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## ORIGINAL ARTICLE

# Effect of Platelet-rich Plasma in Wound Healing on Women Undergoing Recurrent Cesarean Section

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## Abstract

**Background:** 15% of deliveries globally are by caesarean delivery, one of the most frequently performed major surgical procedures, and its use is on the rise. It significantly contributes to postoperative problems at the surgical site like infection, hematoma, and dehiscence. Hemostasis, inflammation, proliferation, epithelialization, fibroplasia, and maturation are only a few of the physiological processes that are involved in the repair of tissue damage. A human plasma product known as platelet-rich plasma (PRP) has excellent hemostatic and healing characteristics because it is filled with platelets, growth factors, and fibrinogen.

**Aim of the work:** This study's objective was to assess how autologous PRP affected the healing of wounds in women having caesarean sections.

**Patients and methods:** According to the inclusion criteria, 200 pregnant females undergoing caesarean sections were chosen at random. The patients were split into two groups:

**Study group:** 100 patients underwent elective Cesarean Section received autologous Platelet-Rich Plasma (PRP) as intervention, only once during surgery on wound area.

**Control group:** 100 patients underwent for elective Cesarean Section who didn't receive autologous Platelet-Rich Plasma (PRP).

On days 1, 7, and 21 following surgery, all patients had wound problems and healing status was assessed using the REEDA score.

**Results:** Redness, edoema, ecchymosis discharge, and approximation (REEDA) Score was lower in the PRP group than in the control group at the study's conclusion.

**Conclusion:** Given that there are more platelets and growth factors present, using PRP appears to be an efficient therapeutic method for wound healing.

**Keywords:** Caesarean section, Platelet-rich plasma, REEDA score, Wound healing outcomes

## 1. Introduction

15% of births worldwide are caesarean sections, and this number has been rising.<sup>1</sup> Caesarean sections are vital operations that save both mother and child's lives, and their use has increased significantly over the past ten years.<sup>1</sup>

According to the most recent 2014 Egypt demographic and health survey (EDHS), CS rates in Egypt have consistently risen, reaching 52%, which represents a more than 100% increase since 2005

and is in line with global trends.<sup>2</sup> C-section births surged to 72% in 2021 compared to 52% in 2014, based on data on family health in Egypt that the Central Organization for Public Mobilization and Statistics (CAPMAS) made available in late August. PRP, a blood component with a high concentration of these cells, significantly boosts the healing abilities and adhesiveness of wounds. Substances that aid tissue healing are produced after PRP treatment. A higher platelet concentration at the location of the wound promotes faster healing and guards against

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infection. Due to endogenous platelet functions that promote wound healing and tissue regeneration by releasing various growth factors, while also boosting local immunity to combat infection and enabling improved scar formation that heals with the primary goal of improving the wound's cosmetic look., PRP, a relatively new intervention that was first used in surgical procedures in 1980, has been tested in a variety of gynaecological and obstetric procedures.<sup>3</sup>

## 2. Patients and methods

This clinical trial was randomised, without the use of a placebo or process blinding. This study involved 200 elective caesarean section patients who volunteered to take part and were found in the labour unit of the Al-Hussein hospital. This study includes all pregnant women who are candidates for elective caesarean delivery who have haemoglobin levels over 12 but neither diabetes nor gestational diabetes.

All procedures were conducted in accordance with guiding principles for care of patients and were approved by Al-Azhar University Ethics Board.

Patients were divided into 2 group:

Study group: 100 patients underwent elective Cesarean Section received autologous Platelet-Rich Plasma (PRP) as intervention, only once during surgery on wound area.

Control group: 100 patients underwent for elective Cesarean Section who didn't receive autologous Platelet-Rich Plasma (PRP).

### 2.1. Inclusion criteria

Al-Hussein Hospital is recommended for all elective surgery candidates who are women.

### 2.2. Exclusion criteria

Positive diabetic history Diabetes during this pregnancy due to gestation, twin pregnancies, prior pregnancies with gestational diabetes, Under-12 haemoglobin, over-25 BMI, and smokers.

### 2.3. Operational design

All patients were subjected to:

An informed consent was taken from every patient, complete history taking: Personal history, any complaint, Obstetric history, menstrual history, past medical and past surgical history and Family history.

