Prevention of surgical delays by pre-admission type and screen in patients with scheduled surgical procedures: improved efficiency

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Introduction

Ideally, a patient's blood samples are collected in advance of the intended transfusion to allow for the Type and Screen (T&S) test, that is, determination of the patient's ABO group and Rh type and screening for unexpected, clinically significant allo-antibodies[1]. A standard T&S can be completed with 30 minutes. If the screen is negative, ABO-compatible blood from the local inventory can be cross-matched within a matter of minutes. By contrast, if the antibody screen is positive, further (sometimes extensive and time-consuming) work-up is necessary to determine the target antigen and clinical significance, and identifying antigen-negative units can be a lengthy and difficult process. So-called antibodies of "unclear clinical significance" (usually auto-antibodies with possible underlying allo-antibody) are especially problematic because these cases need to be sent to a reference laboratory, and the results may not be available for several days.

At our hospital, T&S samples obtained from patients admitted on the same day as the planned surgery were traditionally sent to the Blood Bank on the morning of the surgery according to the practice of most institutions in the USA[2]. Indeed, in 2003 a College of American Pathologists Q-probe of 8,941 T&S tests in 108 institutions revealed that only 2,095 these cases (23% of total) were sent to the Blood Bank at least 3 days prior to the operation, allowing for adequate work-up[3]. This practice was recognised to result in an unwieldy amount of testing in the Blood Bank during the morning hours (when the bank is usually understaffed) and, consequently, cause delays in blood availability[3-5]. In many instances, the surgeon either had to take the risk of not being able to transfuse if needed or cancel and postpone surgery until the pre-transfusion testing was completed and cross-match compatible blood was obtained[4,5]. To address this problem, the Joint Commission has highlighted the importance of completing the pre-transfusion testing days before the operation is to be performed[6]. Indeed, many hospitals (especially large, academic institutions) have extended the time interval for collection of T&S samples to 30 days prior to surgery[6].

Monmouth Medical Center requires that T&S or type and cross-match (T&C) is done on patients who undergo operations in which significant blood loss is anticipated (the list of these operations is reviewed annually and approved by the Blood Utilisation Committee). In February 2013, we implemented a new pre-admission process that includes T&S testing for these patients at least 6, and no more than 28, days before the date of the elective surgery. Patients with a positive antibody screen are reported to the Anaesthesiology Department (an example of this report is shown in Figure 1) and surgeons are advised of the anticipated delay (if any). In this study, we examined the clinical utility of this approach based on 1 year of experience.

Materials and methods

The prospective study cohort comprised 2,544 patients scheduled to undergo elective surgery with required T&S (or T&C) at our Hospital between February 2013 and July 2014. Pre-admission T&S was performed 6 to 28 days before the date of the operation and then repeated on the day of the operation. A standard ABO and D (Rh) type was performed on a Galileo Echo (Immucor Capture-R Ready Screen solid

Positive Antibody Identification
Monmouth Medical Center
Blood Bank

Attn: Dr. Sandy Paskin, MD

Patient Name	
MR#	
DOB	
Date of Surgery	
Surgeon	
Antibody Identification	
Date Antibody detected	
Blood Type	
Comments	

Reviewed by: Dr. _____, MD Blood Bank Resident

Figure 1 - Form to register the data of patients with positive antibody screen.

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phase system for detecting IgG antibodies, [Immucor, Norcross, GA, USA]). Patients with a positive antibody screen result from the Galileo Echo underwent a repeat screen using the MTS gel technique (MTS Anti-IgG Card -MicroTyping Systems, Pompano Beach, FL, USA). If the screen was again positive, the antibody was identified by the MTS gel technique using commercial red blood cell antibody identification panels phenotyped by the vendor. Samples with a non-specific Coombs' reaction (consistent with an auto-antibody) were sent to our reference laboratory (American Red Cross) to rule out the possibility of an underlying allo-antibody. Patients with a positive screen were reported to the Anaesthesiology Department using a standardised form (Figure 1). In turn, the Anaesthesiology Department informed the patient's physician of the findings and advised the surgeons of possible delays as appropriate. After approval by the Monmouth Medical Center Institutional Research Review Board, the positive screen forms (a total of 58 patients) were reviewed.

Results

Of the 2,544 patients included in our study, 58 (2.2%) had a positive antibody screen (summarised in Table I). The majority of these patients (n=50; 1.9% of the total cohort) had at least one clinically significant allo-antibody, and 12 of these patients (0.5% of total) carried multiple allo-antibodies. A total of 63 allo-antibodies were detected in our 50 patients, generated against 10 different RBC antigens. Eight of the positive T&S cases turned out to represent none-specific Coombs' reactions (consistent with an auto-antibody) with no underlying allo-antibody present (confirmed by the reference laboratory). In our study population, the four most frequent allo-antibodies were anti-E (n=19/63, 30%), anti-D (n=15/63, 24%), anti-C (n=10/63, 16%) and anti-K (n=8/63, 13%), respectively. Other, less common allo-antibodies included anti-Jk^a, anti-Fy^a, anti-M, anti-G, anti-S and anti-C^w (Table I).

