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The role of blood bank services in supporting interventional radiology procedures: A Comprehensive Review

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Abstract
Interventional Radiology (IR) has transformed modern medicine by providing minimally invasive image-guided procedures that offer reduced morbidity, shorter hospital stays, and improved patient outcomes compared with conventional surgery. Despite these advantages, many interventional radiology procedures carry a substantial risk of hemorrhage, particularly complex vascular interventions, oncological embolization procedures, trauma management, and hepatobiliary interventions. Consequently, timely availability of safe blood components has become an indispensable component of peri-procedural patient care. Blood bank services play a critical role in ensuring uninterrupted access to compatible blood products, maintaining adequate inventories, supporting emergency transfusion requirements, and implementing patient blood management strategies that optimize clinical outcomes while minimizing unnecessary transfusions.
This review examines the evolving role of blood bank services in supporting interventional radiology practice. The article discusses the historical development of interventional radiology and its increasing reliance on transfusion medicine, highlights blood component utilization during various IR procedures, and explores inventory management, emergency blood release protocols, massive transfusion strategies, point-of-care coagulation testing, hemovigilance, and patient blood management initiatives. Furthermore, emerging technologies such as artificial intelligence, machine learning, predictive blood inventory systems, and digital blood bank integration are evaluated for their potential to improve transfusion efficiency and reduce blood wastage.
Recent evidence indicates that multidisciplinary collaboration between interventional radiologists, transfusion medicine specialists, anesthesiologists, and laboratory personnel significantly enhances procedural safety, optimizes blood utilization, and improves patient outcomes. Future developments in precision transfusion medicine and predictive analytics are expected to further strengthen the integration of blood bank services into interventional radiology workflows. Continued research and implementation of evidence-based transfusion practices will be essential for maximizing clinical effectiveness while ensuring sustainable blood resource management.

Keywords: Interventional radiology, blood bank services, blood transfusion, packed red blood cells, fresh frozen Plasma, platelet transfusion, cryoprecipitate, patient blood management, hemovigilance, massive transfusion protocol

Introduction

Interventional Radiology (IR) has emerged as one of the most significant innovations in modern healthcare over the past five decades. By combining advanced imaging technologies with minimally invasive therapeutic techniques, IR has transformed the diagnosis and management of numerous vascular and non-vascular diseases. Procedures such as angioplasty, arterial embolization, thrombolysis, transjugular intrahepatic portosystemic shunt (TIPS), image-guided tumor ablation, biliary drainage, nephrostomy, uterine artery embolization, and vascular stenting have become routine components of clinical practice. Compared with open surgical interventions, these procedures offer reduced postoperative pain, shorter hospitalization, faster recovery, lower infection rates, and improved patient satisfaction.

However, despite their minimally invasive nature, many interventional radiology procedures involve manipulation of highly vascular organs and major blood vessels. Hemorrhagic complications remain among the most serious adverse events associated with IR, particularly during trauma embolization, hepatic interventions, portal hypertension procedures, complex vascular reconstructions, and oncological embolization therapies. Patients undergoing these interventions frequently present with coagulopathies, thrombocytopenia, liver dysfunction, malignancies, anticoagulant therapy, or massive traumatic injuries, all of which increase transfusion requirements. Consequently, blood transfusion support has become an integral component of comprehensive interventional radiology practice.

The blood bank serves as a cornerstone of peri-procedural patient management by ensuring the timely provision of compatible blood components, including packed red blood cells (PRBCs), fresh frozen plasma (FFP), platelet concentrates, and cryoprecipitate. Beyond routine blood supply, modern transfusion services provide antibody screening, compatibility testing, emergency uncrossmatched blood release, massive transfusion protocol activation, blood inventory optimization, hemovigilance monitoring, and transfusion reaction management. These services collectively contribute to procedural safety and improved clinical outcomes.

Recent advances in transfusion medicine have shifted clinical practice away from liberal transfusion strategies toward evidence-based patient blood management (PBM).

PBM emphasizes optimization of endogenous red cell mass, minimization of blood loss, and individualized transfusion decisions based on physiological parameters rather than arbitrary laboratory thresholds. This paradigm has significantly reduced unnecessary transfusions while preserving limited blood resources without compromising patient safety.

