Automating the transfusion service in the 21st century

The transfusion service has been the last area of the clinical laboratory to adopt computerization and automation. Increased regulatory scrutiny has certainly limited innovation in US laboratories during the past 10 years. On the other hand, blood bankers have been slow adopters of innovation in general. The impetus for change has been driven from outside the laboratory. Our customers demand faster turnaround times while the number of trained staff available to do the work has decreased. Centralized testing has concentrated the work in large laboratories that can process the volume required to make automation cost-effective. In addition, there has been increased oversight from a variety of voluntary and governmental agencies. As automation has been accepted by technologists and management, smaller institutions are realizing the value in standardizing the testing process.

While computerization of the clinical laboratory has been commonplace since the mid 1980s, as late as 2001, 38.5 percent of the participants in the College of American Pathologists Transfusion Medicine Proficiency Survey J-C reported that the transfusion service in their facility was not computerized.[1] The movement away from dependence on the serologic antiglobulin crossmatch as the primary compatibility test began in the mid 1970s. In 1980, Winn and coworkers[2] published an abstract titled "An extended antibody screen to replace the crossmatch." In 2006, approximately 1750 of the 3733 participants in the College of American Pathologists Transfusion Medicine Proficiency Survey J-B reported routinely using the immediate-spin crossmatch method for qualifying patients.[3] In the same survey, approximately 90 participants reported performing the electronic crossmatch. Controversy still exists about the requirements for an electronic crossmatch. The US Food and Drug Administration recently published draft guidelines[4] to provide assistance to facilities considering designing an electronic crossmatch process.

The cost of blood components has continued to be our most significant operating expense. On the other hand, capital equipment has been relatively inexpensive for the transfusion service. Compared to automated instruments that have a life of 5 to 7 years, view lamps, heat baths, serologic centrifuges, cell washers, refrigerators, freezers, and platelet incubators may still be in service 15 or more years after acquisition. As transfusion services automate, they must now compete with the needs of the other sections of the laboratory for scarce capital equipment dollars.

Transfusion service staff needs to develop more expertise in automation and computerization to be good innovators. Blood center information technology professionals understand that interfacing instruments to existing laboratory information systems can present numerous challenges. On the other hand, transfusion service personnel responsible for implementing automation and interfacing instruments may naively believe it will be easy. They are reassured by both the instrument and the software vendors that successful interfaces are in current operation or in development. Because of individual facility system settings, each interface becomes a new challenge, and implementation may take months to years. While middleware can solve many of the incompatibility issues, such devices do add a layer of complexity to validation and problem solving.

An adage from the early days of computerization goes "if you really want to foul something up, let a computer do it." While some errors can still be blamed on unfortunate programming, the international banking system gives us hope that well-designed and tested software can provide an increased level of safety in the transfusion service, cellular therapy, and tissue implantation. We just need to invest in the resources to do it well.

Most health care facilities continue to use 1960s technology to identify patients—a wrist band that is printed without any machine-readable component and an identification card that embosses paper records. We now have two-dimensional bar codes and radio frequency identification (RFID) as options to traditional linear bar codes. The technology to improve patient safety and transfusion documentation has been available since the 1990s. Few facilities, however, have implemented the use of electronic patient identification from the time the patient enters the health care setting through specimen collection, testing, and finally transfusion of the blood component. The FDA published regulations mandating that all drugs (including blood components) contain a bar code that could be used in tracking drug administration.[5] Their goal was to encourage manufacturers to develop hardware and software to prevent medication and transfusion errors.

Distribution of blood components has traditionally occurred directly from the transfusion service. In larger facilities, blood is often retrieved from blood storage refrigerators in operating suites and in remote site refrigerators. In this issue, Staves and colleagues[6] describe their

TRANSFUSION 2008;48:406-407.

system for remote electronic blood issuing in the setting of cardiac surgery. They report a median release time of 59 seconds and a 52 percent reduction in the number of units issued. This compares favorably with the process improvements reported by Cox and coworkers in 1997,[7] when they reported a release time of approximately 60 seconds and a 25 percent reduction in the number of units requested by the medical staff. If appropriately designed and validated systems are implemented, there can be an increase in transfusion safety, a reduction in the amount of work required to provide blood components, and an increase in nurse, surgeon, and anesthesiologist satisfaction by bringing the component closer to the point of use.

The time is now to ask software vendors and instrument manufacturers to develop systems that can provide seamless computer-assisted verification and documentation of patient identification, from specimen collection to transfusion. Regardless of the media used, bar codes, RFID, or some yet unknown technology, we need software that will provide:

- The use of globally identifiable symbols, codes, and meanings for data transfer;
- Physician order entry including the indications for transfusion;
- Specimen tubes labeled with accession numbers that are generated at the bedside;
- Automated instruments that use the labeling generated at the beside;
- Results that are autoverifed (no human verification or acceptance step) when the data are consistent with previous history;
- ABO and Rh compatibility verification between donor unit and the patient;
- Assistance in identifying antigen-negative blood components and the need for special component processing requirements;
- Documentation of the process steps and unit/patient compatibility when removing components from the storage area (either inside the transfusion service or remotely);
- Documentation of the patient identification process and donor unit before transfusion;
- Documentation of the infusion process including double checking, vital signs, and any adverse reaction of the patient to transfusion;
- A reliable method to determine the patient's transfusion history; and
- Integration with the electronic medical record.

We must begin to use technology to provide a safer and more efficient use of blood components and our human resources. It will be expensive. External forces, however, are now converging to support this costly leap into technology. The Joint Commission and the CAP are now advocates for better patient identification systems. Compartmentalized blood storage refrigerators have been designed with software to dispense units and can be linked to software that can document the transfusion. Medication administration systems are now being developed with a transfusion module, and automation has invaded the confines of the moderately sized hospital transfusion service. Our job is to envision the future transfusion service and tell manufacturers what we need and want in updated versions of their products. The rate of change has increased, even in the transfusion service. It is time to "go for it!"

Suzanne Butch, MA, MT(ASCP)SBB
University of Michigan
Ann Arbor, MI
e-mail: butchs@umich.edu

REFERENCES

1. Transfusion medicine (comprehensive) and education challenge survey 2001 J-C. Northfield (IL): College of American Pathologists; 2001.
2. Winn LC, Svboda R, Hafleight EB, Grumet FC. An extended antibody screen to replace the crossmatch [abstract]. Transfusion 1980;20:651.
3. Transfusion medicine (comprehensive) and education challenge survey 2006 J-B. Northfield (IL): College of American Pathologists; 2006.
4. Guidance for industry, "computer crossmatch" (electronic based testing for the compatibility between the donor's cell type and the recipient's serum or plasma type), Draft Guidance. Rockville (MD): U.S. Food and Drug Administration, Center for Biologics Evaluation and Research (CBER), Food and Drug Administration; 2007 Jun.
5. Code of Federal Regulations 21 CFR 606.121 (c)(13) Container Label.
6. Staves J, Davies A, Kay J, Pearson O, Johnson T, Murphy MF. Electronic remote blood issue: a combination of remote blood issue with a system for end-to-end electronic control of transfusion to provide a "total solution" for a safe and timely hospital blood transfusion service. Transfusion 2008;48:411-19.
7. Cox C, Enno A, Deveridge S, Seldon M, Richards R, Martens V, Woodford P. Remote electronic blood release system. Transfusion 1997;37:960-4.