

Comparative Evaluation of Effects of Propofol and Procaine Anaesthesia on Serum Electrolytes and Proteins of Male Wistar Rats

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Abstract

Review Article

Comparative evaluation of effects of Propofol and procaine on serum electrolytes and proteins of male Wistar rats was studied. A total of 20 male Wistar rats were used for the study and were divided into 4 groups. Group 1 was the control group which received 10ml of distilled water, group 2 received 5mg/kg of procaine, and group 3 received 10mg/kg of propofol while group 4 received both 5mg/kg of procaine and 10mg/kg of propofol combined together. After drug administration, blood samples were collected into plain sample bottles for biochemical analysis using automated biochemical analyzer. ANOVA was used as the data analysis method. Results revealed no significant change in sodium, calcium potassium and bicarbonate ions. Estimation of serum proteins revealed no significant change in total protein, albumin and globulin. Conclusively, propofol and procaine anesthesia does not have the potentials to alter serum electrolytes and protein of male Wistar Rats.

Keywords: procaine, propofol, anaesthesia.

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INTRODUCTION

Propofol is an intravenous hypnotic drug used for the induction and maintenance of general anaesthesia (sciencedirect.com). It is rapid on onset, makes users unconscious and prevents pain and discomfort during medical and surgical procedures (Ihua,2025).

It is primarily eliminated through hepatic conjugation to inactive metabolites excreted by the kidney with respiratory depression being a significant side effect (Ihua,2025).

Propofol has rapid onset of action and rapid

recovery. The hypnotic effect of propofol is dose related with small doses causing sedation and increase doses causing unconsciousness and apnea (IHUA,2025).

Short term induction and maintenance of general anaesthesia, propofol general anaesthesia causes no significant changes in serum electrolytes. However, prolong high dose infusion can trigger life threatening complications known as propofol related infusion syndrome (PRIS) which alters electrolyte balance (Ihua et al, 2025). Procaine is an amino ester local anesthetic that does not directly cause significant systematic shifts in

major serum electrolytes such as sodium, calcium, potassium and chloride. Severe toxicity with procaine can lead to metabolic or respiratory acidosis which affects electrolyte balance. (Ihwa, *et al*; 2025).

Globulin is a category of protein in blood plasma unlike albumin which maintains fluid balance, globulin proteins play structural and immune related roles helping the body fight infection, transport nutrients and maintains blood clotting mechanisms. Elevated globulin levels may indicate production of globulin proteins associated with immune responses of inflammation (Ikemi, 2015).

Common causes of High globulin are chronic infections like tuberculosis Hepatitis, HIV, multiple myeloma. Some researchers revealed that Propofol anesthesia does not alter globulin and albumin levels. Instead, the proteins dictate how Propofol behaves in the body. While Propofol does not change protein levels, the amount of albumin in patient's blood drastically changes how propofol is dosed and its clinical effects. Procaine does not alter the actual concentrations (synthesis) of albumin or globulin in the blood. However, the drug physically interacts with these proteins, modifying their structural shape and binding to them during distribution (Iheruanya, 2012).

Methodology

A total of twenty (20) male Wistar rats were secured for the purpose of this study and were allowed for acclimatization for one (1) week.

Results:

Table 1: Estimation of Sodium, Calcium, Potassium, Bicarbonate Ions for the Control and Anaesthetic Drugs (Procaine And Propofol)

Groups	Sodium	Calcium	Potassium	Bicarbonate
Control	73.02 $\pm$ 0.07	3.0 $\pm$ 0.27	3.02 $\pm$ 0.22	23.02 $\pm$ 0.27
Procaine only	73.02 $\pm$ 0.27	3.02 $\pm$ 0.28	3.02 $\pm$ 0.23	23.02 $\pm$ 0.27
Propofol only	73.0 $\pm$ 0.00	3.12 $\pm$ 1.8	3.02 $\pm$ 0.23	23.00 $\pm$ 0.00

Experimental Design

Group 1: This is the control group administered with 10ml of distilled water every day for one (1) week.

Group 2: Administered with 5mg/kg of procaine every day for 1 week.

Group 3: Administered with 10mg/kg of propofol every day for 1 week.

Group 4: Administered with 5mg/kg of procaine and 10mg/kg of propofol every day for 1 week.

Collection of Blood Samples from Experimental Rats

At the end of drug administration to the experimental rats, the rats were sacrificed and blood sample taken via cardiac puncture into plain sample bottles for biochemical evaluation.

Evaluation of biochemical parameters

Serum electrolytes and proteins were evaluated using automated biochemistry analyzer.

Statistical Analysis

Values for the results were presented as mean $\pm$ SEM. The statistical analysis was done using analysis of variance (ANOVA). Differences between mean values were considered significant at $P < 0.05$.

Procaine + Propofol	73.02 $\pm$ 0.26	3.02 $\pm$ 0.28	3.02 $\pm$ 0.28	23.02 $\pm$ 0.27
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No significant change recorded.

Table 2: Estimation of Total Protein, Albumin, Globulin and Fibrinogen

Groups	Total Protein	Albumin	Globulin	Fibrinogen
Control	63.02 $\pm$ 0.26	49.74 $\pm$ 1.8	27.62 $\pm$ 1.7	28.68 $\pm$ 0.18
Procaine only	63.03 $\pm$ 0.25	48.98 $\pm$ 1.7	27.19 $\pm$ 1.9	28.52 $\pm$ 0.19
Propofol only	63.00 $\pm$ 0.01	49.73 $\pm$ 0.18	27.60 $\pm$ 1.8	28 $\pm$ 52 $\pm$ 0.19
Procaine + Propofol	63 $\pm$ 02 $\pm$ 0.27	48.99 $\pm$ 1.9	23.19 $\pm$ 1.8	28.65 $\pm$ 0.15

No significant change recorded

Discussion

This study investigated the effects of high doses of procaine and propofol on serum electrolytes and proteins of male Wistar rats.

It is revealed in this study that both procaine and propofol anaesthetic agents did not have any effect on serum electrolytes (sodium, potassium, calcium and bicarbonate).

This finding is not in consonance with reports of some researchers who reported either significant reduction or significant elevation of serum electrolytes and proteins.

The result is not in consonance with Ihua *et al* (2025) who reported significant changes in serum electrolytes.

Conclusion

Both protein local anesthetic agent and propofol general anesthetic agents does not have the

potential to alter serum electrolytes (sodium, potassium, calcium and bicarbonate) and serum proteins (total protein, albumin, globulin and fibrinogen)

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