The increasing complexity of interventional radiology procedures has simultaneously increased demands on blood banks. High-volume tertiary care centers frequently perform emergency embolizations for trauma patients, ruptured aneurysms, gastrointestinal bleeding, postpartum hemorrhage, and vascular catastrophes requiring immediate blood component availability. Delays in blood product delivery during these emergencies can substantially increase procedural morbidity and mortality. Therefore, seamless communication between interventional radiology suites and transfusion medicine laboratories is essential for rapid clinical decision-making.

Another important consideration is inventory management. Blood products possess limited shelf lives, making efficient inventory control a critical challenge for hospital blood banks. PRBCs generally remain viable for approximately 35–42 days depending on preservative solutions, whereas platelet concentrates require continuous agitation and expire within 5–7 days. Fresh frozen plasma and cryoprecipitate require strict temperature-controlled storage and thawing protocols before administration. Balancing adequate inventory for emergency procedures while minimizing wastage requires sophisticated forecasting and coordination between blood bank personnel and clinical teams.

Technological innovations are reshaping both interventional radiology and transfusion medicine. Digital blood bank systems, barcode-based tracking, radiofrequency identification (RFID), electronic crossmatching, machine learning algorithms, and artificial intelligence-based inventory prediction models are increasingly being implemented to improve transfusion efficiency, enhance patient safety, and reduce blood component wastage. Point-of-care coagulation testing using thromboelastography (TEG) and rotational thromboelastometry (ROTEM) further enables individualized transfusion therapy by providing real-time assessments of coagulation status during complex interventions.

The integration of these technologies supports precision transfusion medicine, allowing clinicians to administer the right blood component to the right patient at the right time. Such approaches are particularly valuable in interventional radiology, where rapid changes in patient hemodynamics may necessitate immediate adjustments in transfusion strategies.

Despite growing recognition of the importance of blood bank support in IR, the available literature remains fragmented, often focusing on individual procedures or isolated transfusion practices rather than providing a comprehensive overview. Moreover, substantial variations exist among institutions regarding transfusion thresholds, emergency blood release protocols, inventory management strategies, and patient blood management implementation. These differences underscore the need for a consolidated review that synthesizes current evidence and identifies opportunities for improving collaboration between interventional radiology and transfusion medicine.

The present review aims to critically evaluate the expanding role of blood bank services in supporting interventional radiology procedures. It examines the utilization of various blood components, discusses current transfusion practices, highlights challenges in emergency blood support, and explores emerging technologies that may optimize blood resource management. By integrating recent evidence from transfusion medicine and interventional radiology, this review seeks to provide clinicians, transfusion specialists, researchers, and healthcare administrators with a comprehensive understanding of how coordinated blood bank services contribute to safer, more efficient, and patient-centered interventional care.

Evolution of Blood Bank Support in Interventional Radiology

The development of interventional radiology has been accompanied by significant advances in transfusion medicine. Early image-guided procedures were relatively simple and associated with minimal blood loss; consequently, blood transfusion was largely reactive and administered only after significant hemorrhage occurred. As the complexity of IR procedures increased, clinicians recognized the importance of anticipating transfusion requirements before interventions rather than responding only after complications developed.

Modern blood banks now function as active clinical partners throughout the patient's treatment journey. Before high-risk procedures, blood grouping, antibody screening, compatibility testing, and reservation of appropriate blood components are routinely performed to avoid delays if transfusion becomes necessary. This proactive strategy has improved procedural preparedness, reduced treatment interruptions, and enhanced patient safety.

The introduction of standardized massive transfusion protocols (MTPs) has further strengthened emergency preparedness. These protocols enable rapid delivery of packed red blood cells (PRBCs), fresh frozen plasma (FFP), platelets, and cryoprecipitate in patients experiencing life-threatening hemorrhage. Simultaneously, the adoption of Patient Blood Management (PBM) principles has shifted clinical practice toward optimizing patients' own blood resources, correcting anemia before procedures, minimizing blood loss, and using restrictive transfusion strategies whenever appropriate. These developments have reduced unnecessary transfusions while improving overall clinical outcomes.

