Comparative Study of Blood Cross Matching Using Conventional Tube and Gel Method

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Abstract

Background: Conventionally tube method is used for compatibility and cross matching in transfusion medicine.

Methods: A comparative study was carried out to evaluate the efficacy of conventional tube and gel technique.

Result: Compatibility testing was performed on 1000 blood samples by conventional test tube method and DiaMed gel method. The results were analysed.

Conclusion: The gel method was found to be a rapid and reliable procedure without controls. There was no requirement of wash phase in indirect antiglobulin test and sensitivity and specificity was comparable to spin tube method. We conclude that this technique is a better substitute for spin tube method.

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Key Words : Compatibility testing; ID gel technique

Introduction

Spin tube method has been the conventional method for compatibility testing and cross matching in transfusion medicine. Compatibility testing and cross matching requires potentiation with bovine albumin, enzyme technique and use of anti human globulin (AHG) i.e. indirect antiglobulin test (IAT). Lapiere [1,2] introduced gel tests using principle of controlled centrifugation of red cells through sephadex gel contained within a microtube. The gel technique is useful for ABO and Rh typing, cross matching Direct and Indirect Antiglobulin Tests (DAT and IAT) and identification of alloantibodies [3-6].

The present study was carried out to evaluate the efficacy of DiaMed Micro typing gel method over the conventional tube method.

Material and Methods

One thousand blood donations collected at Armed Forces Transfusion Centre, Delhi Cantt were tested for compatibility using conventional tube method (spin tube method) and Dia Med ID Gel Method. Samples for cross matching were collected from the pilot tubes of the blood donations. For cross matching serum of recipients with identical blood groups were used for test tube method as well as gel test.

Dia Med ID microtyping system was used for evaluation of gel technique. The following materials were used: low ionic salt solution (LISS)/Coombs ID Cards incorporated with AHG, (each plastic card containing six microtubes with approx 35µl

of sephadex gel prepared in a buffer solution along with preservative), sodium azide and specific reagent AHG, ID Centrifuge 6 S, ID diluent – LISS, donor's red cells and recipient's serum.

A 0.8 % suspension of the donor's red cells was prepared by mixing 10 µl of red cells in one ml of LISS (ID diluents). 50 µl of the donor's red cell suspension is added to the microtube, followed by 25 µl of the patient's serum. The card is incubated at 37°C for 15 minutes, then centrifuged in ID centrifuge and results read. No agglutination indicates that the donor's blood is compatible with the recipient and suitable for transfusion. A negative reaction displays pellets of RBCs at the bottom of micro tube with no aggregates in gel matrix. The presence of agglutination is indicative of incompatibility. Positive results are graded for 1+ to 4+. A 4+ reaction is indicated by a solid band of red blood cells (RBCs) on top of the gel. A 3+ reaction displays agglutinated RBCs in the upper half of gel column. A 2+ reaction is characterized by RBC agglutinates dispersed throughout the column, while a 1+ reaction shows RBC aggregates in mainly lower half of the column.

Results

In this series 99.5% samples showed compatibility and 0.5% samples showed incompatibility with Gel card method but by test tube method 100% samples showed compatibility until subjected to IAT using AHG after incubation at 37°C for 60 minutes, where 0.5% samples incompatible with gel card method were also found to be incompatible.

The sensitivity and specificity of both methods is 100% if use of AHG is included in all tests performed by tube method,

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otherwise the specificity of tube method is 99.5%. In the same way positive predictive value is 100% for both methods, but only 99.5% for tube method if IAT (use of AHG) is not included. The 'p' value calculated by using Mantel-Haenszel test done through WHO software EPI Info is 0.0252009, which is considered statistically significant in case use of IAT is not included in tube method.

The average time required for a single compatibility test by Gel card method was approx 15-20 minutes while that for conventional spin tube method was approx 90 minutes including use of AHG (IAT) and approx 20-30 minutes if IAT was not done.

