Negative Effect of Propofol and Procaine Anaesthesia on Immune Cells of Male Wistar Rats

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***Abstract*—Negative effects of propofol and procaine anaesthesia on immune cells of male Wistar Rats was studied. A total of 20 male Wistar rats were used for the study and were divided into five (5) groups. Group 1 was the control group and was administered with 10ml of distilled water every day for 1 week; group 2 was given 5mg/kg of procaine every day for 1 week; group 3 was administered with 10mg/kg of propofol every day for 1 week; group 4 was given 5mg/kg of procaine and 10mg/kg of propofol combined together every day for 1 week and group 5 was given 5mg/kg of procaine, 10mg/kg of propofol and 10ml of distilled water combined together every day for 1 week. At the end of treatment with drugs, blood samples were collected via cardiac puncture for haemotological evaluation using automated heamatology analyzer. It was revealed that total white cell count, lymphocytes and granulocytes were significantly altered with propofol anaesthesia. TWBC reduces significantly with propofol while lymphocytes and granulocytes (neutrophil, eosinophil, basophil) increase significantly with propofol. Conclusively, propofol has the potential to weaken immune cells and predispose users to infection. High lymphocyte, granulocytes and globulin levels indicates the possibility of the immune cells fighting infection.**

***Index Terms*—Propofol, procaine, anaesthesia, white blood cells.**

I. INTRODUCTION

Propofol is a general anaesthetic used to reduce pain, maintain unconsciousness during medical and surgical interventions. It is also used for moderate and deep sedation (Ihua, 2025). Propofol primarily work by enhancing the activity of neurotransmitter called gamma-aminobutyric acid (GABA) by binding to GABA receptors in the brain, depresses the central nervous system (CNS) by creating state of sedation or general anaesthesia (Ihua, 2025) . Because it depresses the central

nervous systems, propofol can lower blood pressure and slow down breathing. High dose infusion can lead to life threatening condition called Propofol Infusion Syndrome (PRIS).

Recent advances in medicine and technology, the risk of death from anaethesia has decreased significantly (Guyton, 1983). Cancer is a major threat to human health which requires surgical resection. These surgical procedures require anaesthesia and which in turn invasive to the immune system (Juneja, 2014).

Furthermore, propofol is known to have suppressive effect on immune cells such as dendritic cells, macrophages, neutrophils and lymphocytes (Juneja 2014). Propofol has been reported to induce apoptosis and alter the balance of CD4 T-cells (Juneja, 2014).

T-lymphocytes suppresses T-cell functions including glycolysis, effector differentiation and cytothine production. It can reduce the CD4 cell count and T-cell–respondent antibody production while alternating surgical stress-induced shifts in the TA, HT_2 ratio (Ihua, 2025).

Macrophages have been documented to cause anti-inflammatory changes. Propofol limits macrophage migration, polarization and suppresses the release of pro-inflammatory cytokines such as iL-6, TNF-α (Ihua, 2025).

It reduces the phagocytic activity and oxidative burst capacity of neutrophils (Royds and Buggy, 2016). Propofol tends to preserve NK cell activity and counts helping to maintain a more stable level of cell mediated immunity post-surgery (Royls and Buggy, 2016). Because of its suppressive impact on inflammatory mediators, propofol is actively beneficial in managing autoimmune conditions and systemic inflammatory diseases. However, in surgical oncology, the suppression of cell-mediated immunity could theoretically impair body's ability to eliminate residual tumour cells (Ihua, 2025).

Reports have examined the relationship between anaesthetics and cancer recurrence and prognosis. However, no detailed research studies on the effects of propofol on immune cells have been conducted, hence the need for this present study (Ihua, 2025.

II. METHODOLOGY

A total of twenty (20) male wistar rats were used in the course of this study. These rats were allowed for one (1) week for acclimatization.

Group 1: This is also known as the control group and was administered with 10ml of distilled water every day for 1 week:

Group 2: This group was given 5mg/kg of procaine every day for 1 week.

Group 3: This group was given 10mg/kg of propofol every day for 1 week.

Group 4: This group was given 5mg/kg of procaine and 10mg/kg of propofol every day for one (1) week.

Group 5: This group was given 20mg/kg of propofol, 10mg/kg of procaine and 20ml of distilled water.

Collection of Blood Samples from Experimental Rats

At the end of treatment with drugs, the rats were sacrificed and blood samples collected via cardiac puncture into EDTA sample bottles for hematological evaluation and plain sample bottles for biochemical evaluation.

Evaluation of Haematological Parameters

White blood cell parameters and differentials were evaluated using automated haematology analyzer (BC, 2300, Mindiay, Germany).

Evaluation of Serum Globulin

Serum globulin was estimated using automated biochemical analyzer.

Statistical Analysis

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

III. RESULTS

Table: Comparison of Differential White Blood Cell Count for the Control and Anaesthetic Groups

Groups	Neutrophils	Lymphocytes	Monocytes	Eosinophil	Basophil
Control	48.70±0.16	32.11±0.33	11.22±0.28	3.2±0.19	0.98±0.12
Procaine	48.30±0.15	31.98±0.18	11.12±0.18	3.11±0.18	0.99±0.14
Procaine + Propofol	47.90±0.18	53.17±0.19	18.19±0.03	8.18±0.04	2.2±0.14
Procaine + Propofol + Distilled Water	48.70±0.16	32.48±0.18	11.14±0.03	3.18±0.03	0.97±0.01

There is significant difference in group 2 at $P<0.05$

Table 2: Comparison of Total White Blood Cell Count (TWBC), Globulin level for control group and anaesthic groups

Groups	Total White Blood Cell Count	Globulin Level
Control (Group i)	9.50±0.22	28.15±0.18
Procaine (Group II)	9.30±0.18	28.00±0.18
Propofol (Group III)	4.8±0.16	44.12±0.22
procaine + propofol (Group IV)	9.12±0.18	29.10±0.18
Procaine + propofol + distilled water (Group V)	9.00±1.18	27.99±0.15

There is significant difference in groups 3 at $P<0.05$

IV. DISCUSSION

This study evaluated the negative impacts of propofol and procaine on immune cells of male Wistar rats. It was revealed that propofol when used singly has the potential to reduce total white blood cell count, neutrophil, monocytes, eosinophil and basophils. Low white blood cell count reduces immune system and predisposes users to infection and inflammation.

Propofol combined with procaine did not cause significant changes suggestive of the possibility of procaine reversing or preventing the effects propofol. It was further revealed that propofol combined with procaine increases lymphocytes level while propofol only without combination reduces lymphocytes level. When lymphocytes increase (lymphocytosis) it probably means that the body is fighting infection. It is an indicator of autoimmune diseases, chronic inflammation and blood cancers.

It was also shown that propofol combined with procaine significantly increased granulocytes compared to control group. High granulocyte is a marker of infection, stress, inflammation and malignancy.

V. CONCLUSION

Propofol general anaesthesis reduces white blood cell count while propofol combined with procaine increases WBC count, lympholcytes and granulocytes. Propofol has the potential to weaken immune cells and predisposes the users to infection. High lymphocyte and granulocytes as revealed in this study indicates that the immune system was fighting infection.

VI. RECOMMENDATION

Use of propofol anaesthesia in immune compromised patients and individuals should be done with caution.

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