Blood Bank Services Throughout the Interventional Radiology Workflow

Blood bank involvement begins long before an interventional procedure and continues well after its completion. During the pre-procedural phase, laboratory personnel perform ABO and Rh typing, antibody screening, crossmatching, and review previous transfusion histories to identify potential compatibility issues. Patients with liver disease, malignancy, thrombocytopenia, trauma, or coagulation disorders require individualized transfusion planning because of their increased bleeding risk. Early communication between the blood bank and the interventional radiology team ensures that adequate blood products are readily available for high-risk procedures.

During the procedure, the patient's clinical condition can change rapidly, particularly in emergency interventions. Blood banks must therefore maintain continuous readiness to provide additional blood components with minimal delay.

Efficient communication systems and streamlined transport mechanisms have significantly reduced turnaround times, allowing emergency blood products to reach the IR suite within minutes. Such rapid response is especially critical during trauma embolization, ruptured aneurysms, postpartum hemorrhage, and severe gastrointestinal bleeding, where prompt transfusion can be life-saving.

Following the procedure, blood bank responsibilities extend beyond supplying blood products. Documentation of blood utilization, monitoring for transfusion reactions, investigation of adverse events, traceability of blood components, and quality assurance activities all contribute to maintaining safe transfusion practices. Information collected through post-transfusion surveillance also supports hospital transfusion committees in evaluating transfusion appropriateness and refining institutional policies.

Blood Components Used in Interventional Radiology

Selection of the appropriate blood component depends on the patient's clinical condition, laboratory findings, and the nature of the procedure. Packed red blood cells remain the most frequently administered blood product during interventional radiology because they restore oxygen-carrying capacity following acute blood loss or severe anemia. Current evidence favors restrictive transfusion strategies in clinically stable patients, reserving transfusion for situations where it is likely to improve oxygen delivery and patient outcomes rather than relying solely on laboratory values.

Fresh frozen plasma is primarily used to replace deficient coagulation factors in patients with liver disease, disseminated intravascular coagulation, or active bleeding associated with abnormal coagulation profiles. Unlike PRBCs, plasma should not be administered simply for volume replacement because excessive transfusion may contribute to fluid overload and pulmonary complications.

Platelet concentrates are indicated in patients with thrombocytopenia or platelet dysfunction who are undergoing procedures with an increased risk of bleeding. Recommended platelet thresholds vary according to procedural complexity, with higher counts generally required for neurovascular or other high-risk interventions. Cryoprecipitate provides concentrated fibrinogen and selected coagulation factors and is particularly valuable during massive hemorrhage or in patients with hypofibrinogenemia. Maintaining adequate fibrinogen levels is increasingly recognized as an important aspect of hemorrhage control, particularly in trauma, liver disease, and obstetric emergencies.

Although blood transfusion can be life-saving, clinicians must remain aware of potential complications such as transfusion-associated circulatory overload, transfusion-related acute lung injury, allergic reactions, febrile reactions, alloimmunization, and, rarely, infectious disease transmission. Careful patient selection and adherence to evidence-based transfusion guidelines remain fundamental to minimizing these risks.

Inventory Management and Emergency Blood Support

Efficient blood inventory management is essential because blood components have limited shelf lives and unpredictable demand. Emergency interventional procedures often require immediate access to blood products, whereas elective cases may not ultimately require transfusion despite prior reservation of blood units. Consequently, blood banks must balance adequate emergency preparedness with responsible utilization of available resources.

Many institutions have adopted electronic inventory systems that continuously monitor stock levels, automate inventory rotation, and generate alerts when supplies become critically low. Blood ordering policies such as the Maximum Surgical Blood Ordering Schedule, type-and-screen protocols, and electronic crossmatching have reduced unnecessary reservation of blood products while maintaining rapid availability for patients who genuinely require transfusion. Continuous temperature monitoring, validated transport systems, and strict cold-chain maintenance further preserve blood quality and minimize wastage.

Emergency blood release protocols are particularly important when patients present with uncontrolled hemorrhage. In situations where compatibility testing cannot be completed immediately, uncrossmatched group O blood may be issued according to institutional policies until fully compatible units become available. Successful implementation of these protocols depends on clear communication between clinicians and transfusion medicine specialists, ensuring rapid response without compromising patient safety.