Table I - Unexpected allo-antibodies detected during pre-admission testing in 2,544 patients scheduled for elective surgery at Monmouth Medical Center between February 2013 and July 2014.

Alloantibodies	In male	In female	Total
E	6	13	19 (30%)
D	1	14	15 (18%)
K	1	7	8 (16%)
C	2	8	10 (16%)
Jk^a	1	2	3 (5%)
Fy^a	1	1	2 (5%)
G	0	3	3 (2%)
S	0	1	1 (2%)
m	1	0	1 (2%)
CW	0	1	1 (2%)
Total	13 (21%)	50 (79%)	63 (100%)

One of the 12 patients with multiple antibodies (a 43-year old human immunodeficiency virus-positive man with a complex transfusion history) had three allo-antibodies (against C, D, and Jk^a) whereas the other 11 had two allo-antibodies with the most common combination being anti-D and -E (n=5).

Not unexpectedly, more women (n=40, 80%) then men (n=10, 20%) had an unexpected allo-antibody (pregnancy is a well-established cause of allo-immunisation). Type O was the most common ABO type with a positive antibody screen (n=24, 48% of total), followed by type A (n=13, 26%), type B (n=8, 16%) and type AB (n=5, 10%): this is consistent with the frequency of ABO types in the general population. The mean age of female patients was 63 years (range, 30 to 88 years) whereas that of male patients was 74 years (range, 43 to 85 years). Orthopaedic or spine surgery was the leading indication for T&S in both men (n=8) and women (n=19) with a positive antibody screen. In women, the second most common indication was hysterectomy with or without bilateral salpingo-oophorectomy (n=12).

As yet, repeat T&S performed on the day of surgery has not detected any patients with newly formed alloantibodies whose initial screen was negative.

Discussion

Avoidable delays in providing a necessary transfusion should be viewed as process errors[4]. A particularly time-sensitive situation in which delays can be especially problematic involves patients who are taken to the operating room before their pre-transfusion testing is completed. Yet, the AABB Standards are silent regarding the time-frame within which the pre-transfusion (T&S) testing should be completed before elective surgery begins[7]. Consequently, market forces have led to a standard practice of same-day-admission with the T&S sample delivered to the Blood Bank only on the day of the operation[2,3]. Although this practice works well for most patients, a recent College of American Pathologists Q-probe found that a significant subset of patients (2% of total) was put at risk because the T&S collected on the same day as surgery revealed an unexpected allo-antibody[3]. This Q-probe also pointed out that many surgeons may not recognise the time and effort needed to find cross-match compatible blood for patients with a positive T&S: indeed, a recent study reported 12 patients who were either already in or en route to the operating room when the surgery had to be aborted due to lack of available blood[4]. This situation is entirely avoidable if the pre-admission T&S is completed in a timely fashion prior to the surgery.

In our study of 2,544 patients, we found a positive T&S in 58 (2.2%), which turned out to indicate a clinically significant allo-antibody in 50 cases (1.9%). This is similar to the rate reported in the literature (2%), both in the USA[3,8] and Korea[9]. Not unexpectedly, the majority of patients with a positive antibody screen (80% of total) were women who had likely acquired the allo-antibodies during previous pregnancies. The most common allo-antibodies in this population were anti-E (30%) and anti-D (24%), the two most immunogenic members of the Rh group (anti-D prophylaxis does not prevent E-alloimmunisation). Importantly, rescreening the patients by repeat T&S for allo-antibodies on the day of surgery (the T&S is valid for 3 days only) detected no additional cases.

Conclusions

We conclude that universal pre-admission T&S when done 6 to 28 days prior to surgery identifies patients (2.2% of total) who have a positive screen and for whom cross-match compatible blood may not be found in our inventory if the specimen is delivered to the Blood Bank on the day of the operation (as was the practice before February, 2013). Although the number seems small (a total of 58 patients during the study period of 1 year), we consider this improvement as an important patient safety and satisfaction issue and recommend our approach to other hospitals. An added benefit of this programme is that it generates a "historical" T&S record for these patients (required for electronic cross-matching that we intend to implement this year); this record negates the need to obtain two independently drawn T&S tubes on the day of the surgery[10].

Authorship contributions

Data were collected and analysed by ZP. The study was designed and the paper written by AS.

The Authors declare no conflict of interest.

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