

Optimizing the Utilisation of Antiglobulin Testing in A Tertiary Care Centre: A Multi-Departmental Retrospective Analysis

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Abstract- Antiglobulin testing is a vital tool in immunohematology and transfusion medicine for detecting clinically significant red cell antibodies and supporting safe transfusion practices. This retrospective study evaluated the utilization patterns, diagnostic yield, and appropriateness of antiglobulin testing across multiple departments in a tertiary care center. Laboratory records were reviewed to assess patient demographics, clinical indications, requesting specialties, and test outcomes. Analysis revealed considerable variation in ordering practices and positivity rates among departments. A large proportion of tests were negative, indicating potential overutilization in certain clinical settings, whereas positive results were predominantly associated with hemolytic anemia, transfusion reactions, and autoimmune conditions. The findings suggest that implementing evidence-based testing criteria, clinician education, and regular utilization audits can improve test appropriateness, enhance laboratory efficiency, reduce unnecessary healthcare expenditure, and maintain high standards of patient safety and diagnostic accuracy.

Index Terms Antiglobulin testing; Direct antiglobulin test (DAT); Indirect antiglobulin test (IAT); Immunohematology; Transfusion medicine; Laboratory utilization.

I. INTRODUCTION

The Antiglobulin test, or Coombs test, is a critical diagnostic test in transfusion medicine. It can be classified as the Direct Antiglobulin Test (DAT) and the Indirect Antiglobulin Test (IAT). The DAT is mainly utilized for the identification of antibodies or complement proteins bound to red blood cells, commonly in diseases such as autoimmune hemolytic anemia, hemolytic disease of the fetus and newborn (HDFN), and transfusion reactions which is done by washing the collected

blood sample in saline to isolate the patient's RBCs and to remove unbound antibodies that may otherwise confound the result. DAT adds a monospecific or polyspecific reagent to the washed RBCs to detect bound IgG and/or complement C3.

In practice, many laboratories first use the polyspecific reagent that can detect both IgG and C3, a positive result is followed by monospecific testing to characterize the antibody further (1). The IAT is applied in antibody screening, cross-matching during blood transfusion procedures, and in antibody detection in antenatal and sensitized individuals. For IAT, serum from a blood sample gets isolated, and native RBCs are removed. The isolated serum sample then gets incubated with foreign RBCs of known antigenicity. Antiglobulin reagent is then added, and the presence of agglutination indicates a positive result.

Coomb's test has a central role in the tertiary care hospital among various departments such as Hematology, Transfusion Medicine, Pediatrics, Obstetrics, and Internal Medicine. With greater awareness and clinical acumen during diagnosis, the test is more commonly ordered, even as a reflex or precautionary one. The clinical usefulness of these tests depends on proper indication, interpretation, and correlation with patient history and laboratory findings. Though it is easy and sensitive, it can result in false positive and false negative results due to indiscriminate or inappropriate use, resulting in unnecessary studies, over diagnosis, and additional healthcare costs through clinical uncertainty, inappropriate interventions, and patient distress.

Although the clinical utility of the Coomb's test is firmly established, increasing concern exists regarding its inconsistent and sometimes improper use in all departments of tertiary care centers. Research at similar institutions implies that a substantial percentage of Coomb's test requests are possibly unjustified clinically, repeated unnecessarily, or done in situations where the yield would be small. Such misuse has the potential to result in inefficiency in the healthcare system and misallocation of laboratory resources. In addition, justification of Coomb's test use is consistent with overall objectives of evidence-based care, cost-conscious care, and patient safety. It is conducive to laboratory stewardship efforts and assists in alignment with institutional quality improvement and resource optimization goals. Creation of department-specific guidelines utilizing real-world experience can improve clinical decision-making, eliminate redundancy, and optimize care institution-wide.

To date, limited studies have comprehensively analyzed Coomb's test utilization from a multi-departmental perspective within tertiary care centres, particularly in resource-sensitive healthcare environments. Most existing literature focuses either on the technical aspects of Coomb's test or on its role in specific diseases. Our study is distinct in its cross-disciplinary, institution-wide scope, evaluating test utilization patterns over a defined period and correlating them with clinical outcomes and indications.

