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Platelet Rich Plasma (PRP) Therapy in Pediatric Surgical Wound Care My Experience in a Tertiary Care Hospital in Bangladesh

Dr. S.M. Khalid Mahmud[1*], Dr. Jahanara Laizu[2], Prof. Dr. Aminur Rashid[3], Dr. Aminul Islam[4], Dr. S. M. Mahmud[5]

[1]Associate Professor, Department of Pediatrics Surgery, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh
[2]Associate Professor, Department of Pharmacology, Uttara Adhunik Medical College, Dhaka, Bangladesh
[3]Professor and Head, Department of Pediatric Surgery, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh
[4]MS Student, Department of Pediatric Surgery, Bangladesh Shishu Hospital & Institute, Dhaka Bangladesh
[5]Registrar, Department of Pediatric Surgery, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh

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***Corresponding author:** Dr. S.M. Khalid Mahmud
Associate Professor, Department of Pediatrics Surgery, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh

Abstract **Original Research Article**

Background: In recent years, platelet-rich plasma (PRP) has been used in complicated pediatric surgical wound care; burn wound repair, plastic surgery, bone and tendon ligament injury repair and other treatment. Clinical studies indicate that, PRP has a good curative effect on wound care. But in Bangladesh, we have very limited research- based information regarding the outcome of platelet rich plasma (PRP) therapy in complicated pediatric surgical wound care. ***Aim of the Study*:** The aim of this study was to evaluate the outcome of platelet rich plasma (PRP) therapy in complicated pediatric surgical wound care. ***Methods:*** This prospective observational study was conducted in Bangladesh Shishu Hospital & Institute Dhaka, Bangladesh during the period from January 2021 to June 2022. In total 34 pediatric patients with complicated surgical wound were recruited as the study population. In all cases, the treatment procedure was carried out using autologous donations. Collected data were processed, analyzed and disseminated by using MS Excel and SPSS version 23.0 program as per necessity. ***Results:*** In this observational study, in analyzing the final outcomes we observed that, among total 34 complicated pediatric patients with surgical wound, in more than one third of the cases (68%) wounds were healed whereas in the rest 32% cases wound were not healed. The mean ±SD hospital staying period was found as 6.45±2.16 days whereas the mean ±SD healing time was found as 11.47±3.29 weeks. ***Conclusion:*** As per the findings of this study we can conclude that, platelet-rich plasma (PRP) has a good curative effect on complicated pediatric surgical wound care. This study can provide reliable evidence for the clinical use of PRP in the clinical cure/repair of several wound.

Keywords: Platelet Rich Plasma, PRP, Complicated, Pediatric, Surgical wound care.

INTRODUCTION

Platelet-rich plasma is well-defined as a slice of the plasma fraction of autologous blood taking a platelet concentration beyond baseline [1, 2]. Platelet-rich plasma (PRP) also has been referred to as platelet-enriched plasma, platelet-rich concentrate, autologous platelet gel, and platelet releasate [1]. Platelet releasates have been used to treat wounds since 1985 [3]. Platelet-rich plasma (PRP) serves as a growth factor agonist [4] and has both mitogenic and chemo-tactic properties [5, 6]. In accumulation to use in the treatment of chronic skin and soft tissue ulcerations [7, 8], publications regarding the use of platelet-rich plasma (PRP) include periodontal and oral surgery [9, 10] as well as maxillofacial surgery [11]. In many studies, it was reported that, platelet-rich plasma functions as a tissue sealant and drug provision system [12], with the platelets initiating wound repair by releasing locally acting growth factors [13] via α- granules degranulation [14]. Platelet-rich plasma (PRP) is easy to yield with minimal effort [15] and can be prepared as needed at the point of care [16]. In a two-step procedure, whole blood from the patient is first centrifuged to separate the plasma from packed red blood cells and then further centrifuged to separate PRP from platelet-poor plasma [17]. This focus is then activated with the addition of thrombin or calcium, causing in a gelatinous platelet gel [16, 18]. Clinically valuable Platelet-rich plasma contains at least one million platelets per microliter [16]. Not all presently marketed PRP devices are equivalent for not all concentrate viable platelets in

satisfactory numbers to enhance healing, with these differences accounting for many of the criticisms regarding the efficacy of platelet-rich plasma [19]. Although previous platelet-rich plasma studies have used a wide range of devices for the preparation of platelet-rich plasma [20], not all have been approved for use in humans.

