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Activated Platelet Rich Plasma as a New Treatment Modality for Cataract Disorders: In Vivo Study

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A B S T R A C T

Introduction: Cataract is the main cause of visual impairment and vision loss in the world, where 33% of the world's population has decreased vision due to cataracts. This study aims to explore the role of platelet-rich plasma (PRP) in inhibiting the pro-inflammatory cytokine interleukin-1ß, thereby triggering tissue repair in cataract cases in vivo study. **Methods:** This study is an experimental study with a post-test-only approach with a control group design. A total of 30 rats (*Rattus norvegicus*) Wistar strain was included in this study (male, 150-200 g, 8-10 weeks). The rats were divided into 3 groups, P1 (the group that was not induced by cataract and not treated with platelet-rich plasma), P2 (the group that was induced by cataract and given 10 uL of intraocular saline injection), and P3 (the group that was induced by cataract and given an intraocular injection of platelet-rich plasma). Plasma 10 uL). **Results:** The results showed that the P3 group that received platelet-rich plasma treatment showed a significant decrease in IL-1B levels when compared to the P2 group with cataract induced but without PRP administration ($p<0.05$). **Conclusion:** Activated platelet-rich plasma has potential as a new therapeutic modality in cataract conditions through inhibition of chronic inflammatory response in vivo studies.

1. Introduction

A cataract is one of the serious health problems experienced by quite a lot of elderly patients. As a person gets older, the performance of each organ will decrease, including the eye lens organ.[1,2] Cataracts are the leading cause of visual impairment and vision loss in the world, where 33% of the world's population has decreased vision due to cataracts. The World Health Organization (WHO) estimates that 18 million people are blind in both eyes due to cataracts, and this condition constitutes 48% of blindness cases worldwide.[3]

Cataracts are caused by various factors, all of which play a role in the initiation of the chronic inflammatory process. Chronic inflammation will cause the activity of various pro-inflammatory cytokines, which will prevent the activation of anti-inflammatory cytokines and inhibit the resolution of the lens tissue of the eye.[4-6] This will cause damage and cloudiness to the eye lens. Current treatment modalities are surgery and lens replacement, but these modalities are not without risks. Invasive processes that are carried out have the potential to cause various complications. Disturbances may even cause widespread damage.[7,8] Optional exploration of new minimally invasive therapeutic modalities is the best solution.

Platelet-rich plasma is a blood product that is rich in growth factors.[9-11] Platelet-rich plasma comes from one of the blood components, namely platelets. Platelets are components that play an important role in the regeneration or repair of damaged or impaired body tissues.[12,13] This is due to the richness of platelets with growth factors. Growth factors are part of anti-inflammatory cytokines that play a role in inflammation inhibition and activation of tissue regeneration processes.[14-16] This potential is quite promising for the improvement of chronic inflammatory processes in cataract cases. This study is one of the early exploratory studies that have the potential to determine the role of platelet-rich plasma in inhibiting the pro-inflammatory cytokine IL-1B, thereby triggering tissue repair in cataract cases in vivo study.

2. Methods

This study is an experimental study with a post-test-only approach with a control group design. A total of 30 white rats (*Rattus norvegicus*) Wistar strain was included in this study and met the inclusion criteria in the form of the male gender, weighing between 150-200 grams, and of age 8-10 weeks first, rats were acclimatized for 7 days, then divided into 3 groups (P1, P2, and P3) randomly, where each group consisted of 10 rats. The P1 group was a group of rats that were not induced by cataracts and were not treated with platelet-rich plasma; the P2 group was a group of rats that had cataracts induced by intraperitoneal injection of sodium selenite 4 mg/kgBW and given an intraocular injection of 10 uL saline; a P3 group is a group of rats induced by cataracts by intraperitoneal injection of sodium selenite 4 mg/kgBW and given an intraocular injection of platelet-rich plasma 10 uL, the treatment was administered once a week for 4 weeks. This study has been approved by the CMHC-Science and Research Center Research Ethics Commission, No. 35/CMHC/KEPK/2021.

Platelet-rich plasma was obtained by first taking 3 mL of rat blood, then the process of isolation of platelet-rich plasma was carried out by mixing with 0.5% citrate buffer and centrifuged at 1200 rpm for 15 minutes. Next, the platelets were isolated and activated by adding 1% thrombin. The process of making platelet-rich plasma is carried out at the Eureka Research Laboratory, Palembang, Indonesia. Induction of OA was carried out by first anesthesia in rats using ketamine (dose of 0.015 mg/gBW) intramuscularly and chlorate (dose of 0.0025 mg/gBW) subcutaneously. Sodium selenite was injected intraperitoneally in experimental rats. Mice were monitored daily for signs of distress and signs of infection. Evacuation of the eye was carried out by performing a transpalpebral enucleation (the lens that was enucleated was the cloudiest lens) followed by making a palpebral incision and freeing the eyeball from the surrounding tissue, tracing the back of the eyeball with tweezers until the optic nerve could be reached. Next, cut the optic nerve and remove the eyeball. Then evacuate the anterior segment with scissors. Identify the lens, remove and rinse with physiological fluids to avoid mixing with other tissues. The eyepiece of the rat was put into a closed microtube container containing 0.9% NaCl liquid, one container for one sample. The samples were temporarily stored in a cooler bag (temperature $\leq 20^0$C) and immediately stored in the freezer (temperature -20^0C). Analysis of interleukin (IL)-1β levels. was carried out using the enzyme-linked immunosorbent assay (ELISA) method according to the manufacturer's instructions (CloudClone®)

After the data is collected, data cleaning, coding, and tabulation are carried out. All results were assessed by means ± standard deviation accompanied by a normality test (Shapiro Wilk) and data homogeneity test (Levene Statistic). The test used in this study is one-way Anova. The results are said to be meaningful if $p \leq 0.05$. Data analysis was performed using SPSS version 25 for Windows.

3. Results

Table 1 shows the levels of inflammatory markers (IL-1β levels). Higher levels of IL-1β inflammation of the lens tissue occur in cataracts. The P3 group that

received the platelet-rich plasma treatment showed a significant decrease in the level of 1β when compared to the P2 group that was induced by cataracts but was only given saline treatment ($p<0.05$)

Table 1. Comparison of IL-1β levels between groups

Group	IL-1β levels (ρg/mL) Mean ± SD	value*
P1	23.56 ± 1.87	0.002
P2	245.87 ± 12.32	
P3	55.64 ± 2.43	

*one-way ANOVA, $p<0.05$

4. Discussion

Cataracts are caused by chronic inflammation of the lens tissue due to various precipitating factors.[1,3] Various precipitating factors such as trauma or the aging process trigger a series of inflammation that results in the activation of various pro-inflammatory cytokines, namely IL-1β, IL-6, and TNF alpha. Activation of the IL-1cytokine inflammatory cytokine, TGF-β.[16-18] This causes no repair of lens tissue, and even chronic inflammatory processes lead to activation of various processes of apoptosis and necrosis. The platelet-rich plasma that is rich in growth factors shows the potential to suppress the activation of the inflammatory cytokine IL-1β. The ability of platelet-rich plasma to suppress IL-1β indicates the potential of this biological agent in reducing chronic inflammation and preventing lens damage. Of course, these results show the promising potential of platelet-rich plasma as a biologic agent modality in treating cataracts.

5. Conclusion

Activated platelet-rich plasma has potential as a new therapeutic modality in cataract conditions through inhibition of chronic inflammatory response in vivo studies.

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