Despite known use of antibody screening (AS), it has not been adopted uniformly across blood centers in India. Many centers in India are currently using a type and hold policy with subsequent antihuman globulin (AHG) crossmatch when blood units are requested. The main aim of this study was to assess the benefits of a type and screen (TS) policy in which blood grouping and AS are performed simultaneously during the first hospital visit. If the AS is negative, subsequent requests for blood units would require an immediate spin test (IST) crossmatch with release of blood units, followed by an AHG crossmatch. This prospective, observational study was conducted at a tertiary health care center between July 2014 and December 2018 and included only Indian patients. Blood grouping and AS were performed during the first hospital visit on a total of 22,888 patients; the majority of patients were from hemato-oncology and blood marrow transplant, hepatology and liver transplant, cardiothoracic vascular surgery, and medical intensive care units. Demographic parameters were evaluated for risk of alloimmunization, and a record of the same was maintained. Depending on the AS results, a further course of action was chosen. Clinically significant alloantibodies were detected in 145 patients, and autoantibodies were detected in 53 patients. Alloantibodies were mainly against Rh and Kell blood group antigens. A significantly higher proportion of patients in the AS+ group required blood transfusion when compared with the AS– group. In cases wherein the IST crossmatch was compatible but AHG crossmatch was not, follow-up did not demonstrate any clinical or laboratory evidence of hemolysis. AS is a safe, efficient, and beneficial tool for pretransfusion compatibility testing in both AS+ and AS– patients. With a TS policy, AHG crossmatch can be omitted in AS– patients without compromising safety. 

**Key Words:** type and screen, antibody screening, alloimmunization, DAT, blood transfusion

Antibody screening (AS) is an important component of a pretransfusion immunohematology workup. Type and screen (TS) followed by an immediate spin test (IST) crossmatch is considered superior to type and hold followed by an antihuman globulin (AHG) crossmatch. To make blood transfusions as safe as possible, it is desirable to perform AS for patients using a reagent red blood cell (RBC) panel called an antibody screening panel, which consists of two or more phenotyped RBC reagents. If a clinically significant antibody is detected in a patient, it is important to provide corresponding antigen-negative units to this patient. The TS approach in pretransfusion testing was approved by the U.S. Food and Drug Administration and AABB in 1984, and this approach has been strongly recommended. The first few reports in the literature about the TS approach were published thereafter, establishing that RBC units can be safely transfused without AHG crossmatch in AS– patients. None of the patients in these studies demonstrated any clinical or serologic evidence of hemolysis. The safety of this approach was further evaluated in massive transfusion and also in patients with autoantibodies. The Indian literature has some data in which transfusion safety with the use of TS and IST crossmatch has been compared with AHG crossmatch. These studies have revealed that the TS approach is safe and cost-effective. Despite knowing the use of AS, it has not been uniformly adopted as a part of routine pretransfusion testing by blood transfusion services across India, primarily because transfusion services are decentralized—there are more than 3000 transfusion services across the country, with lack of standardization. Currently, AS is usually performed when an AHG crossmatch shows incompatibility. Therefore, scarce data are available in terms of optimization of RBC antibody detection during pretransfusion testing. Also, most studies do not comment on the population included in the study. With increasing medical tourism in India, multiply transfused patients visit various tertiary care centers in search of better health care; thus, including these patients in the data of Indian studies might lead to overestimation of the prevalence of RBC alloimmunization. The present study was planned to evaluate the use of AS during pretransfusion testing with the following objectives:

1. To study the prevalence of clinically significant antibodies only in the Indian population.
2. To study the advantages of performing TS, providing IST crossmatch–compatible units to AS– patients.
3. To study transfusion-relevant data in AS+ patients.
4) To perform lab evaluation during follow-up of patients transfused with IST crossmatch–compatible but AHG crossmatch–incompatible units.

**Materials and Methods**

This prospective, observational study was conducted at a tertiary health care center in India between July 2014 and December 2018 (54 months). Only Indian patients were included in the study for analysis.

The study protocol was approved by the institutional review board. Because all procedures were standard of care, no additional samples were drawn, and anonymized patient data were analyzed without any active intervention; the Ethics Committee approval was waived. Nevertheless, informed consent for participation in the study was obtained from all patients included in the study.

