Have we forgotten the importance of ABO blood grouping?

Background

Global haemovigilance data demonstrates that laboratory errors contribute significantly to morbidity and mortality. United Kingdom Serious Hazards of Transfusion (SHOT) data reveals that the largest error category is Incorrect Blood Component Transfused (ICBT), and that this category accounted for 70% of all errors across the first decade of reporting. SHOT reports that 30% of ICBT reports occurred in hospital transfusion laboratories. The 2008 SHOT Annual Report cites a marked increase in ICBT reporting from laboratories possibly due to an increased awareness placed on laboratories due to new government regulations. New Zealand haemovigilance reports for 2008 cite almost 50% of ICBT errors as having occurred in the laboratory. This apparent increase in the reporting of laboratory-based error calls for a re-assessment of staff training and competency and the urgent need to ‘get the basics’ right.

ABO grouping is the most fundamental practice conducted in transfusion laboratories and is also the most important. The introduction of column-based methods and automation in blood grouping may allow for a reduction in the potential for human error, but may also cause reduction in reagent choice and loss of control over the test performance. This study focused on comparing ABO blood grouping method sensitivity, and assessing operator technical ability when performing blood grouping tests.

Methods

In 2004 and 2008, the Royal College of Pathologists of Australasia (RCPA) Transfusion QAP and CSL provided educational exercises with 4 whole blood samples. They included 3 blood group A samples with varying A antigen strengths labelled in the graphs as ‘++’, ‘+’ and ‘+’. The antigen strength of ‘+++’ is equivalent to a strong example of an A, and ‘+’ in between these strengths. A single example of mid-strength A,, was included. All cells were created using KODE™ technology and the plasma in each sample included ABO antibodies to match the cell group. Simulated plasma with appropriate reverse group antibodies was included and the samples were supplied in evacuated blood collection tubes to allow manual and automated systems to test the samples in exactly the same manner as patient samples. These samples were created with the intent to examine the participating laboratories ability to detect weak cell groups, score the reactions seen and interpret the blood groups.

The 2004 survey was distributed to 717 recipient laboratories across Australia and the 2008 survey was distributed to 765 participants. Group and screen methods, reagent manufacturer, scores, result interpretation were recorded and reported. Laboratories were able to record results in more than one platform if that was their routine practice.

What is KODE™ Technology?

CSL Limited has been successfully marketing products in Australia for over six years that have A and B antigens added to red blood cells using KODE™ technology. The Securacell™ and Controcell™ range of quality control products have had carbohydrate A and B antigens, added in precisely controlled amounts in order to create sensitivity controls (Figure 1). These constructs have a Functional Control (F), a Spacer (S) and a Lipid tail (L) eg FSL-A or FSL-B as used in Securacell™ and Controcell™.

Results

The proportion of laboratories that reported using Column-Agglutination Technology (CAT) techniques was relatively stable across both surveys (53% in 2004 and 50% in 2008). In contrast the number of laboratories who reported results in traditional tube techniques declined significantly from 48 to 38% demonstrating an increased reliance on CAT platforms. The most sensitive method (platform plus reagent) across both surveys was deemed to be 100% sensitive and the relative sensitivities of all other methods was calculated. Tube technique was the most sensitive testing platform with a relative sensitivity of 63%, followed by CAT 52%, Microplate 50% and Tile 42%. Tube reagent sensitivities ranged from 0 to 100% with the 3 most commonly used Anti-A reagents having 79%, 56% and 50% relative sensitivity (Figures 2 and 3).

Discussion

In nine instances results were reported with the A cell in the reverse group where no reaction was expected. Analysis of the blood group interpretation showed that there were 85 (3.6%) reports where discrepancies between cell and serum groups were ignored and the blood group interpretation was incorrect.

The KODE™ cells allow comparison of sensitivity of any testing platform, including CAT, where potency assessment by dilution is difficult or impossible. The 2nd International Monoclonal Workshop Data shows all of the submitted monoclonal Anti-A antibodies detected the trisaccharide form of the A antigen as used with the KODE™ technology to transform the O cells to Aweak cells for this study. In particular, reagents that show potent activity with the main antigenic form of the human A antigen (A type 2) also show potent reactivity with A trisaccharide.

The three reagents that failed to detect any of the Aweak cells used in this study were shown to have very low potency using traditional reagent dilution methods and these reagents appear to be targeted at low cost markets. Are these reagents suitable for blood group testing? Do we truly understand the sensitivity of our reagents and equipment? The performance of the ABO group may not be as error-free as we would like to believe. As these results highlight, there appears to be an unacceptable error rate when testing personnel are presented with non-standard blood grouping reactions, particularly those showing weaker than usual forward grouping patterns. In some cases the reverse grouping reactions are also affected which is particularly worrying and in other cases incompatible forward and reverse grouping reactions were reported with no accompanying explanation. This leads to the question of what else may we be missing? Do we have a training and competency issue? Are we missing weak reactions, mixed field, haemolysis? Have we forgotten the importance of the ABO blood group?

References


Figure 1. Insertion of Glycolipids: showing an inserted natural glycolipid and the insertion of a KODE™ glycolipid

Figure 2. ABO Testing 2004 Survey: Platform sensitivity to Aweak cells

Figure 3. ABO Testing 2004 Survey: Platform sensitivity to Aweak cells

Figure 4. ABO Testing 2008 Survey: Platform sensitivity to Aweak cells

Figure 5. ABO Testing 2008 Survey: Platform sensitivity to Aweak cells

Figure 6. ABO Testing 2008 Survey: Tube reagent sensitivity to Aweak cells

Figure 7. ABO Testing 2008 Survey: Tube reagent sensitivity to Aweak cells

The relative sensitivity of the 3 reported CAT brands were 90%, 82% and 39%. Further testing demonstrated this was due to the potency of the A antigens in the columns. A significant increase in overall CAT platform sensitivity for one of the two most commonly used platforms was observed when the 2008 data was compared to the 2004 data (Figures 6 and 7).