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Original Research Article

Plasma and Whole Blood Viscosities of Male Wistar Rats Induced with Ketamine General Anaesthesia and Lidocaine Local Anaesthesia

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Abstract: ***Background*:** Although anaesthetic agents are indispensable during a surgical operation, they can cause haemorheological changes resulting in a dynamic change of blood flow. The dissociative general anaesthetic ketamine and the amide-type local anaesthetic lidocaine find clinical and experimental use in a wide application. Nevertheless, their effects on the viscosity of blood plasma and whole blood have not been researched on an individual and combined basis. This research paper aimed to determine the effects of ketamine and lidocaine when used separately and in combination, in the plasma and whole blood viscosity of male Wistar rats. ***Methodology*:** A total of thirty-five male Wistar rats were split into five groups (n = 7) which included Control, Lidocaine, Lidocaine with Adrenaline, Ketamine, and Ketamine + Lidocaine. Two days of intraperitoneal administration of treatments took place. The samples of blood were obtained through cardiac puncture. The LOVIS 2000 M/ME Microviscometer measured plasma and whole blood viscosities; by computing the rolling times of a steel ball through a capillary tube, it calculates the dynamic and kinematic viscosities. One way ANOVA was adopted as the statistical analysis method for the study. ***Results and Discussion*:** Individually and in combination, ketamine contributed to the variable changes in plasma and whole blood viscosities independently and along with lidocaine. Whereas the concentration of lidocaine (maximally in combination with adrenaline) had a more negligible effect on the level of viscosity, ketamine had no significant effect on the viscosity level. Ketamine combined with lidocaine was involved in altering viscosity which also was in line with the change of red blood cell deformability, as well as aggregability. ***Conclusion*:** Lidocaine raises plasma viscosity especially when used with adrenaline, its impact on plasma viscosity is minimal when compared to that of ketamine.

Keywords: Plasma and Whole Blood Viscosity, Ketamine, Lidocaine.

1. INTRODUCTION

Anaesthesia is the use of medicine to prevent pain during surgical procedures. It is divided into two main types, such as local and general anaesthesia (Ikimi, 2020). General anaesthesia affects the whole body and makes the person unconscious. It induces anaesthesia throughout the body and can be administered either through inhalation or direct injection into the blood stream (Ikimi, 2020).

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Local anaesthetics provide restricted anaesthesia because it is administered to the peripheral sensory nerves innervating a region usually by injection (Johnson, 2013). Local anaesthetic drugs are used in three different ways as follows: local application, injectables and nerve blocks (Johnson, 2013). Local anaesthetics such asprilocaine, bupivacaine, lidocaine are given for local numbing but absorbed into the blood-stream where it produces side effects such as soreness at injection site, tingling sensation, ringing ear, headache, dizziness, confusion, hypotension (Johnson, 2013).

Previous investigators differed in their findings on the influence of anaesthetic agents on whole blood and plasma viscosities. Albert *et al*., (2011) reported increase in blood viscosity with lyicopropane and decrease with thiopentone as well as halothane while Boyan *et al*., (2015) reported no change in viscosity during anaesthesia with these agents.

Aronson *et al*., (2011) also reported no change in viscosity when treated with cyclopropane and halothane. Magofa *et al.,* (2010) reported that during ketamine anaesthesia, there was no significant, increase or reduction in blood viscosity as well as plasma viscosity.

Despite the benefits of anaesthesia, it is reported that combination of ketamine and lidocane deceases Minimum Alveolar Concentration (MAC) in experimental dog (Brown, 2014). Little or no work has been reported on plasma and whole blood viscosities attributed to anaesthesia.

2. METHODOLOGY

2.1: Ethical Approval

This study was performed with animals treated in accordance with guide for the care and use of laboratory animals after securing ethical statement approval from the Research Ethics Committee (REC) of the Faculty of Basic Medical Sciences (FBMS), Rivers State University with REC approval number: RSU/FBMS/REC/23/160.

2.2: Experimental Animals

Thirty five (35) Wistar rats were acquired for the purpose of this study. The rats were housed in a well-ventilated room with adequate light source and temperature. The animals were fed adequately and allowed for acclimatization for one week before commencement of the experiment.