**Type and Screen**

According to institutional policy, a TS (blood grouping and AS) was performed during the first hospital visit of all patients, regardless of potential need for blood components. When the same patient was admitted to the hospital at a later time and required blood transfusion, a request was generated by the respective department and sent to the RBC serology lab of the transfusion service. The requisition form consisted of demographic data; clinical details; laboratory data; reason for transfusion; required component details; and previous history of blood transfusion, transplant, and pregnancy. Based on the priority, there were three types of requisition forms:

1) **Routine:** Transfusion expected after 12 hours.
2) **Urgent:** Time to transfusion around 2 hours.
3) **Lifesaving:** Units arranged on priority, as soon as possible, or at maximum within 10 minutes of receiving the requisition form.

AS results were checked from the Hospital Information System. If AS had been performed within 3 months, it was not repeated. AS was repeated only in those cases in which either the patient had received blood transfusion after the last AS, there was history of another sensitizing event (i.e., pregnancy or transplant), or if the AS was performed more than 3 months before the date of receiving the request. Depending on results of AS, further course of action was chosen.

If the patient was found to have no unexpected antibody, IST crossmatch–compatible units were issued. In such cases, an AHG crossmatch was performed after issue. In cases in which the AHG crossmatch was compatible, no follow-up was done; in cases in which AHG crossmatch was incompatible, patients were followed up after the transfusion for 7 days. This follow-up was in the form of clinical evaluation as well as laboratory evaluation for hemolysis.

If AS was positive, antibody identification was performed. In cases of the presence of an alloantibody, respective antigen-negative and AHG crossmatch–compatible units or the AHG crossmatch–compatible unit alone (in situations where units were required emergently) were issued to the patient. This decision tree was prepared in accordance with British Committee for Standards in Haematology guidelines. Figure 1 illustrates the institutional algorithm for the pre-transfusion compatibility testing. If an autoantibody was present, a complete serologic evaluation was performed to rule out or rule in the presence of underlying single or multiple alloantibodies. If no underlying alloantibody was identified, either a “best-matched” (defined as an RBC unit for which reaction strength was less than that of the autocontrol strength) or Rh and Kell phenotype-matched, AHG crossmatch–compatible unit was issued to the patient. However, if the patient had alloantibodies along with autoantibodies, an antigen-negative AHG crossmatch–compatible unit with adsorbed plasma was given to the patient. A “best-matched” unit was transfused only when the patient had signs of decompensation and could not wait for serologic evaluation. In lifesaving conditions such as surgical bleed, road traffic accident, or postpartum hemorrhage, as per institutional policy, either group-specific or group O RBCs were issued.

**Patient Sample, Methodology, and Equipment**

**Blood Grouping**

Forward and reverse blood grouping were performed using EDTA and clotted serum blood samples, respectively, by automated hemagglutination (NEO, Gamma Immucor, Houston, TX). Serum sample was preferred over plasma for its complement-containing properties to enhance the detection of complement-dependent antibodies.

**Antibody Screening**

AS was performed using a cotted serum sample collected in a BD (Franklin Lakes, NJ) vacutainer using Capture-R Ready Screen 3 (Gamma Immucor). Samples showing a positive AS were further tested for antibody identification using Capture-R Ready-ID Panels (Gamma Immucor). Whenever necessary, additional testing was carried out by conventional tube testing (CTT) using Panocell-10, ficin-
Advantages of type and screen

treated Panocell-10, and Panocell-20 (Gamma Immucor). A serum sample was preferred over plasma for its complement-containing properties to enhance the detection of complement-dependent antibodies. Depending on the results of AS, patients were divided into two categories: AS+ and AS–.

**Phenotyping**

Rh and Kell typing of donors and patients was performed by automated hemoagglutination (NEO, Gamma Immucor). Typing for other common antigens (k, Jkα, Jkβ, Lea, Leb, M, N, S, Fya, and Fyb) was performed by CTT using antisera (Immucor, Norcross, GA). For s and P1, antigen typing was performed by CTT using Bioclone antisera (Ortho Clinical Diagnostics, Raritan, NJ).

**Direct Antiglobulin Test**

In the case of a positive AS and positive autologous control, autoantibody was suspected, and further serological evaluation was done. Direct antiglobulin testing (DAT) was performed on whole blood samples. Where applicable, adsorption studies were performed using autologous or allogeneic RBCs as per standard operating procedures of the department. Wherever required, elution was performed by acid elution (BAG Healthcare, Lich, Germany).

**AHG and IST Crossmatch**

Both AHG and IST automated hemagglutination crossmatches were performed by NEO (Gamma Immucor) using patient serum and donor RBCs.