Discussion

The Gel Test was first released in Europe and then in USA [7]. The technology was developed by Lapierre et al [4]. The basic principle of the gel test is that instead of a test tube, the serum and cell reaction takes place in a microtube. Six of such microtubes are embedded in a plastic card to allow ease of handling, testing, reading and disposal [8].

In our study 0.5% samples, which showed agglutination by gel card technique and not by the routine spin tube method, when subjected to 60 minute incubation at 37°C followed by IAT, showed comparable results. Our findings are in agreement with other studies [6,9,10]. Bromilow et al [10], proposed that in gel IAT there is an increased serum to cell ratio and there is no need of wash phase, thus reducing possibility of elution of weakly bound antibodies from red blood cells thereby decreasing chances of false positive or false negative results. Rumsey [7], concluded that gel test is at least as sensitive as an LISS IAT tube test, with a better balance of sensitivity and specificity which is in agreement with our study. Bromilow et al [11], pointed out that gel test increases standardisation of laboratory techniques and introduces more objective reading of hemagglutination reaction. Complete tests remain stable within the gel, allowing rereading and it can be photocopied. The disposal of plastic cards by incineration is easy.

Bromilow [10], states that ID gel system is a simple, sensitive, rapid and innovative method for detection of antigen antibody hemagglutination reaction. Leitch et al [2], stated that the results are stable, thus permitting reading and verification later on. Cate et al [12], found gel system appropriate for detection and identification of antibodies. Kaur et al [6], opined that Diamed gel card system has ease of use, stability of results and enhanced sensitivity. The Gel card method testing takes 15-20 minutes as compared to 90 minutes by the spin

tube method which is an advantage in cases of emergency blood transfusion.

This study shows that gel card method is better than conventional spin tube method because of its simplicity, stability of results, dispensation of controls, absence of wash phase with comparable sensitivity and specificity. We recommend its usage for routine blood group serology in transfusion centres of all hospitals.

Conflicts of Interest

None identified

Intellectual Contribution of Authors

Study Concept : Col D Swarup, Brig PS Dhot

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References

1. Lapierre Y. The gel test: A new approach for detection of red cell antibodies/ antigen in a solid phase. Proceedings of XX Congress of the International Society of Blood Transfusion Society. Manchester: British Blood Transfusion Society, 1988:145.
2. Letich K, Forrest A, Mitchell R. A preliminary trial of the gel test for blood group serology. *Br J Biomed Sci* 1993;50:1.
3. Mollison PL. Blood Transfusion in Clinical Medicine. 9th Edition. Blackwell Scientific Publications, 1993.
4. Lapierre Y, Rigal D. The gel test: A new way to detect red cells antigen - antibody reactions; *Transfusion*. 1990; 30: 109-13.
5. Novaretti MCZ, Jeus ES. Evaluation of a gel test system for the detection of transplacental haemorrhage. *Transfusion* 1994; 34 (Suppl): S 110.
6. Kaur R, Kakkar N, Dhanoa J. Use of gel-based DiaMed - ID microtyping system for cross matching enhances sensitivity. *Indian J Pathol Microbiol* 2003; 46: 617-20.
7. Rumsey DH, Ciesielski DJ. New protocols in serological testing: A review of techniques to meet today's challenges. *Immunohaematology* 2000; 16: 131-7.
8. Malyska H, Weiland D. The gel test. *Lab Med* 1994; 25: 81-5.
9. Novaretti MCZ, Jens ES, et al. Comparison of tube and gel technique for antibody identification. *Immunohaematology* 2000; 16: 138-41.
10. Bromilow IM, Adams KE, Hope J, Eggington JA, Dugid JKM. Evaluation of the ID gel test for antibody screening and identification. *Transfusion Medicine* 1991; 1: 159-61.
11. Bromilow IM. Gel Techniques in blood group serology. *Med Lab Sci* 1992; 49: 129-32.
12. Cate John C, Reilly N. Evaluation and implementation of the gel test for indirect antiglobulin testing in a community hospital laboratory. *Arch of Pathol and Lab Med* 1999; 121: 693-7.