2.3: Drugs

The experimental rats were treated with 5mg/kg of ketamine according to Yohanne *et al.,* (2018) who used same doses of ketamine in his study while 2% of lignocaine at 2mg/kg according to Yakubu *et al.,* (2020) were administered to the experimental rats.

2.4: Experimental Design

Thirty five (35) male Wistar rats were divided into five (5) groups of six (6) rats each.

Group 1: This is the control group. The rats in this group were administered with 1ml of diluted distilled water orally for 2 days.

Group 2: Male Wistar rats in this group received 2mg/kg of plain lignocaine (lidocaine without adrenaline) for 2 days.

Group 3: Male Wistar rats in this group received 2mg/kg of lidocaine with adrenaline for 2 days.

Group 4: Male Wistar rats in this group received 5mg/kg of ketamine every day for 2 days.

Group 5: Male Wistar rata in this group received 5mg/kg of ketamine and 2mg/kg of lidocaine combined together everyday for 2days.

2.5: Collection of Blood Samples from Experimental Rats

At the end of treatment with drugs, the rats were sacrificed and blood samples collected by cardiac punctures into various sample bottles for haematological, hemostatic, haemorheological and biochemical investigations using appropriate techniques.

2.6: Estimation of whole Blood and Plasma Viscosity

Blood samples were collected into test tubes containing EDTA for stabilization and to avoid coagulation. LOVIS 2000 MIME Microviscometer was used to measure the rolling time of a ball inside an inclined capillary. The integrated software automatically calculates kinematic and dynamic viscosity.

2.7: Statistical Analysis

Values for the results are pressed as meant SEM. The statistical analyses were done using the analysis of variance (ANOVA).

Computer softwares, Microsoft excel 2013 edition and SPSS 23.0 windows were used. Differences between mean were considered at $p<0.05$.

3. RESULTS

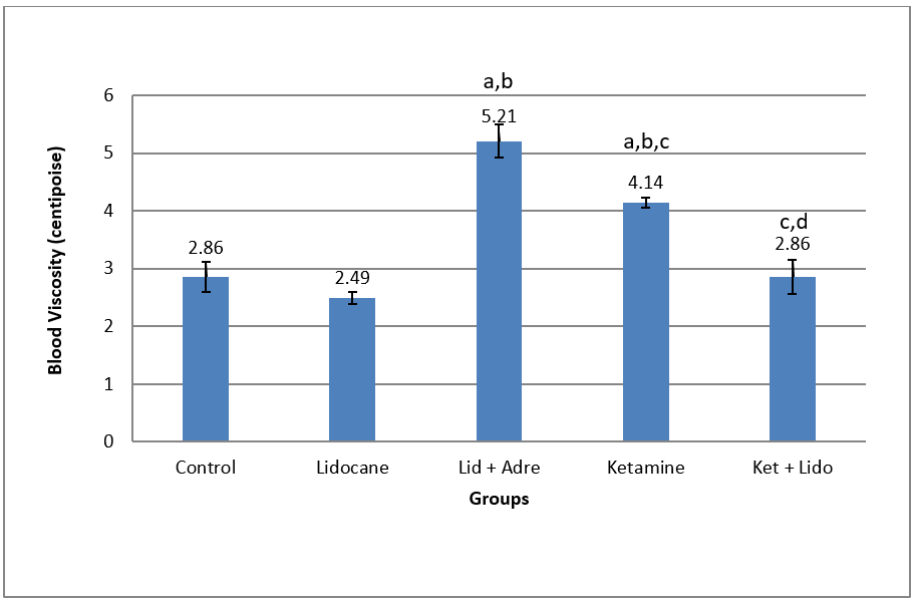

Figure 1: Comparing blood viscosity in all the experimental groups. Results presented as mean ± SEM. a, b, c, and d = versus control, lidocane, Lid plus adre, and ketamine groups respectively at p<0.05