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**Fig. 1** Institutional algorithm for pretransfusion compatibility testing. N = number of patients. AHG = antihuman globulin; N* = number of RBC units; IST = immediate spin test.
RBCs for Transfusion

All RBC concentrates were prepared from 450 mL whole blood units collected in a top and bottom blood bag system with inline leukofilter with greater than 3 log reduction capacity. All units were tested for anti-hepatitis C virus (HCV), anti-human immunodeficiency virus (HIV), hepatitis B surface antigen, malaria, and syphilis using chemiluminescence immunoassay (Vitros 3600 Immunodiagnostic System, Ortho Clinical Diagnostics) and HIV, hepatitis B virus (HBV), and HCV using nucleic acid testing (Procleix Ultrio Plus Assay, Grifols, Barcelona, Spain). All RBC units were phenotyped for Rh and Kell antigens (D, C, E, c, e, K) using solid-phase RBC adherence (Galileo NEO, Immucor). In cases wherein an unexpected antibody was detected against an Rh and/or Kell system antigen, antigen-negative units were selected from the inventory in first-in, first-out order. When alloantibody specificity was outside of Rh and Kell systems, antigen typing of donor units was performed accordingly, and antigen-negative units were issued.

Statistical Analysis

Demographic details of the patients and lab results were entered by specialty in a Microsoft (Redmond, WA) Excel sheet. Based on the results of AS, patients were divided into two categories: AS+ and AS−. The independent Student t test was applied for various transfusion parameters to measure the statistical significance between the two groups. Statistical analysis was performed using SPSS software (version 25.0.0.0, IBM, Armonk, NY). A p value <0.05 was considered statistically significant.

Results

Prevalence and Type of Clinically Significant Antibodies Detected in the Patient Population

During the 54 months of the study period, a total of 22,888 patient samples were studied. The majority of patients were from hemato-oncology and blood marrow transplant, hepatobiliary sciences and liver transplant, cardiac surgery, and medical intensive care units (Fig. 2). The prevalence of unexpected antibodies detected in our study was less than 1 percent (0.87%; 198). Of the 198 AS+ patients, 145 (0.63%) were found to have alloantibodies while the remaining 53 (0.24%) had autoantibodies with clinical signs and symptoms suggestive of autoimmune hemolytic anemia (AIHA). Details of the antibodies identified are provided in Tables 1 and 2.
Blood transfusion was the second most common sensitizing event among female patients, but it was the most common sensitizing event in male patients (Table 3). The second most common alloantibody found was anti-E (21 of 127, 16.5%). After the Rh system, Kell was the second most common blood group system in which alloantibodies were detected (11 of 127, 8.7%). In patients who possessed more than one alloantibody, antibodies against the Rh blood group antigens were common to all. In patients making multiple alloantibodies, anti-D was the most common alloantibody detected (12 of 18, 66.6%). Therefore, Rh and Kell were the two most common blood group systems in which alloantibodies were detected (107 of 127, 84.3%).

Alloimmunization was observed to be higher in female patients (99 of 145, 68.3%). Among all alloantibody specificities detected during the study, antibodies were detected at a lower age in female patients compared with male patients except anti-S, which was detected at a lower age in male patients (Table 1).

Among the 22,888 samples on which TS were performed, 53 samples showed panreactivity with reagent screening RBCs. These patients, on further serologic and clinical evaluation, were diagnosed with AIHA, most of which were determined to be warm AIHA (31 of 53, 58.5%). One-fifth of these AIHA (19%) patients had underlying single or multiple alloantibodies as well, most of which were directed against Rh and Kell blood group antigens (Table 2).
Advantages of Antibody Detection in Type and Screen Policy

In approximately one-third of the patients who required blood transfusion (6955 of 22,690, 30.7%), no antibody was detected, and most of these patients required blood transfusion without any priority (on a routine basis) (Table 3). Just 2.2 percent of patients (155 of 6955) required blood transfusion on an urgent or lifesaving basis.

In a large number of patients (6191 of 6955, 89%) in the AS– group, TS had already been performed on a previous visit. In these patients, RBC units were provided in approximately 5 minutes after IST crossmatch. In 764 cases (764 of 6955, 11%) in which TS had not been performed previously, there were 609 (609 of 764, 79.8%) patients who required blood transfusion on an urgent or lifesaving basis.