METHODOLOGY

This was a prospective observational study which was conducted in in Bangladesh Shishu Hospital & Institute Dhaka, Bangladesh during the period from January 2021 to June 2022. In total 34 pediatric patients with complicated surgical wound were recruited as the study subjects. Proper written consents were taken from all the participants before data collection. In all cases, the treatment procedure was carried out using autologous donations. The whole intervention was conducted in accordance with the principles of human research specified in the Helsinki Declaration [21] and executed in compliance with currently applicable regulations and the provisions of the General Data Protection Regulation (GDPR) [22]. As per the inclusion criteria of this study, only paediatric patients with patients with complicated surgical wound were included. On the other hand, according to the exclusion criteria of this study, patients with a poor nutritional status, advanced age, over 15 years old; or inability to perform their own wound care or have it performed by a caregiver every day for an extended period until the wound healed were excluded. Donor whole blood was fractionated by centrifugation using the Spectra Optia Apheresis System (Terumo BCT, Lakewood, CO, USA). Blood was collected from large vein and transferred through a sterile device to a centrifuge spinning at 2400–2800 rpm depending on the hematocrit value, platelet count and target performance for the procedure. The blood cell separator identifies the different components, based on their weight and density. The procedure takes around 90 min and donors must meet the eligibility requirements for apheresis donation: a bodyweight > 50 kg, good general health with no abnormal lab results, age > 18 and <65 years, good venous access and no history of blood borne illnesses or abnormal bleeding. Once the al-PRP was thawed, it was placed directly on the wound, left uncovered for half an hour. Subsequently, the wound and product were covered with a sterile gauze until the following day. All the demographic and clinical data of the participants were recorded. A predesigned questioner was used in data collection. All data were processed, analyzed and disseminated by using MS Excel and SPSS version 23.0 program as per necessity.

RESULTS

In this study, among total 34 participants, 59% were male whereas the rest 41% were female. So male participants were dominating in number and the male-female ratio was 1.4:1. The mean ±SD age of the participants was 3.18±1.34 years. In blood group analysis, we observed that, majority (53%) of our patients were with blood group 'O'. Besides these cases, with group 'A' and 'B' were found as 32% and 15% respectively. Rh positive cases were 79% whereas negative were 21%. The mean ±SD haemoglobin level (g/dL) of our participants was 13.66±1.26 where normal status was found among 76% cases. The mean ±SD white blood cell count ($1x10^3$ µL) of our participants was 8.93±3.88 where normal count was found among 62% cases. The mean ±SD platelet count ($1x10^3$ µL) of our participants was 256.74±189.37 where normal count was found among 56% cases. The mean ±SD Lymphocyte count ($1x10^3$ µL) of our participants was 1.73±0.62 where normal count was found among 71% cases. In this study, the mean ±SD cholesterol level (mg/dL) of our participants was 157.46±41.52 where normal status was found among 56% cases. The mean ±SD Albumin level (g/dL) of our participants was 4.18±0.83 where normal status was found among 91% cases. In this observational study, in analyzing the final outcomes we observed that, among total 34 complicated pediatric patients with surgical wound, in more than one third of the cases (68%) wounds were healed whereas in the rest 32% cases wound were not healed. The mean ±SD hospital staying period was found as 6.45±2.16 days whereas the mean ±SD healing time was found as 11.47±3.29 weeks.