Massive Transfusion Protocols and Point-of-Care Coagulation Testing

Major hemorrhage remains one of the most serious complications encountered during complex interventional radiology procedures, particularly in trauma, ruptured aneurysms, gastrointestinal bleeding, and obstetric emergencies. In such situations, rapid restoration of circulating blood volume and correction of coagulation abnormalities are essential to prevent organ failure and improve survival. To address these challenges, most tertiary healthcare institutions have implemented Massive Transfusion Protocols (MTPs), which provide a standardized framework for the prompt delivery of blood components during life-threatening bleeding.

Unlike traditional transfusion practices that primarily focused on replacing red blood cells, modern MTPs emphasize balanced transfusion using packed red blood cells, fresh frozen plasma, platelets, and cryoprecipitate. This approach not only restores oxygen-carrying capacity but also corrects coagulation factor deficiencies and platelet dysfunction that commonly develop during massive hemorrhage. Early activation of MTPs has been associated with faster hemorrhage control, reduced mortality, and improved coordination among emergency physicians, anesthesiologists, transfusion medicine specialists, and interventional radiologists.

Recent advances in coagulation assessment have further improved transfusion practices. Conventional laboratory tests such as prothrombin time, activated partial thromboplastin time, and international normalized ratio often require considerable processing time and provide only a limited assessment of the coagulation process. In contrast, point-of-care technologies such as thromboelastography (TEG) and rotational thromboelastometry (ROTEM) provide rapid, bedside evaluation of clot formation, clot strength, fibrinogen function, platelet activity, and fibrinolysis. These techniques enable clinicians to identify the specific cause of bleeding and administer targeted blood components instead of relying on empirical transfusion. The

use of TEG- or ROTEM-guided transfusion has been shown to reduce unnecessary blood product utilization while improving hemostatic management and patient outcomes.

Patient Blood Management and Transfusion Safety

The concept of Patient Blood Management (PBM) has significantly changed modern transfusion practice by encouraging clinicians to optimize the patient's physiological condition before considering blood transfusion. Rather than treating laboratory values alone, PBM promotes individualized clinical decision-making based on the patient's symptoms, hemodynamic status, ongoing blood loss, and overall medical condition.

The first principle of PBM focuses on identifying and correcting anemia before elective procedures through iron supplementation, vitamin replacement, or erythropoiesis-stimulating agents when appropriate. The second emphasizes minimizing procedural blood loss by optimizing coagulation status, using image-guided vascular access, adopting meticulous procedural techniques, and promptly managing bleeding complications. The third principle encourages clinicians to improve patients' tolerance to anemia and avoid unnecessary transfusions whenever possible. Collectively, these strategies have been associated with lower transfusion rates, fewer transfusion-related complications, shorter hospital stays, and more efficient utilization of limited blood resources.

Although transfusion therapy is often indispensable, it is not without risk. Patients undergoing interventional radiology procedures may experience adverse reactions ranging from mild febrile or allergic reactions to serious complications such as acute hemolytic transfusion reactions, transfusion-related acute lung injury (TRALI), and transfusion-associated circulatory overload (TACO). Careful patient identification, compatibility testing, continuous monitoring during transfusion, and prompt recognition of adverse events remain essential for ensuring patient safety.

Hemovigilance programs provide an additional layer of protection by monitoring the entire transfusion process, from donor selection to post-transfusion follow-up. Comprehensive documentation, traceability of blood products, adverse event reporting, regular audits, and continuous staff training enable healthcare institutions to identify preventable errors and implement quality improvement measures. Strong hemovigilance systems not only improve patient safety but also contribute to evidence-based refinement of institutional transfusion policies.

Blood Inventory Optimization and Emerging Technologies

Efficient management of blood inventories remains one of the greatest challenges faced by hospital blood banks. Blood components are valuable biological resources with limited shelf lives, making both shortages and wastage significant concerns. Elective interventional radiology procedures frequently involve precautionary blood reservations that may ultimately remain unused, whereas emergency procedures often require immediate access to multiple blood components. Maintaining an appropriate balance between preparedness and conservation therefore requires careful planning and continuous monitoring.