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In the AS+ group, more than half of the patients had AS performed before the request of blood, and all such patients received blood within the defined time frame. In 45 percent of cases in which AS was positive and autoantibody or alloantibody was detected, the blood transfusion service required more time for immunohematology serologic evaluation of the patient’s sample before making compatible blood available for transfusion. None of the cases were denied for blood transfusion, however. As a result of Rh and Kell phenotyping of all the blood units in inventory, and because most of the antibodies were detected against these antigens, provision of blood became extremely easy in such cases. There were 45 patients who required some delay in surgery or blood transfusion; these patients had either autoantibody with or without alloantibody or antibody against antigens in blood group systems other than Rh or Kell.

Table 3. Demographic, clinical, and transfusion details of patients requiring blood transfusion (N = 22,888)

<table>
<thead>
<tr>
<th></th>
<th>No antibody detected, n (%)</th>
<th>Antibody detected, n (%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of patients</td>
<td>22,690 (99.1)</td>
<td>198 (0.9)</td>
<td>NA</td>
</tr>
<tr>
<td>Age, years</td>
<td>45.8 ± 18.5 (0–93)</td>
<td>32.5 ± 11.7 (5–76)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Male/female ratio</td>
<td>1.6</td>
<td>0.6</td>
<td>NA</td>
</tr>
<tr>
<td>Previous events of sensitization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H/o transfusion</td>
<td>2054/22,690 (9.1)</td>
<td>65/198 (32.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>H/o pregnancy</td>
<td>694/6955 (7.5)</td>
<td>99/122 (81.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>H/o previous transplant</td>
<td>14/22,690 (0.06)</td>
<td>5/198 (2.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Transfusion parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients requiring blood transfusion</td>
<td>6955/22,690 (30.7)</td>
<td>100/198 (50.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Blood units transfused</td>
<td>21,500</td>
<td>548</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>TS available before blood requirement</td>
<td>6191/6955 (89.0)</td>
<td>55/100 (55)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>TS not available before blood requirement</td>
<td>764/6955 (11.0)</td>
<td>45/100 (45)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Urgent need for blood transfusion</td>
<td>106/6955 (1.5)</td>
<td>18/100 (18)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Lifesaving need for blood transfusion</td>
<td>49/6955 (0.7)</td>
<td>7/100 (7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>TAT when no prior TS, minutes</td>
<td>46.22 ± 3.63 (35–60)</td>
<td>240.52 ± 16.34 (110–720)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>TAT when prior TS, minutes</td>
<td>15 ± 4 (3–60)</td>
<td>35 ± 7 (3–720)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Surgery/transfusion postponement due to TAT</td>
<td>0</td>
<td>11/100 (11)</td>
<td>NA</td>
</tr>
<tr>
<td>IST crossmatch–compatible/AHG crossmatch–incompatible</td>
<td>3</td>
<td>0</td>
<td>NA</td>
</tr>
</tbody>
</table>

Values are presented as n (%), n/N (%), or mean ± standard deviation (range).

NA = not applicable; H/o = history of; TS = type and screen; TAT = turnaround time; IST = immediate spin test; AHG = antihuman globulin.

Followed by a comprehensive crossmatch afterwards. In the AS– group, as a result of the TS policy, there were no cases in which blood transfusion or surgery was postponed due to delay in providing units for transfusion.

In the AS+ group, more than half of the patients had AS performed before the request of blood, and all such patients received blood within the defined time frame. In 45 percent of cases in which AS was positive and autoantibody or alloantibody was detected, the blood transfusion service required more time for immunohematology serologic evaluation of the patient’s sample before making compatible blood available for transfusion. None of the cases were denied for blood transfusion, however. As a result of Rh and Kell phenotyping of all the blood units in inventory, and because most of the antibodies were detected against these antigens, provision of blood became extremely easy in such cases. There were 45 patients who required some delay in surgery or blood transfusion; these patients had either autoantibody with or without alloantibody or antibody against antigens in blood group systems other than Rh or Kell.

the highlighted text is not stated in any of the provided tables---should it be added to table 3? Also these numbers do not match numbers in Table 3 for urgent or life saving need???
Follow-Up of Patients Who Were Transfused with IST Crossmatch–Compatible but AHG Crossmatch–Incompatible Blood Units

During the period of study, we identified three cases wherein the IST crossmatch was compatible, but the AHG crossmatch was incompatible. On further serologic evaluation of these cases, two cases were donors found to be DAT+, and the remaining case demonstrated anti-P1. Both of the DAT+ donor units demonstrated reactivity with complement (C3b/C3d) only. During follow-up, none of the cases demonstrated any sign of hemolysis. Post-transfusion DAT was negative in all cases, and other laboratory parameters, both immediately after the transfusion and 7 days post-transfusion, were within their respective normal ranges (Table 4 and Fig. 3).

