Complications in Whole Blood Donors: Facts and Myths – A Comprehensive Review

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Abstract Introduction

Almost 120 millions of blood units is donated every year. According to global data almost 6.5% of population are blood donors. This great amount is still not enough to satisfy global need, a lot of patients that need regular blood transfusion do not have access to a safe blood. Many therapies today rely on the availability of blood products and blood can be stored only for a specific time concluding that the need for donation is regular. To encourage people to donate blood medical community must provide reliable information so that blood donors could feel safe and taken care of. Blood donation is considered a safe procedure, however, in some cases, complications may occur, which are discussed in the article below.

Purpose

The aim of the study is to compare available sources of factual and nonfactual complications in whole blood donor. Among society there are lots of contradictory information that can influence on total amount of blood donation and readiness to become a blood donor. In this article we tried to dispel doubts.

Materials and methods

A literature review was conducted using PubMed as the primary database Google Scholar and medical literature. The search terms included: blood donor, blood donation, low hemoglobin, complication, vasovagal reaction, hypertension.

Results

Overall complication rate is about 6.3/1000 donations and is significantly higher for component blood donation using the automated method compared to whole blood donation using the manual method. The exact number of all complications varies depending on the data source, the classification criteria used and country. The medical staff responsible for overseeing the donation process is obligated to provide donors with optimal conditions and proper preparation before donation in order to minimize the risk of complications that may negatively affect the quality of blood and its components, as well as the willingness and readiness of donors to give blood.

Keywords: blood donation, complications, blood donor, hypertension, low hemoglobin, serum ferritin

1. Introduction – about the procedure

Blood donation is a safe process and well-regulated process (1,2). On the day of donation, the donor should feel healthy and well, as their well-being is important for blood service. Typically, blood donation process involves several key steps: registration, medical screening and the actual collection of blood. During registration, the donor's identity is verified and they receive essential information about the donation procedure and post-donation care. Next is the medical examination, during which the physician collects information about the donor's age, weight, chronic illnesses, potential exposure to transmissible infections, travel to endemic areas, pregnancy or breastfeeding status, recent surgeries or hospital stays, and currently taken medications. Lifestyle factors such as the frequency of previous donations, iron supplementation, hydration status, and recent meals are also reviewed to confirm eligibility (3). The donor undergoes physical examination, which includes checking body temperature, blood pressure, pulse, skin condition, and red blood cell or hemoglobin levels. If all criteria are met, the donation proceeds. The donor is seated comfortably, and the arm is cleaned and sterilized. Blood bag and the needle used to collect blood are sterile and can't be reused to ensure the process is completely safe. The actual blood collection takes only about 8-10 minutes on average. A standard whole blood donation collects approximately 450-500 milliliters of blood.

After donation, donor is advised to rest and if they feel well they can leave shortly after (2).

2. Complications

2a. Mild complications

The risk of complications related to blood donation is low. The most common and typically mild side effects are mostly caused by the needle that is inserted through the skin, which can lead to minor tissue injury such as bruising, localized pain and swelling. Other mild complications include fainting and nerve irritation, which occur at a frequency raging from about 1 in 10 to 1 in 1000 donations, depending on individual risk factors (4). Certain groups are more prone to these reactions. Younger individuals, female, and first-time donors are statistically at greater risk of feeling faint during the donation process. For instance, a first-time female donor faces roughly a 10% chance of fainting, compared to just 2% for a female donor with prior experience (5). These reactions are typically harmless and are often linked to anxiety, dehydration, or low blood pressure. Blood donation staff are trained to manage such events promptly by having donor lie down, elevate their legs, and hydrate post-donation to aid recovery.