Table 1: Demographic status of participants (N=34)

Variable	**n (%)/Mean ±SD**	
Gender distribution		
Male	20	59%
Female	14	41%
Age (Year)	3.18±1.34	

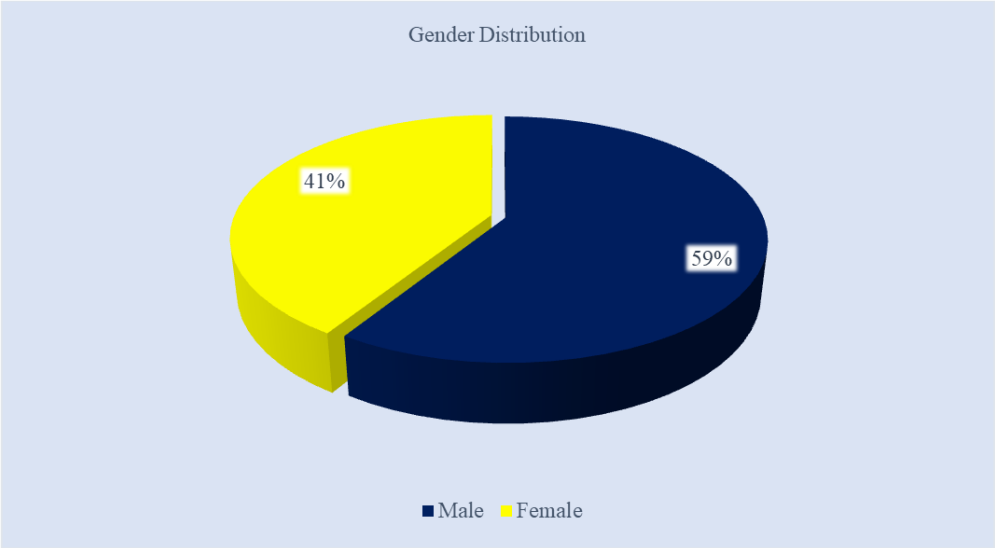


Figure I: Pie chart showed gender wise participants (N=34)

Table 2: Baseline blood test results among participants (N=34)

Variables	**n (%)/Mean ±SD**	
Blood group		
O	18	53%
A	11	32%
B	5	15%
Rh		
Positive	27	79%
Negative	7	21%
Haemoglobin level (g/dL)		
Mean ±SD	13.66±1.26	
Normal	26	76%
Elevated	3	9%
Reduced	5	15%
White blood cell count ($1x10^3$ µL)		
Mean ±SD	8.93±3.88	
Normal	21	62%
Elevated	13	38%
Platelet count ($1×10^3$ µL)		
Mean ±SD	256.74±189.37	
Normal	19	56%
Elevated	5	15%
Reduced	10	29%
Lymphocyte count ($1×10^3$ µL)		
Mean ±SD	1.73±0.62	
Normal	24	71%
Lymphopaenia	10	29%
Cholesterol level (mg/dL)		
Mean ±SD	157.46±41.52	
Normal	19	56%
Elevated	9	26%
Reduced	6	18%
Albumin level (g/dL)		
Mean ±SD	4.18±0.83	
Normal	31	91%
Reduced	3	9%