| Table 4. Post-transfusion follow-up of patients who were AS− IST crossmatch–compatible and AHG crossmatch–incompatible
(n = 3) |
<table>
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<tbody>
<tr>
<td></td>
<td>Immediately after transfusion</td>
<td>Day 1</td>
<td>Day 7</td>
<td>Normal range</td>
</tr>
<tr>
<td>Direct antiglobulin test</td>
<td>Negative</td>
<td>Negative</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Increase in hemoglobin, g/dL</td>
<td>Not done</td>
<td>1.4</td>
<td>1.2</td>
<td>~1</td>
</tr>
<tr>
<td>Urine analysis for RBC (per high power)</td>
<td>Negative</td>
<td>Negative</td>
<td>Negative</td>
<td>0–2</td>
</tr>
<tr>
<td>Serum LDH, U/L</td>
<td>232</td>
<td>211</td>
<td>221</td>
<td>120–246</td>
</tr>
<tr>
<td>Total bilirubin, mg/dL</td>
<td>0.9</td>
<td>0.8</td>
<td>0.9</td>
<td>0.2–1.3</td>
</tr>
<tr>
<td>Indirect bilirubin, mg/dL</td>
<td>0.7</td>
<td>0.6</td>
<td>0.7</td>
<td>0.0–1.1</td>
</tr>
<tr>
<td>Direct bilirubin, mg/dL</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.0–1.1</td>
</tr>
<tr>
<td>Hemoglobinuria</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Plasma hemoglobin, g/dL</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
</tr>
</tbody>
</table>

AS = antibody screening; IST = immediate spin test; AHG = antihuman globulin; RBC = red blood cell; LDH = lactate dehydrogenase.

This study was conducted in a tertiary health care center with a Department of Transfusion Medicine including an advanced immunohematology laboratory, well equipped with reagents and trained personnel to resolve complex cases of immunohematology. The aim of any such laboratory is provision of safe units in the shortest possible span of time. Aggarwal et al.19 conducted a study to assess the TS policy and found that it considerably reduces the turnaround time for issuing compatible units. The findings of the present study were similar to those in the study by Aggarwal et al.19 Almost all patients in the present study received transfusions within the stipulated time—except for 11 patients, in whom serologic evaluation was complex.

The prevalence of unexpected antibodies varies according to the history of sensitizing events like blood transfusion, pregnancy, or transplant. The type of patients and the methods used for detection of these antibodies plays an important role in predicting this prevalence. In multiply transfused patients, reported prevalence has been as high as 38 percent, whereas in patients with no prior history of transfusion, it has been reported as low as 0.12 percent.20–23 Two studies from the Indian subcontinent have reported prevalences of 0.75 percent and 3.4 percent, respectively.16 The prevalence of clinically significant alloantibody in the present study was 0.64 percent—comparable with that reported by Chaudhary and Agarwal.16 The specificity of unexpected antibodies was found to be highest against Rh and Kell antigens, greater than 86 percent. Among the Rh blood group system, alloimmunization against D was found to be the highest. Most of the patients who had anti-D were women of childbearing age. The prevalence of anti-D is highest in antenatal females in India, primarily because of lack of awareness for Rh isoimmunization and inadequate Rh immunoprophylaxis.24 Also, routine antenatal AS is not performed on all pregnant women in our country. However, the present center has a protocol for antenatal AS for all pregnant women.

Higher prevalence of Rh and Kell alloimmunization has been well established among multiply transfused patients and providing compatible units for such patients is a challenge. Transfusion of Rh and Kell phenotype–matched blood is strongly recommended in such cases. Various studies have strongly recommended routine transfusion of Rh and Kell phenotype–matched blood to patients with thalassemia and sickle cell disease for the same reason.25–28 A study from India, however, did not find routine transfusion of Rh and Kell phenotype–matched blood to all patients beneficial.29

The authors concluded that the majority of the patients were non-responders; thus, provision of Rh and Kell phenotype–matched units only to hematopoietic progenitor cell transplant recipients seems the best option for a country like ours. The authors also noted that anti-K was the third most common antibody after anti-D and anti-E. Alloimmunization to K has been well studied in pregnant women and other patient categories, especially thalassemia patients. Pal and Williams30 conducted a population study to identify the current

Discussion

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Question: Table 4 is supposed to have data for these 3 patients but only 1 set of results is stated.
prevalence of RBC alloimmunization among pregnant women and found that anti-E is the most common antibody, followed by anti-D and anti-K. The authors concluded that anti-D alloimmunization has decreased significantly with awareness, with some increase in anti-E and anti-K alloimmunization.