Complete physical examination, General examination: Vital signs (Blood pressure, Temperature, Heart rate, Respiratory rate).

#### 2.3.1. PRP preparation

Before the start of each procedure, PRP was prepared in the study group's operating room. To protect sterilisation, all of the procedures were carried out in an operating room.

- (1) The patient's arm was used to extract venous blood (55–60 cc) into a 60 ml sterile syringe that contained citrate as an anticoagulant.
- (2) To avoid platelet activation during blood centrifugation, the suggested processing temperature is between 21 and 24° Celsius.
- (3) In order to separate the blood into its three layers—platelets and white blood cells make up the upper layer, the buffy coat, a thin layer rich in white blood cells, makes up the middle layer, and red blood cells make up the lowest layer—it was immediately centrifuged for 15 min at 3200 rpm.

To encourage the development of soft pellets (platelets and erythrocytes) at the tube's bottom, the plasma was centrifuged once more for 15 min at 3200 rpm. PRP was buffered by using sodium bicarbonate.

### 2.4. Statistical analysis

Using SPSS 22.0 for Windows, all data were gathered, tabulated, and statistically examined (SPSS Inc., Chicago, IL, USA). Using the Shapiro Walk test, the distribution of the data was examined for normality. Frequencies and relative percentages were used to depict qualitative data. The difference between the qualitative variables was calculated using the chi square test<sup>2</sup> and Fisher exact, as shown. For parametric and non-parametric data, respectively, the mean and SD (standard deviation) were used to express quantitative data.

For parametric and non-parametric variables, respectively, the Independent T test and the Mann-Whitney test were employed to compare quantitative variables in two groups. Normal and non-parametric variables were correlated using the Pearson's correlation coefficient and the Spearman's correlation coefficient, respectively. In addition, we characterise strong correlation as values around 1, and weak correlation as values near 0. The frequency of the independent variable was assumed to increase as the frequency of the dependent variable decreased, with the (+) sign thought to denote a

direct association, and the (–) sign indicated an inverse connection. To enable the comparison of multiple testing methodologies and the selection of threshold values for test findings, the receiver operating characteristic (ROC) curve was developed. The Cantor technique was used to calculate the areas under ROC curves and their standard errors, compare them using the normal distribution, and account for correlation of observations collected from the same cases. According to the area under a ROC curve (AUC) value, outstanding is defined as 0.90 to 1; good as 0.80–0.90; fair as 0.70–0.80; poor as 0.60–0.70; and failing as 0.50–0.6. The optimal cutoff point was the highest accuracy point. The two-tailed significance test was performed for each statistical comparison.  $P > 0.05$  denotes no difference, level of  $P$  value 0.05 denotes a significant difference, and  $P$  0.001 denotes a highly significant difference.

### 3. Results

This table shows that there is no significant difference between the groups regarding Age, BMI, and residence (Table 1).

This table shows that there is no significant difference between the groups in term of miscarriage parity and gravidity (Table 2).

This table shows that there is no significant difference between the groups regarding socioeconomic level (Table 3).

This table shows that there is no significant difference between the two studied groups regarding routine laboratory parameters (Table 4).

### 4. Discussion

It has been demonstrated that platelet-rich plasma (PRP), a plasma active component that is high in platelets and growth factors, is beneficial for promoting wound healing of surgical scars and enhancing the effectiveness of scar repair.<sup>4</sup>

The main goal of this study was to evaluate platelet-rich plasma's efficiency in promoting wound healing in women who underwent elective

Table 2. Clinical characteristics distribution among the studied groups.

	PRP (n = 100)	Non-PRP (n = 100)	z	P
Parity	3.22 ± 1.59	3.48 ± 1.68	1.243	0.267
Mean ± SD				
Gravida	4.76 ± 1.94	5.2 ± 2.13	1.72	0.134
Mean ± SD				

caesarean sections. This clinical trial study was conducted in accordance with guiding principles for care of patients and were approved by Al-Azhar University Ethics Board. Selection of Subjects two hundred elective cesarean section were recruited from Labor ward in Al hussin hospital who agreed to participate in our study. They were divided into two groups; PRP group (n = 100) and non-PRP group (n = 100). The duration of the study ranged from 6 to 12 months.