2b. Vasovagal reaction (VVR)

This is one of the most common adverse events associated with whole blood donation and is considered more serious than other mild complications due to its potential to cause loss of consciousness and injury (6). The mechanism of VVR is linked to sudden vasodilatation, reduced blood pressure, decreased cardiac output, and cardio-inhibitory reflex, which together may be triggered by anxiety, pain, or mild hypovolemia from blood loss during donation (7). VVR can be classified based on the timing of onset – immediate which occurs during or shortly after donation and delayed which can occur outside the donation center, usually within 24 hours following donation (8). The overall prevalence of VVR is estimated to be around 25 per 1000 donations, although this number varies depending on the study population, blood center, and country (9,10).

Multiple studies agree that the rate of incidence is higher for first-time donors compared to repeated donors. The risk is further increased in female donors and those of younger age (8,9,11,12). Other contributing factors include low weight, and pre-donation hypotension, and stress or anxiety related to the donation experience (12–14). The patophysiology of VVR can be divided into four distinct phases: early stabilization, circulatory instability (early presyncope), terminal hypotension (late presyncope), and recovery (7). Most donors who experience VVR are found to be in phase 2. Usually we find blood donors in stage 2, which is characterized by dizziness, nausea, and lightheadedness

without full syncope. Unfortunately, donors who experience a vasovagal reaction are less likely to return for future donations (3,15).

2c. Low hemoglobin

Low hemoglobin deferral occurs often; it affects about 10% of whole blood donations and usually is consequence of iron deficiency anemia (16). This can happen in frequent donor because blood donation removes a lot of iron from the donor's body and the 8-weeks minimum inter-donation interval is not enough for recovery of hemoglobin and restoration of iron supplies. Donation causes an estimated 80-88g loss of hemoglobin per whole blood donation in women (based on a normal range of Hb 12.5-16 g/dL) and results in a 204 to 299 mg loss of iron, so donation has great impact on iron deficiency. The most vulnerable group is pre-menopausal women, who often suffer from low hemoglobin and iron deficiency anemia because of menstruation and pregnancy—they may already have low hemoglobin before their first donation attempt (17,18). Other causes can include unrecognized malignancy in relatively healthy person. Regular and repeated blood donation reduces body iron stores, which leads to low hemoglobin. If iron removed from the body is not replaced, the donor can develop anemia (19). Furthermore hemoglobin itself is not adequate measure to detect iron deficiency (20,21). Research show that the rate of deferral due to low hemoglobin is lower in donors who take iron supplements compared with those who do not (20). Iron supplementation needs to be considered in regular, repeat blood donors (20,22).

2d. Low serum Ferritin

Serum ferritin is the most reliable marker for evaluating iron stores in the body. Studies have found that serum ferritin levels are significantly lower among regular blood donors compared to first-time donors (23). This decrease is gradual and directly related to the number and frequency of donations, highlighting the cumulative effect of iron loss over time (24). Unlike hemoglobin, which reflects current oxygen-carrying capacity, serum ferritin can detect iron deficiency in its early, pre-clinical stages—even before anemia develops. Therefore, ferritin measurement is a valuable tool not only for screening at-risk donors but also for monitoring the effectiveness of iron supplementation therapy (22,25).

2e. Less common complications

Although blood donation is generally safe, a small number of whole blood donors may experience rare yet serious complications. The overall rate of such events is low, ranging from 0.005% to 0.016% of all donations (6). Less common complications include localized or systemic allergic reactions, accidental arterial puncture, local inflammation of the vein (phlebitis), nerve or tendon injury, chest pain, and thrombotic complications such as brachial artery pseudoaneurysm, arteriovenous fistula, compartment syndrome, angina pectoris, stroke, or, in extremely rare cases, anaphylactic shock (3,6). The frequency and type of these complications vary across different countries, likely due to differences in donor selection criteria, population health, and adverse events reporting standards. However, variations have also been observed within the same country across different years, suggesting that local practices, staff training, and donor demographics also influence outcomes. Additionally, a range of individual factors can contribute to the occurrence of systemic reactions. Among the most important are age, sex, biological predispositions, stress levels, fluid intake, nutritional status, and adequate rest prior to donation (6). These elements can influence how the donor's body responds to the blood donation process and may increase susceptibility to adverse events if not properly managed.