A study from northern India conducted by Elhence et al. demonstrated the same findings among thalassemia patients, in whom anti-K was the second most common antibody after anti-E. Karimi et al. noticed that anti-K was the most common antibody among Iranian transfusion-dependent thalassemia patients. Contrary to these findings, there are some studies where alloimmunization to K has been reported to be very low, even with higher rates of alloantibodies in the Rh blood group system.

Column agglutination technology (CAT) and solid-phase RBC adherence have shown higher sensitivity than CTT methods (93.5–100% for CAT versus 50% for CTT). Bhagwat et al. reported on blood grouping comparing CAT and CTT and found a concordance in results for 942 of 1000 samples (94.2%), discordance for 4 of 1000 (0.4%) samples, and an uninterpretable result for 54 of 1000 samples (5.4%). On resolution, the uninterpretable results reduced to 49 of 1000 samples (4.9%), with 951 of 1000 samples (95.1%) showing concordant results. Similarly, for crossmatching, automated CAT showed concordant results in 887 of 927 crossmatches (95.6%) and discordant results in 3 of 927 crossmatches (0.32%) compared with those by CTT.

Considering safety of blood transfusion, there has been considerable improvement in pretransfusion compatibility testing. In 1984, AABB recommended that AHG crossmatch can be replaced safely by TS and IST crossmatch in patients with negative AS. There are several studies in which the omission of AHG crossmatch has been studied in detail, and it has been established that TS is a more scientific, cost-effective, and efficient method of pretransfusion testing. There are studies in which patients have been followed up after transfusion of AS−, IST crossmatch−compatible and AHG crossmatch−incompatible blood, and they have not shown any signs of a hemolytic transfusion reaction. Therefore, TS with IST crossmatch is an established and preferred pretransfusion compatibility testing method over the conventional type and AHG crossmatch when the AS is negative.

The primary aim of the present study was to assess the practical use of AS during pretransfusion compatibility testing to provide units within the defined turnaround time. In the AS− group, irrespective of the type of request, units were issued within the defined time frame without delay in transfusion or surgical procedure.

Fig. 3 Post-transfusion laboratory follow-up of patients who were AS− and received IST crossmatch−compatible and AHG crossmatch−incompatible RBC units (n = 3). AS = antibody screening; IST = immediate spin test; AHG = antihuman globulin; RBC = red blood cell.
Of the 198 AS+ cases (0.64%), 100 patients required blood transfusion. Only 11 patients in this category did not receive blood units within the defined time frame. These patients had autoantibody with underlying alloantibody(ies) or the antibodies identified were against antigens other than those in the Rh and Kell blood group systems. Providing antigen-negative units to patients with AIHA possessing underlying alloantibody(ies) within the stipulated time is one of the most challenging tasks in transfusion practice. Immunohematology workups like acid elution, autoadsorption or alloadsorption, and minor antigen typing are time-consuming procedures. In alloimmunized patients, those who had antibodies against clinically significant blood group antigens other than those in the Rh and Kell systems also required more time to complete the process of compatibility testing because the present center performs routine phenotyping of donor units for only Rh and Kell antigens. Despite these hurdles, transfusion was not denied to any patient who was AS+.

With reference to the last objective of this study, we followed up on three patients in whom IST crossmatch was compatible but AHG crossmatch was incompatible and who were transfused with AHG crossmatch–incompatible blood. None of these patients had any clinical or laboratory evidence of hemolysis, and their increment in hemoglobin was appropriate. The present study demonstrates the safety of the IST method of crossmatch. In the two cases in which the DAT was positive, no evidence of hemolysis was observed. Although there are studies of DAT+ donors, routine DAT testing in donors is not recommended. The third case identified anti-P1, an antibody that can react at 4°C without being clinically significant. This antibody has been known to give a positive AS and has also demonstrated incompatibility in the AHG phase of crossmatch, where it is considered clinically significant and AHG crossmatch–compatible units are required for the patient.17

Conclusions

In the present study, we have demonstrated that AS is a beneficial tool for pretransfusion compatibility testing. It is safe, efficient, and beneficial in both AS+ and AS− patients. A TS policy for compatibility testing has great usefulness, and AHG crossmatch can be safely omitted in the AS− group without compromising safety of blood transfusion. Optimization of AS during pretransfusion testing increases operational efficiency and helps in inventory management, especially in resource-constrained settings.

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