#### 4.1. The main results of this study were as following

Regarding demographic information, there are no notable differences between the groups in terms of age, BMI, or place of residence. Our findings were consistent with the findings of study,<sup>5</sup> which stated that a total of 52 women were evaluated for eligibility and that 40 of them were enrolled in the study (20 women in each group; PRP & control groups).

The study's participants had an average age of 27.79 ± 6.8 years. Age, weight, height, and BMI did not significantly differ between the two groups at the beginning of the study.

Similar details regarding the 194 participants who enrolled in the trial were given in Ref. <sup>6</sup>.

The 138 eligible patients were split into two groups: 67 were given the PRP therapy group, and 71 were given the control group. At first, there were no noticeable changes in the patient characteristics across the groups because they were evenly matched. According to the results of the current study, there are no appreciable differences between the groups in terms of miscarriage parity and gravidity. According to their findings,<sup>7</sup> which agree with our own, 140 patients in all were involved in the trial, with 70 being assigned to the treatment group and 70 to the control group. There was no

Table 1. Demographic characteristics among the studied groups.

	PRP (n = 100)	Non-PRP (n = 100)	t	P
Age (years)	31.69 ± 3.25	32.11 ± 3.84	0.835	0.406
Mean ± SD				
BMI (kg/m <sup>2</sup> )	24.31 ± 1.28	24.25 ± 1.54	0.300	0.765
Mean ± SD				
Residence				
Rural	47 (47%)	44 (44%)	0.182	0.671
Urban	53 (53%)	56 (56%)		

Table 3. Socioeconomic level among the studied groups.

	PRP (n = 100)	Non-PRP (n = 100)	t	P
Low	26 (26%)	28 (28%)	0.954	0.621
Moderate	69 (69%)	64 (64%)		
High	5 (5%)	8 (8%)		

Table 4. Laboratory parameters between the two studied groups.

	PRP (n = 100)	Non-PRP (n = 100)	t	P
Hb (g/dl) Mean $\pm$ SD	11.19 $\pm$ 2.11	10.42 $\pm$ 2.53	1.57	0.119
TLC ( $\times 10^3$ /l) Mean $\pm$ SD	8.15 $\pm$ 2.32	8.23 $\pm$ 2.35	0.157	0.875
PLT ( $\times 10^3$ /l) Mean $\pm$ SD	245.54 $\pm$ 57.76	242.17 $\pm$ 61.22	0.263	0.793
ALT (U/l) Mean $\pm$ SD	76.22 $\pm$ 65.34	78.25 $\pm$ 69.11	0.139	0.889
AST (U/l) Mean $\pm$ SD	82.37 $\pm$ 76.52	84.53 $\pm$ 72.41	0.131	0.896
Creatinine (mg/dl) Mean $\pm$ SD	1.2 $\pm$ 0.368	1.32 $\pm$ 0.451	1.37	0.164
Urea (mg/dl) Mean $\pm$ SD	25.62 $\pm$ 5.83	28.34 $\pm$ 7.31	1.98	0.051
RBS (mg/dl) Mean $\pm$ SD	137.75 $\pm$ 25.41	141.96 $\pm$ 27.65	0.739	0.461

difference in the gravidities of the two groups, with approximately half of the patients in each group being primigravida. Our findings were corroborated by a study from,<sup>8</sup> which demonstrated that PRP was administered subcutaneously before skin closure in this group of 120 patients undergoing elective CS to improve wound healing, reduce the risk of wound infection and gapping, and lessen the potential for the development of unsightly scars. No obvious distinction between the two groups could be seen in the parity. There is no discernible variation in the groups' socioeconomic standing in the study we have. Our findings concurred with the study,<sup>8</sup> which discovered no statistically significant variations in socioeconomic level between the groups. The results of the current analysis demonstrate that there is no discernible difference between the two study groups in terms of common laboratory measures. Our results are in line with those of study,<sup>5</sup> according to which the mean preoperative haemoglobin levels in the intervention and control groups were, respectively, 12.01 1.3 and 11.98 1.4 g/dl. The intervention and control groups had the largest postoperative HB reductions (2.5 vs. 2.9 g/dl, respectively), although this difference was not statistically significant. No difference in HB levels between the intervention and control groups was found by the Mann-Whitney *U* test. Study of,<sup>7</sup> which found no discernible differences in the hemodynamic indices or blood groups between the two groups, validated our findings. Similar to how,<sup>6</sup> showed that no blood types nor hemodynamic markers significantly differed between the two groups. The current study discovered that the anticipated blood loss and operation time for the two groups did not significantly differ from one another.