3. Preventing complications

Most studies on complications in blood donors primarily focus on immediate reactions occurring in first-time donor. Unfortunately, there is still limited data on the safety and long-term outcomes of repeat blood donations. For various reasons, donors often do not receive detailed information about the donation procedure and its potential risks. Additionally, medical staff involved in the donation process may not always be fully aware of the frequency or nature of complications.

Providing donors with clear and transparent information about possible complications is important for several reasons. First, it ensures that informed consent is obtained. Second, it enables both donors and staff to anticipate and respond to early signs of complications faster and more effectively. On the other hand, providing high-quality care during the process is crucial. This is particularly true today, as stricter donor eligibility criteria have led to a decrease in the number of suitable donors compared to previous years. To maintain a stable and adequate blood supply, ensuring a safe and positive donor experience is key (2,26).

3a. Prevention by education

Blood collection should be performed under the supervision of a physician and involve qualified personnel. All staff involved in blood donation process should receive regular training on preventing complications, recognizing early symptoms, and managing adverse events appropriately (1).

Another essential part of preventing complications is educating donors about their possible occurrence, early warning signs, and methods of prevention. Donors should be encouraged to report symptoms and ask questions throughout the process. Preventive strategies also include simple predonation measures. For example, donors should be encouraged to drink around 500mL of water before donation to minimize the risk of VVR incidence (3,27). They should also consume familiar foods prior to donation to maintain blood sugar levels and avoid discomfort. However, heavy or fatty meals should be avoided, as they can cause lipemia—a condition which interferes with blood processing and may lead to temporary disqualification from donating (27).

3b. Treatment

Procedures to be followed in the event of complications should be clearly outlined in dedicated protocols (Standard Operating Procedures – SOP). These protocols must be easily accessible in every location were blood collection is performed. Additionally, a designed area should be available to provide care for donors who experience complications during or after donation. Donors who suffer any adverse reactions should remain under observation and receive appropriate care until their condition stabilizes and their overall well-being has improved (1). Delayed complications, which may occur within 24 hours after donation are reported in approximately 46 cases per 100000 donations. To reduce the risk of such events and support recovery, donors should be advised to rest, after donation, avoid strenuous activity, and refrain from using the arm from which blood was taken. In terms of returning to work, it is recommended that donors avoid occupational duties for at least 12 hours if the tasks are low risk. For professions that demand significant physical exertion or high levels of concentration—such as pilots, surgeons, or deep-sea divers—a minimum rest period of 24 hours is advised to ensure safety (28).

3c. Documentation

All complications related to the blood donation process, along with a detailed description of their symptoms, consequences, and the actions taken, should be documented in the donor's medical record. The documentation is essential for ensuring continuity of care, improving donor safety, and

identifying patterns of adverse events. The collected data should be systematically analyzed to support the development of preventive strategies and to mitigate the risks and impact of future complications (1).

3d. Informing the donor

If a complication is identified, the donor must be promptly informed about their condition, the treatment provided, and the expected outcome. They should be given the opportunity to consult with a physician, remain under observation until their condition is fully stable, and receive clear post-donation care instructions. This is particularly important for donors who experience VVRs, as there is a known risk of delayed fainting. Such individuals should be advised not to drive or engage in activities that could endanger themselves or others in the event of post-donation fainting episode (1).

4.Myths and misconceptions 4a. Hypertension

Donating blood provides an opportunity for regular blood pressure measurements. In some donors hypertension is diagnosed at a certain stage. Regular blood pressure monitoring offers a chance for early detection of health issues and ongoing cardiovascular health assessment. However, this contributed to the myth that donating blood causes the onset of hypertension. In fact, the opposite is true – health assessment conducted during blood donation facilitate the early diagnosis like hypertension, which often remains asymptomatic for prolonged period. Available literature have not confirmed it, but authors emphasized that blood donation screening increase hypertension awareness what is good for public health. There are some voices indicating that regular donations are associated with pronounced decreases of blood pressure (29–32).