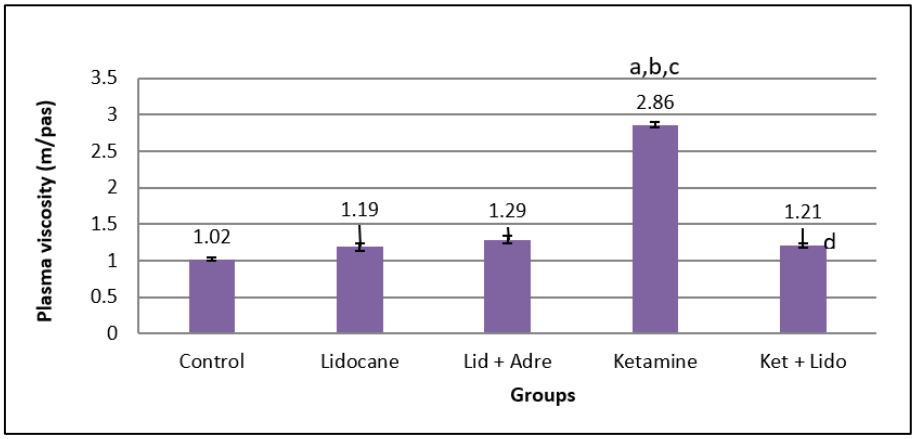

Figure 2: Comparing plasma viscosity in all the experimental groups. Results presented as mean ± SEM. a, b, c, and d = versus control, lidocane, Lid plus adre, and ketamine groups respectively at p<0.05

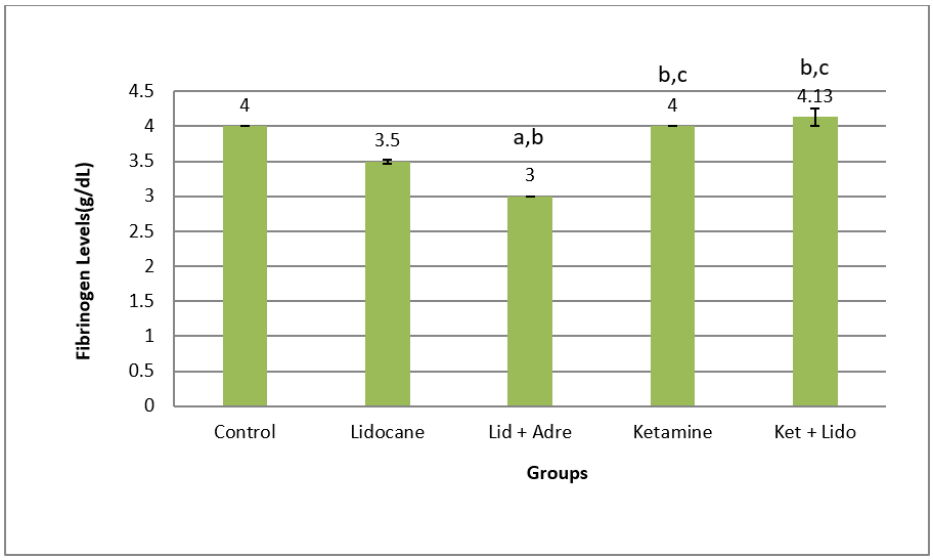

Figure 3: Comparing fibrinogen levels in all the experimental groups. Results presented as mean ± SEM. a, b, c, and d = versus control, lidocane, Lid plus adre, and ketamine groups respectively at p<0.05

4. DISCUSSION

It was observed that both types of anaesthetic agents do not alter plasma and whole blood viscosities. The findings of the study contradicts the report of Albert *et al.,* (2011) who reported increase in blood viscosity with cyclopropane and decrease in blood viscosity with thiopentone and halothane.

The findings of the study is in consonance with the reports of Aronson *et al.,* (2011) who reported no change in viscosities with cyclopropane and halothane.

The findings of the study is also consistent with the reports of Magofa *et al.,* (2010) who reported that during ketamine anaesthesia, there was no significant increase or decrease in blood viscosity and fibrinogen concentration.

5. CONCLUSION

It is concluded as follows that:

i. Anaesthetic agents do not influence the plasma and whole blood viscosities negatively.
ii. Different types of anaesthetic agents do not have the capacity to alter the viscosities of blood and cannot cause heart problems in users.

6. RECOMMENDATIONS

The following recommendations are drawn from this study:

i. Different types of anaesthetics, be it general or local anaesthesia, are safe.
ii. Different types of anaesthesia are encouraged to be used in patients with heart problems.

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