Investigation of<sup>5</sup> offered help for our discoveries by showing that the optional results (blood misfortune and fever) were tantamount in the two gatherings. Confusions of the injuries in cesarean medical procedures are one of the most widely recognized reasons for puerperal horribleness and a persevering issue. Effective PRP application has

acquired acknowledgment in the careful world as an original methodology with the possibility to lessen postoperative injury disease, accelerate wound mending, and decrease torment and other terrible impacts. PRP is a volume part of blood with a high grouping of platelets over the gauge, which impressively works on the cement properties and wound mending process. Following PRP organization, substances that help tissue rebuilding are delivered. The supra-physiological convergence of platelets at the injury site speeds up mending and forestalls contamination.<sup>9</sup> Because of its physiological importance in injury mending, PRP is utilized all the more consistently for various helpful purposes, and involving it as a feature of routine clinical care is turning out to be more ordinary. Nonetheless, it's not yet obvious whether the impacts of effective PRP treatment are real or imagined.<sup>10</sup>

In the pack in our grip, there's a huge difference between the two concentrated on packets as regard day 1, 7, 30 REEDA score. Meanwhile, there a introductory reduction in REEDA score in the two get-togethers in any case, the dwindling was more important in PRP group. Our results were maintained by examination of (6) as they uncovered that in the assessment of the redundant time scores, For all conditions, the PRP pack's scores varied from the control pack less. After five days, the PRP pack's REEDA score decreased by 1.03 points, or 43 points overall. This example was trustworthy the first time around, and the findings after eight weeks revealed a decreasing of  $-0.57$ , a 42.5 decline. In a similar example, after five days, the normal bunch's REEDA score decreased by 0.64 points, or by 25, and after eight weeks, it had decreased by 0.87 points, or by 47 points. According to the overall evaluation using additional measurements, PRP therapy primarily affected how the REEDA score was determined and how the standard bunch was treated ( $F(1, 132) = 7.28, P = 0.008$ ). Likewise,<sup>11</sup> showed that between April 2018 and July 2020, the PRP group had a lesser decline in REEDA score than the standard group on day 1, day 7, and continued until a partial time (1.510.90 versus 2.491.12,  $P 0.001$ ). Likewise, in



the disquisition of,<sup>7</sup> while looking at REEDA scoring between the two gatherings, our discoveries uncovered a massive distinction between the review and control bunch; in any case, right off the club, the injury of the PRP bunch showed more prominent greensickness, enema, and overflowing release than the standard group with a  $p$  worth of 0.0001; though, in the preceding multi week, 2 weeks, and a month, the PRP bunch showed an advanced huge discrepancy with further noteworthy enhancement of the injury REED also,<sup>8</sup> uncovered that there was a tremendous distinction in REEDA scoring between the two gatherings, with the PRP gathering's injury at first displaying further greenishness, had a  $P$  value of lower than 0.0001, edoema, and more generous release than the comparison group. On the other hand, the PRP group outperformed the standard group in terms of enhancement in the injury REEDA scaling on days 7 and 30, with a  $P$  value of lower than 0.0001.

As the  $P$ -value. Our discoveries are predictable with those of,<sup>12</sup> who delved a many PRP activators on REEDA scoring and set up that PRP by and large delivered current results with lower scar development and a dropped rush of impurity. PRP has been used in relative examination for colorful non-obstetric surgeries, and when varied with the control, PRP shows a significant distinction.<sup>13</sup>

#### 4.2. Conclusion

PRP helps caesarean section patients experience faster wound healing and less discomfort.

We recommend using this new technique in all women undergoing caesarian section as can as possible to improve wound healing process and to prevent wound complications after caesarian section.

#### Authorship

All authors have a substantial contribution to the article.

#### Disclosure

The authors have no financial interest to declare in relation to the content of this article.

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#### Conflicts of Interest

The authors declared that there were no conflicts of interest.

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