4b. Addiction and overproduction of blood

Available literature does not confirm that regular blood donation can addict or cause overproduction of blood (33,34). Donors may feel physically energized or mentally gratified. This feeling is attributed to positive reinforcement, the sense of social contribution, and the release of moodenhancing hormones, rather than being a sign addiction or harmful physiological overcompensation (35). The human body maintains strict control over erythropoiesis (the production of red blood cells) through feedback mechanisms involving erythropoietin, a hormone produced primarily in the kidneys. After a blood donation, erythropoietin levels temporarily rise to stimulate the production of new red blood

cells, restoring homeostasis within a few weeks. The process is limited once the baseline red cell mass is reestablished (36,37).

4c. Permanent weakness

As explained above, the body is fully capable of regenerating the volume of blood lost during donation—plasma is replaced within 24 to 48 hours, while red blood cell mass is typically restored within a few weeks, depending on iron status and individual health. Moreover, blood donors maintain normal levels of physical performance, cognitive function, and daily activities after donating, and experience no long-term adverse effects. With adequate intervals between donations and thorough qualification process before allowing to donate, whole blood donation does not pose a risk of lasting weakness (38,39).

4d. Tattoos and piercings

A common myth is that individuals with tattoos are permanently ineligible to donate blood. Most blood donation services impose a temporary deferral—usually around 3-4 months—after getting a tattoo or a piercing. This precaution helps reduce the risk of transmitting blood-borne infections such as hepatitis B or C, especially if the tattooing process was not sterile. However, if the tattoo was done in a licensed parlor using sterile, single-use equipment, many centers may reduce or even eliminate the waiting period entirely (40,41).

4e. Common and rare blood types

Misunderstandings about blood types often influence donation choices. Some assume that having a common type like O positive (O+) or A positive (A+) means their contribution is less impactful, while rare types such as AB negative (AB–) or the Ro subtype are always the most in demand. In reality, all blood types play a vital role in sustaining a safe and responsive blood supply. Common types are urgently needed because they correspond to a broad patient population, particularly during surgeries and emergencies. Meanwhile, rare types remain indispensable for individuals who require precise matches. Blood services continuously monitor supplies across all groups, emphasizing that every donor matters and every blood type is necessary to meet the needs of diverse patients (42,43).

4f. Age limit

While many countries set a minimum age limit of 18, the upper age limit is more flexible than often believed. Most blood services allow healthy adults to continue donating well into their 60s or even 70s, provided they meet all the standard health criteria. Individualized health assessments are key to ensuring that age does not become an unjustified barrier to donation (39).

4g. Medications

A common misconception is that individuals taking any form of medication are automatically disqualified form donating blood—this can discourage willing donors managing chronic illnesses or taking routine medications such as antihistamines, antidepressants, or contraceptives. In reality, the eligibility to donate blood while on medication depends on the type of drug, the underlying condition being treated, and the donor's overall health. In some cases, temporary deferrals may apply if a medication could impact the safety of the recipient (e.g. isotretinoin or certain antibiotics)
(44).

5. Conclusion

In conclusion, whole blood donation is a safe and well-regulated medical procedure that plays a vital role in healthcare systems worldwide. While minor and generally manageable complications may occur, the overall risk is low, especially when donation is conducted by trained professionals following established protocols. However, ensuring the safety and sustainability of blood donation goes beyond clinical procedures—it requires ongoing education of both donors and blood center personnel. Misconceptions about eligibility, health risks, or the value of certain blood types can lead to unnecessary self-exclusion among individuals who may otherwise be healthy and willing to donate. It is essential to communicate that potential donors should not self-defer based on assumptions. Instead, educational outreach, transparent qualification processes, and continuous staff training are key to dispelling myths, improving donor confidence, and promoting consistent, inclusive blood donation practices across all demographics and blood groups.

Disclosure

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