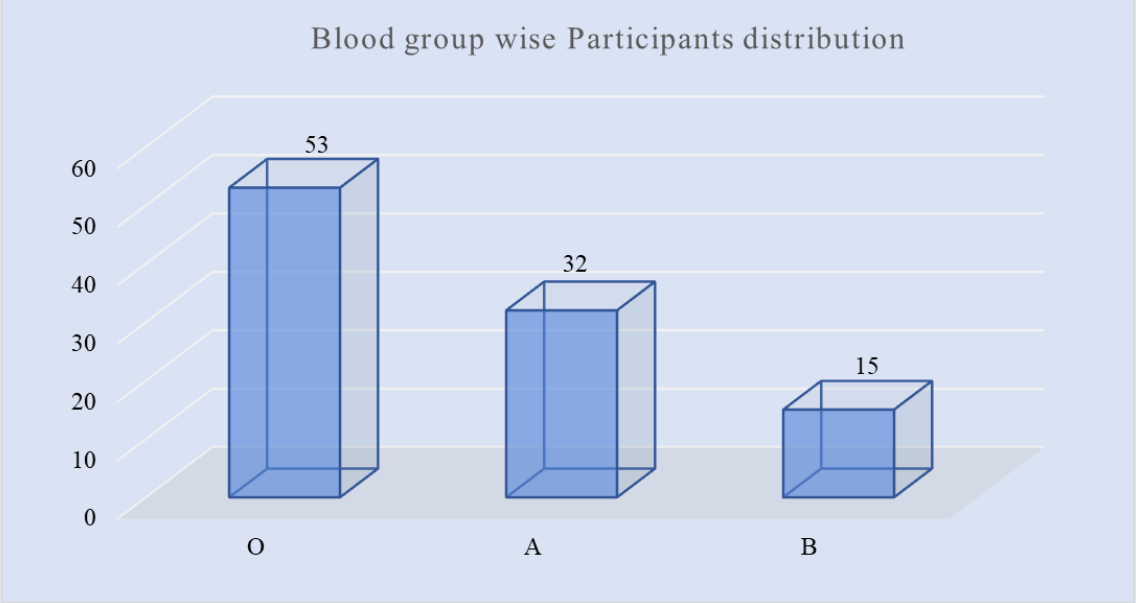


Figure II: Bar chart showed blood group wise participants blood test results (N=34)

Table 3: Outcomes among participants (N=34)

Characteristics	**n (%)/Mean ±SD**	
Healed	23	68%
Not healed	11	32%
Hospital staying (Day)	6.45±2.16	
Healing time (Week)	11.47±3.29	

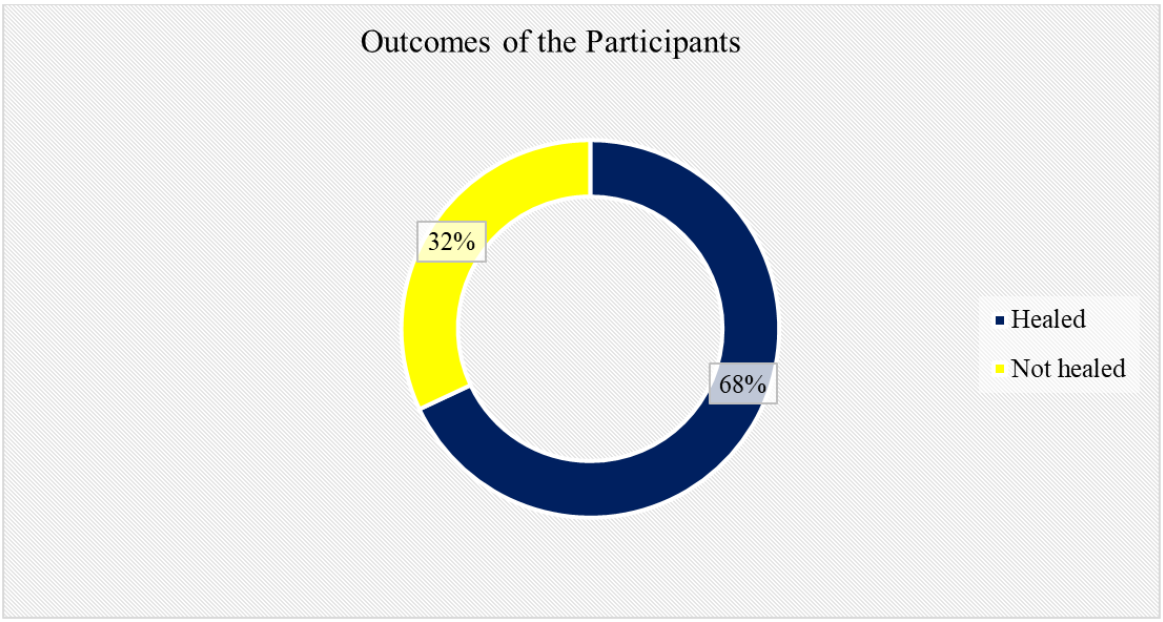
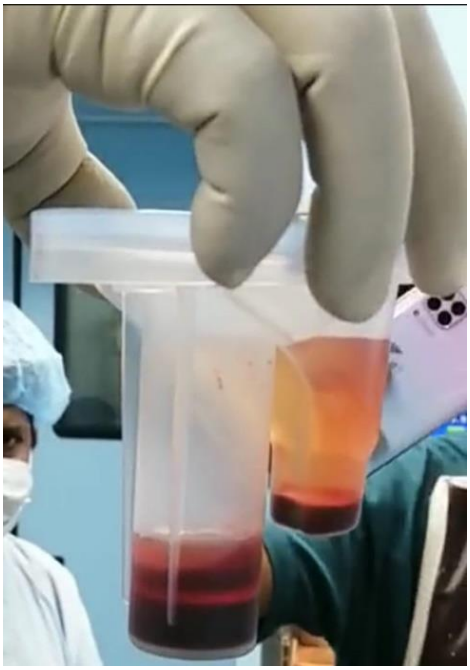


