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Exploring the Impact of Blood donation on Intraocular pressure: A comprehensive research investigation

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Abstract :

Background:
The study aimed to investigate alterations in intraocular pressure (IOP) resulting from blood donation, considering factors such as reduced blood volume and changes in fluid dynamics. A comparative study was conducted on 70 individuals meeting specific criteria, involving comprehensive eye assessments and IOP measurements using a Schiotz tonometer before and after blood donation. Intraocular pressure (IOP) is a critical parameter in ocular health, reflecting the fluid pressure within the eye. This study explores potential changes in IOP associated with blood donation, considering physiological factors such as alterations in blood volume and fluid dynamics.

Purpose :
While the impact of blood donation on systemic factors is well-documented, its specific effects on intraocular pressure remain underexplored. Existing literature emphasizes the importance of understanding ocular changes in response to alterations in systemic parameters.

Methods:
A comparative study was conducted on 70 eligible participants. Informed consent was obtained, and participants underwent a comprehensive eye examination, including visual assessment, retinoscopy, slit lamp biomicroscopic examination, and fundus examination. Intraocular pressure was measured using a Schiotz tonometer before and after blood donation.

Results:
Data analysis utilizing paired sample T-Tests indicated only subtle changes in intraocular pressure following blood donation. The mean IOP before blood donation is 17.0±0.910 and after blood donation is 16.5±1.262.

Conclusion:
In conclusion, this study demonstrates a significant difference in intraocular pressure before and after blood donation, shedding light on the intricate relationship between systemic physiological changes and ocular dynamics.

IndexTerms – IOP,Blood Donation, Tonometry.

INTRODUCTION

In the intricate realm of ocular health, intraocular pressure (IOP) serves as a pivotal indicator, regulated by the delicate equilibrium between the production and drainage of aqueous humor within the anterior cavity[1,2]. Deviations in this dynamic system can lead to elevated IOP, instigating optic nerve damage and visual impairments[3,4], with heightened risks for the onset of glaucoma—a progressive neurodegenerative disorder ranking as the second leading cause of irreversible blindness[5,6] .

Contrastingly, the act of blood donation, a selfless endeavor involving the voluntary extraction of blood for transfusions or the creation of biopharmaceutical medications through fractionation, introduces a state of diminished blood volume. This reduction in circulating blood volume prompts a cascade of physiological responses, culminating in compromised tissue perfusion, cellular hypoxia, and end-organ damage.

Within this intricate interplay, ocular health emerges as a focal point, as adequate blood supply is vital for the sustenance of retinal neurons and the preservation of visual function[7,8]. Notably, the repercussions of blood donation-induced hypovolemia extend beyond immediate considerations, with potential implications for ocular diseases such as glaucoma, age-related macular degeneration, diabetic retinopathy, and central serous retinopathy[9,10,11].

This research delves into the profound effects of blood donation on ocular dynamics, using a cohort of healthy blood donors as a controlled model for simulated acute hypovolemia. By scrutinizing the alterations in mean arterial pressure, cardiac output, and peripheral vascular resistance, we aim to unravel the intricacies of this physiological response, shedding light on its impact on intraocular pressure and, consequently, ocular health. Through this exploration, we endeavor to contribute valuable insights that transcend the immediate scope of blood donation, fostering a deeper understanding of its implications for ocular well-being in both the short and long term.

healthy blood donors can tolerate a loss of 20% of blood volume before experiencing hypotension. This decrease in blood volume leads to a reduction in mean arterial pressure, followed by decreased cardiac output and pulse pressure[12]. Subsequently,

the sympathetic nervous system is activated, leading to increased heart rate and peripheral vascular resistance to restore mean arterial pressure and ensure adequate perfusion to vital organs, while perfusion pressure to non-vital organs, including the eye, decreases[1]

NEED OF THE STUDY.

This study fulfills a crucial need by investigating the influence of blood donation on intraocular pressure (IOP). The findings hold significant clinical relevance, providing insights that can guide healthcare professionals in anticipating and managing potential ocular changes in donors. Prioritizing patient safety, the research aims to enhance the overall donor experience by fostering transparency and satisfaction. Additionally, the study contributes to scientific knowledge, shedding light on an underexplored aspect of ocular health. By communicating these outcomes, it contributes to public health awareness, promoting informed donation practices and encouraging further research into the intricate relationship between systemic physiological changes and ocular dynamics

RESEARCH METHODOLOGY

This study compared the effects of blood donation on intraocular pressure (IOP) in 70 participants from Kanachur Hospitals and Research Centre in Mangalore. The aim was to investigate the impact of blood donation on ocular health. Participants eligible for inclusion were aged between 18 and 30 years. They had either a refractive error of $\leq \pm 1.00$D or were emmetropes (individuals with normal vision). Additionally, participants were required to have a minimum hemoglobin level of 13.0 g/dl and a weight above 55kg for boys and 48kg for girls. Participants with a history of ocular surgery or any systemic or ocular health diseases were excluded from the study. Individuals who had donated blood within the past eight weeks were also ineligible. Moreover, participants taking medications known to influence blood pressure or ocular parameters were not included in the study. These criteria were established to ensure the homogeneity of the participant population and minimize potential confounding factors that could affect the study outcomes. Before participation, written consent was obtained from all subjects, and their demographic information and medical history were collected. The study procedures included a comprehensive ocular examination. Intraocular pressure (IOP) was measured using a Schiotz tonometer, an indentation tonometer that assesses the depth produced on the corneal surface by a known weight. Measurements of IOP were taken before and after blood donation. Prior to donation, participants' weight, height, and systemic blood pressure were recorded. Blood donation was then performed following standard procedures. Post-donation, the same procedures were repeated, including measurement of IOP. The data collected were analyzed statistically, with results presented as mean and standard deviation. A comparison between pre- and post-donation IOP measurements was conducted using the T-test. This study provides valuable insights into the potential effects of blood donation on ocular health and intraocular pressure.

RESULTS AND DISCUSSION

In this study involving 70 subjects, with 19 females and 51 males aged between 19 and 32, a statistically significant decrease in intraocular pressure (IOP) was observed after blood donation.

IOP (mm Hg)	N	Mean	SD	mean difference	Test statistics	p value
Before Blood Donation	70	17.0	0.910	0.5	187	0.005
After Blood Donation	70	16.5	1.262			

Table 1: IOP before and after blood donation.

Prior to blood donation, the mean IOP was measured at 17 mmHg, while after blood donation, it decreased to 16.5 mmHg (table 1). This difference in IOP before and after blood donation was found to be statistically significant, with a p-value of 0.005. Therefore, the data indicate a decrease in IOP following blood donation, and this decrease is deemed to be statistically significant based on the analysis conducted. Interestingly, the findings from this study align with those of Mengmeng Yu et al.[13], who reported a significant reduction in IOP 24 hours after a 200 ml blood donation. These results suggest a potential temporary decrease in IOP following blood donation, likely attributed to factors such as reduced blood volume and alterations in fluid dynamics within the body. However, despite the statistical significance observed in this study, it's important to note that the decrease in IOP may not have a lasting impact and might not be clinically significant in the long term. Further long term research is needed to fully understand the implications of blood donation on intraocular pressure and its potential consequences for ocular health.

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