Several evidence-based strategies have been introduced to optimize inventory management. Electronic crossmatching, type-and-screen protocols, maximum surgical blood ordering schedules, and first-expiry-first-out inventory rotation have substantially reduced unnecessary blood reservations and component wastage. Integration of blood bank information systems with hospital electronic medical records has further improved communication between clinical departments and transfusion services, facilitating real-time monitoring of blood availability and more efficient allocation of resources.

Digital transformation is increasingly reshaping transfusion medicine. Automated barcode systems, radio-frequency identification (RFID), electronic compatibility testing, and integrated laboratory information systems have enhanced traceability while reducing clerical errors. These technologies enable accurate tracking of blood products throughout the transfusion chain and strengthen overall quality assurance.

Artificial intelligence (AI) and machine learning are expected to play an increasingly important role in the future of blood bank management. Predictive algorithms can analyze historical transfusion data, procedural complexity, seasonal variations, and hospital workload to forecast blood demand more accurately. Such systems may assist blood banks in optimizing inventory levels, reducing shortages, minimizing expiry-related wastage, and improving emergency preparedness.

Machine learning models also show promise in predicting peri-procedural bleeding risk, estimating transfusion requirements, and identifying patients at increased risk of massive hemorrhage. Although these technologies remain under evaluation, they have the potential to complement clinical judgment by supporting personalized transfusion planning and improving resource utilization. Successful implementation, however, will require high-quality clinical data, rigorous validation, standardized protocols, and ongoing collaboration between clinicians, transfusion medicine specialists, and information technology experts.

Future Perspectives

The growing complexity of interventional radiology procedures will continue to increase the demand for highly coordinated transfusion support. Future developments are expected to focus on precision medicine, personalized transfusion strategies, molecular blood group genotyping, and advanced clinical decision-support systems. Broader implementation of Patient Blood Management programs and point-of-care coagulation testing is likely to further reduce unnecessary transfusions while improving patient outcomes.

Regional blood-sharing networks, cloud-based inventory management systems, and integrated digital platforms may strengthen emergency preparedness by facilitating rapid redistribution of blood products during disasters and mass casualty incidents. At the same time, artificial intelligence has the potential to revolutionize inventory forecasting, automate blood allocation, and support individualized transfusion decisions based on patient-specific risk profiles.

Despite these advances, significant variation persists among healthcare institutions regarding transfusion thresholds, emergency blood release policies, and implementation of advanced technologies. Future multicenter studies are therefore needed to establish standardized, evidence-based guidelines specific to interventional radiology and to evaluate the long-term clinical and economic benefits of digital innovations in transfusion medicine.

Conclusion

Interventional radiology has become an indispensable component of modern healthcare, providing safe and effective minimally invasive treatment for a wide range of vascular and non-vascular diseases. As procedural complexity continues to increase, the importance of comprehensive blood bank support has become more evident. Contemporary blood banks contribute far beyond the provision of blood products, serving as essential clinical partners responsible for compatibility testing, inventory management, emergency blood release, massive transfusion support, transfusion safety, and patient blood management.

The integration of standardized transfusion protocols, point-of-care coagulation testing, and evidence-based Patient Blood Management strategies has improved hemorrhage control, reduced unnecessary transfusions, and enhanced overall patient safety. Furthermore, advances in digital technologies, artificial intelligence, and predictive analytics offer promising opportunities to optimize blood inventory management and support more individualized transfusion practices.

Continued multidisciplinary collaboration among interventional radiologists, anesthesiologists, hematologists, transfusion medicine specialists, and laboratory professionals will be essential for translating these innovations into routine clinical practice. Strengthening evidence-based protocols, expanding digital integration, and promoting responsible blood utilization will not only improve procedural outcomes but also ensure the sustainable use of this limited and invaluable healthcare resource.