Figure III: Ring chart showed outcomes among participants (N=34)



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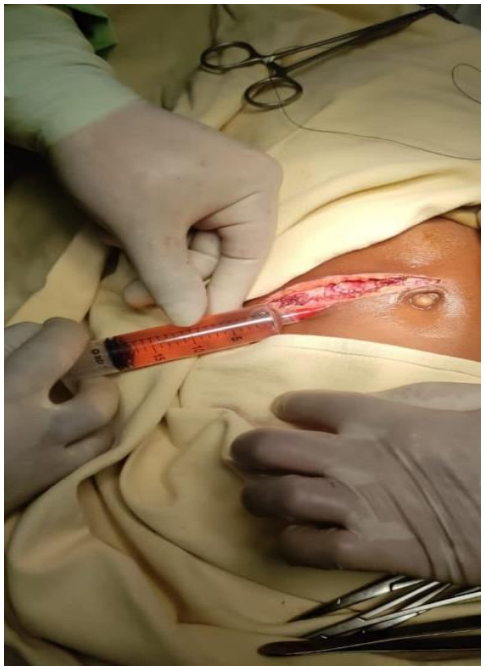

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Picture 1 & 2: PRP Surgical Procedures

3

4

Picture 3 & 4: PRP Surgical Procedures

DISCUSSION

The aim of this study was to evaluate the outcome of platelet rich plasma (PRP) therapy in complicated pediatric surgical wound care. In this study, among total 34 participants, 59% were male whereas the rest 41% were female. So male participants were dominating in number and the male-female ratio was 1.4:1. The mean ±SD age of the participants was 3.18±1.34 years. In blood group analysis, we observed that, majority (53%) of our patients were with blood group 'O'. Besides these cases, with group 'A' and 'B' were found as 32% and 15% respectively. Rh positive cases were 79% whereas negative were 21%. By promoting safe and natural healing, platelet rich plasma is a promising alternative to the current standard of care for hard-to-heal wounds such as those patients, many having a history of DM and/or treatment with

hydroxyurea and all a poor response to other treatments [23]. It is obtained from density gradient centrifugation of peripheral venous blood and contains a wide variety of growth factors, fibroblasts, mesenchymal stem cells, and white blood cells [24]. Some studies have confirmed that, PRP can promote wound healing, inhibit the growth of various bacterial species, improve angiogenesis and reduce postoperative pain [25, 26]. In this observational study, in analyzing the final outcomes we observed that, among total 34 complicated pediatric patients with surgical wound, in more than one third of the cases (68%) wounds were healed whereas in the rest 32% cases wound were not healed. The mean ±SD hospital staying period was found as 6.45±2.16 days whereas the mean ±SD healing time was found as 11.47±3.29 weeks. There is growing evidence that, platelet rich plasma (PRP) improves the healing of chronic wounds and the use of this product is increasing in the field of wound repair [27]. In a study, it was reported that, the rate of proliferation of granulation tissue was significantly faster in al-PRP-treated patients than in controls during the first 2 weeks of treatment, suggesting that, al-PRP can stimulate granulation tissue proliferation in the early stages of healing [28]. Recently, significantly faster healing has been found with either al- or au-PRP, wounds healing in a mean of <60 days versus >85 days with conventional wound care [29]. Some systematic reviews as well as meta-analyses have found that au-PRP therapy improves the rate of complete and partial healing of hard-to-heal wounds compared to standard wound care [30, 31].

Limitation of the Study

Though it was a single centered study with small sample size, was conducted in a very short period of time the findings of this study may not reflect the exact scenario of the whole country.

CONCLUSION & RECOMMENDATION

As per the findings of this study we can conclude that, platelet-rich plasma (PRP) has a good curative effect on complicated pediatric surgical wound care. This study can provide reliable evidence for the clinical use of PRP in the clinical cure/repair of several wound. We recommend for wider use of platelet-rich plasma (PRP) in several wound care.

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