II. REVIEW OF LITERATURE

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III. AIM AND OBJECTIVE

- To evaluate and optimize the utilization of antiglobulin testing (direct and indirect) across various clinical departments in a tertiary care Centre through a retrospective, multi-departmental analysis.
- To assess the frequency and pattern of antiglobulin test (DAT and IAT) request across different departments over a specified period.
- To analyze the correlation between test results and clinical outcomes or subsequent patient management decisions

IV. MATERIALS AND METHODS

- Study Design: Retrospective study
- Sample Size: Total of 285 antiglobulin test (AGT) cases analyzed over a 12-month period
- Duration: January 2024 to December 2024
- Setting: General Medicine, ICU, Neonatology, Pediatrics, OBG, ER, Dialysis, OT, Pulmonology departments of Saveetha Medical College Hospital.
- Data Collection: Patient recorded data, test type (DAT/IAT), ward/department, test results, diagnosis.
- Data Analysis:
 - * Frequency distribution for test positivity (DCT/ICT).
 - * Chi-square test to compare variables like age, gender, department wise positivity.
 - * p-value < 0.05 considered statistically significant
 - * IBM SPSS Version 26

V. RESULTS

(Table. 1- Total Positivity rate)

TEST TYPE	POSITIVE	NEGATIVE	TOTAL	POSITIVITY RATE (%)
DIRECT COOMBS TEST	89	150	239	37.2%
INDIRECT COOMBS TEST	25	21	46	54.3%
COMBINED TOTAL	114	171	285	40.0%

- Of the 285 tests, 114 (40.0%) yielded positive results.
- The ICT showed a higher positivity rate (54.3%) than DCT (37.2%), indicating a greater burden of alloimmunization in the studied population.

Summary of Key Statistical Findings:

- Overall positivity rate for antiglobulin testing was 40%.
- ICT showed a higher positivity (54.3%) compared to DCT (37.2%).
- Gender did not significantly influence test positivity ($p = 0.62$).
- Ward-based analysis showed highest test positivity in ICU and General Medicine, suggesting testing is clinically indicated in these critical and immunologically active patient populations.
- Pediatrics and Neonatal units contributed large numbers of negative results, suggesting a more selective approach may improve resource utilization.
- Age had strong correlation with test positivity ($p < 0.001$), with adults testing more frequently positive.

VI. DISCUSSION

The Direct and Indirect Coombs Tests (also referred to as the Direct and Indirect Antiglobulin Tests) are crucial diagnostic tools in immunohematology. The Direct Coombs Test (DCT) detects antibodies or complement components bound directly to red blood cell (RBC) membranes, while the Indirect Coombs Test (ICT) identifies unbound circulating antibodies in a patient's serum that can bind to RBC antigens. The DCT is primarily employed in diagnosing autoimmune hemolytic anemia (AIHA), hemolytic transfusion reactions, and hemolytic disease of the fetus and newborn (HDFN), whereas ICT is an essential tool in pre-transfusion testing and antenatal screening.

In the present study, a greater proportion of females tested positive for both DCT and ICT. This observation correlates with the known higher prevalence of autoimmune diseases among women, especially during their reproductive years. Hormonal influences and genetic predispositions contribute to heightened immune reactivity in females, resulting in a higher incidence of antibody formation.

The age-wise distribution of Coombs positivity showed a concentration in the 19–30 and 30–50-year age groups. This trend may reflect the peak exposure to alloimmunizing events such as pregnancy and transfusion. Notably, the pediatric population (0–18 years) had lower DCT positivity, likely due to reduced autoimmune incidence and fewer transfusions at this age. However, DCT testing in neonates remains critical, especially for early diagnosis of HDFN.

The highest numbers of positive DCT cases were reported from General Medicine (GM) and the Intensive Care Unit (ICU), followed by the Oncology ward. This distribution suggests that hemolytic anemia, autoimmune disorders, and complex transfusion needs are more prevalent in these settings. Previous studies have also shown a high prevalence of DCT positivity in critically ill patients due to immune dysregulation and multiple transfusions.

VII. CONCLUSION

The study found that a notable proportion of AGT orders—up to 24%—were made without clear clinical indications, leading to unnecessary testing, reagent wastage, and delayed processing times. It was also observed that AGT was sometimes repeated within short intervals without new signs or symptoms, especially in transfusion-related cases where recent cross match results remained valid. This redundant testing contributed to avoidable financial costs and workload strain on laboratory personnel.

The study also showed that AGT was requested for routine anemia evaluations or low-grade febrile illnesses, showing a gap in test indication awareness among clinicians. Moreover, improper timing or repetition of AGT created delays in reporting critical cases and also diluted the diagnostic value of truly positive results. These inefficiencies indicated an urgent need for targeted interventions, including both administrative policy updates and clinical education programs.

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