References

1. Carson JL, Guyatt G, Heddle NM, *et al.* Clinical practice guidelines from the AABB: Red blood cell transfusion, international guidelines. JAMA, 2023.
2. Pagano mb, Stanworth SJ, Valentine S, *et al*. The 2023 AABB international guidelines for red blood cell transfusions: What is new? Transfusion,2024:64(4):727–732. doi:10.1111/trf.17764.
3. Association for the Advancement of Blood & Biotherapies (AABB). Standards for a Patient Blood Management Program. 5th ed. Bethesda, MD: AABB; 2025.
4. World Health Organization. Guidance on Implementing Patient Blood Management. Geneva: WHO, 2025.
5. AABB. Patient Blood Management Toolkit. Bethesda, MD: AABB; 2025.
6. Shaz BH, Hillyer CD, Abrams CS, Roshal M, editors. Transfusion Medicine and Hemostasis. 3rd ed. Elsevier; 2022.
7. Murphy MF, Pamphilon DH, Heddle NM. Practical Transfusion Medicine. 6th ed. Wiley-Blackwell; 2021.
8. Fung MK, Grossman BJ, Hillyer CD, Westhoff CM, editors. Technical Manual. 21st ed. Bethesda: AABB, 2023.
9. Klein HG, Anstee DJ. Mollison's Blood Transfusion in Clinical Medicine. 13th ed. Wiley-Blackwell, 2022.
10. Clevenger B, Richards T. Patient blood management to reduce surgical transfusion. Br J Surg, 2020.
11. Muñoz M, Acheson AG, Auerbach M, *et al*. International consensus statement on perioperative patient blood management. Anaesthesia, 2020.
12. Frank SM, Thakkar RN, Podlasek SJ, *et al*. Implementing patient blood management in clinical practice. Anesthesiology Clinics, 2020.
13. Leahy MF, Hofmann A, Towler S, *et al*. Improved outcomes through patient blood management. Transfusion Medicine Reviews, 2021.
14. Stanworth SJ, New HV, Apelseth TO, *et al*. Effects of restrictive versus liberal transfusion strategies: updated evidence reviewTransfusion, 2021.
15. Goel R, Ness PM, Takemoto CM, *et al*. Platelet transfusion practices in modern transfusion medicine. Blood, 2021.
16. Kaufman RM, Djulbegovic B, Gernsheimer T, *et al*. Platelet transfusion: Clinical practice guideline. Ann Intern Med, 2015.
17. Callum JL, Pinkerton PH, Lima A, *et al*. Bloody Easy 5: Blood Transfusions, Blood Alternatives and Transfusion Reactions. Ontario Regional Blood Coordinating Network, 2022.
18. Estcourt LJ, Malouf R, Trivella M, *et al*. Platelet transfusions prior to surgery for people with thrombocytopenia. Cochrane Database Syst Rev, 2021.
19. Hunt BJ. Bleeding and coagulopathies in critical care. N Engl J Med, 2020.
20. Levy JH, Moore KT, Neal MD, *et al*. Massive transfusion management and trauma resuscitation. Anesthesiology, 2020.
21. Spahn DR, Bouillon B, Cerny V, *et al*. European guideline on management of major bleeding and coagulopathy following trauma. Crit Care, 2023.
22. American College of Surgeons Committee on Trauma. Advanced Trauma Life Support (ATLS®) Student Course Manual. 11th ed. Chicago: ACS, 2023.
23. Society of Interventional Radiology. Consensus guidelines for periprocedural management of thrombotic and bleeding risk in image-guided interventions. J Vasc Interv Radiol, 2019.
24. Patel IJ, Rahim S, Davidson JC, *et al*. Society of Interventional Radiology consensus guidelines for periprocedural management of thrombotic and bleeding risk. J Vasc Interv Radiol, 2019.
25. Dariushnia SR, Gill AE, Martin LG, *et al*. Quality improvement guidelines for interventional radiology procedures. J Vasc Interv Radiol, 2020.
26. Kaatz S, Ahmad D, Spyropoulos AC, Schulman S. Guidance on reversal of anticoagulants. J Thromb Thrombolysis, 2020.
27. Kozek-Langenecker SA, Ahmed AB, Afshari A, *et al*. Management of severe perioperative bleeding: Updated ESAIC guidelines. Eur J Anaesthesiol, 2023.
28. Nice. Blood Transfusion Guideline. Updated edition. London: National Institute for Health and Care Excellence, 2026.
29. ISBT Working Party on Haemovigilance. International haemovigilance recommendations. International Society of Blood Transfusion, 2022.
30. Bolton-Maggs PHB, Poles D, Watt A, Thomas D, Cohen H. The UK Serious Hazards of Transfusion (SHOT) Annual Report. Manchester: SHOT, 2023.