic...
Table 1: Macroscopic and microscopic parameters for evaluation of APRP and HPRP

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<thead>
<tr>
<th>Macroscopic evaluation</th>
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<tr>
<td>Edema</td>
<td>Acute inflammation</td>
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<td>Exudation</td>
<td>Fibroblast proliferation</td>
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<td>Coloration Temperature</td>
<td>Granulation tissue proliferation</td>
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<td>Healing status</td>
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<td>Cosmetic appearance</td>
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appearance. Before graft application on defect, subcutaneous tissue was removed by scalpel and superficial incisions were given on the inner side of the graft to create the mesh/perforations to minimize the accumulation of hematoma or seroma beneath the graft. Full thickness skin grafts were used in the study.

Half of the collected PRP was injected subcutaneously in the graft and the remaining half was injected subcutaneously in the surrounding tissue of graft. Finally treated auto graft was sutured with simple interrupted sutures on defect using 2-0 Prolene™. The operated sites were covered with polyfax skin ointment followed by appropriate ipost operative management of the area. All the rabbits were treated with cephalixin antibiotic at the dosage 10-15 mg/kg, subcutaneously every 12 hours for 10 days. Clinical evaluation of autologous and homologous PRP was done on the basis of parameters mentioned in Table 1.

A small fragment of both control and experimental grafts were harvested from each rabbit on days 3, 7 and 14 after surgery. Slides of the graft fragments were prepared and stained with haematoxylin and eosin staining for histopathological examination. The results, obtained in form of grades, were statistically analyzed by graphical representations.

RESULTS AND DISCUSSION

The results indicated that both APRP and HPRP were effective in comparison to untreated control as all rabbits developed edema on day 5 which increased in severity by day 14 at control (untreated) site, while at treated site edema was subsided on day 8. Exudate disappeared from APRP and HPRP treated rabbits till day 14 and at untreated site developed sanguineous, serosanguineous and seropurulent exudate throughout the study. Treated site in both groups showed marked redness through day 1 to 14 whereas colour variation was observed at untreated site due to infection. A complete healing was observed at treated site till day 14 in all rabbits. Four rabbits showed excellent cosmetic appearance and remaining four had satisfactory appearance.

While comparing APRP and HPRP treated groups the healing status, colouration and cosmetic appearance of APRP group (Group A) were more satisfactory than HPRP group (Group B). Temperature of grafts being treated with APRP was lesser than HPRP group. Similarly edema and exudates were less in APRP group than HPRP group. Rather HPRP group had some sanguineous discharges as compare to APRP group. At third day of drafting there was recruitment of neutrophils beneath epidermis that developed acute inflammation. This inflammation was more pronounced in HPRP group as compare to APRP group. However, this inflammation was subsided in both groups by day 7. Autologous treated grafts showed remarked changes being important for the healing of grafts such as epidermis was thicker and fibrous connective tissue proliferation was more pronounced as compare to HPRP group on histopathological examination.

Both autologous and homologous PRP gave better healing than untreated control site that indicated the useful effect of PRP as a surgical wound healing promotor in skin grafting. This is in accordance with the studies of Kakudo et al. (2012) who showed successful wound healing with PRP in human patients with ulcers. However, these findings are in contrast to the findings of Hermeto et al. (2012) who found better results by fibrin glue as compared to PRP in dog’s skin grafts.
Autologous PRP treated skin grafts presented minimum inflammation, less exudates, better cosmetic appearance and better coloration as compared to homologous PRP treated groups. This may be due to the differential growth factors in both types of PRP that aid in healing. Moreover, the subsiding of inflammation is due to reduction of cytokine that may be more in case of APRP as compared to HPRP. The quick disappearance of erythema and edema by using autologous PRP may be due to faster rate of re-epithelialization and reduction in post-operative edema (Bhanot and Alex, 2002).

Accelerated granular proliferation was observed in autologous PRP treated group as compared to homologous treated group. These results are in agreement with the studies of Bottegoni et al. (2016) who described the better effect of APRP as compared to HPRP in humans infected with osteoarthritis but they also described short time clinical by APRP may be due to its multiple growth factors that may be missing in HPRP. Moreover, as APRP contains antibodies from the same host this may be another factor in attracting immune cells at injury site and fasting the healing process.

As this study first time evaluated the comparative healing with burn injuries.

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CONFLICT OF INTEREST
This study confers no conflict of interest.

REFERENCES


