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Decoding the Root Causes of Donor Collection Failures: A Retrospective Analysis

Hina Aslam, Lakshmi Priya, V.*, P. Subhashini
Department of Pathology, Sree Balaji Medical College and Hospital, Chennai, India

Abstract

Donor collection failures, including incomplete or unsuccessful blood collection attempts, pose significant challenges on maintaining an adequate blood component supply. These include donor-related issues, procedural errors, and environmental factors. There is notable scarcity in literature that comprehensively examines and investigates the underlying root causes of these failures within blood centres. This retrospective study aims to identify and analyse the root causes of donor collection failures in a blood bank setting at Tertiary Care Hospital. Data was reviewed retrospectively from the blood centre of Tertiary Care Hospital over a period from Jan 2022 to July 2024 with regard to cause of failure collection and the donor characteristics and then descriptive statistical analysis done. Results showed that a higher frequency of collection failures during blood donation was recorded in donors of age 26 – 35 years and 78% of collection failures occurred due to Insufficient blood flow (40%) resulting in low volume collection, failure collection due to prolonged duration (22%) and hematoma at puncture site (16%). Understanding these root causes is essential for developing effective strategies to improve the efficiency of blood collection processes, enhance donor experiences, and ensure a reliable blood supply. Additionally, successful blood collection is not only vital for maintaining an adequate supply of blood products but also for fostering positive donor experiences, which is crucial for encouraging repeat donations and maintaining a steady donor base.

Keywords: *Adverse Reaction, Blood Centre, Donor Blood Donation, Failure Collection, Hematoma, Low Volume.*

Introduction

Blood donation is a cornerstone of healthcare, providing an essential resource that supports a wide range of medical procedures, from emergency surgeries to chronic disease management. The availability of a sufficient and safe blood supply is critical to meeting the needs of patients, ensuring that life-saving transfusions can be administered whenever necessary. However, the process of blood collection is simple but fraught with challenges [1]. Despite the critical role that blood donation plays in healthcare, the collection process is not always successful. Failures in donor collection, where the process is either incomplete or unsuccessful, can lead to shortages in blood availability and may deter donors from returning in the future, ultimately impacting the overall blood supply [2].

These collection failures can arise from a variety of factors, including issues related to the donors themselves, procedural mishaps, equipment malfunctions, and environmental conditions within the collection facility. For instance, some donors may have veins that are difficult to access, or they may experience adverse reactions during the donation process, such as fainting or anxiety, which can lead to an incomplete donation [2]. On the other hand, procedural errors, such as incorrect needle insertion or deviations from standard protocols, can also result in failed collections [3]. Furthermore, the reliability of blood collection

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****Corresponding Author: lachu21.lp55@gmail.com***

equipment and the environmental conditions within the donation centre, such as temperature, humidity, and noise levels, can all influence the success of the collection process [4,5]. Despite these challenges, there has been a lack of comprehensive studies that thoroughly examine the root causes of donor collection failures and adverse donor reactions [1].

Materials and Methods

Study Design and Data Collection

This retrospective analysis was conducted at a Blood centre within a Tertiary healthcare hospital. Data were collected from donor records spanning Jan 2022 to July 2024. The study focused on cases where blood collection attempts were either unsuccessful or incomplete, excluding instances where donors voluntarily discontinued the process.

Inclusion Criteria

1. Donors who attempted to donate blood during the specified period from Jan 2022 to July 2024.
2. Documented instances of failed or incomplete blood collection attempts.
3. Records containing detailed information on the reasons for collection failure.

Exclusion Criteria

1. Instances of voluntary withdrawal by donors.
2. Incomplete records that lacked clear documentation of the reasons for failure.

Data Analysis

Data were systematically analysed to identify common themes and root causes of donor collection failures. Descriptive statistical analysis was employed to quantify the frequency of different types of failures.

Results

A total of 3020 donations were recorded during the analysed period from Jan 2022 to July 2024, of which 55 collection failures were noted (Table 1 and Figure 1).

Table 1. Distribution of Cases based on Year

Year	2022	2023	2024 till July	Total
No. of blood donations	1102	1211	707	3020
No. of Failure Collections	12	19	24	55

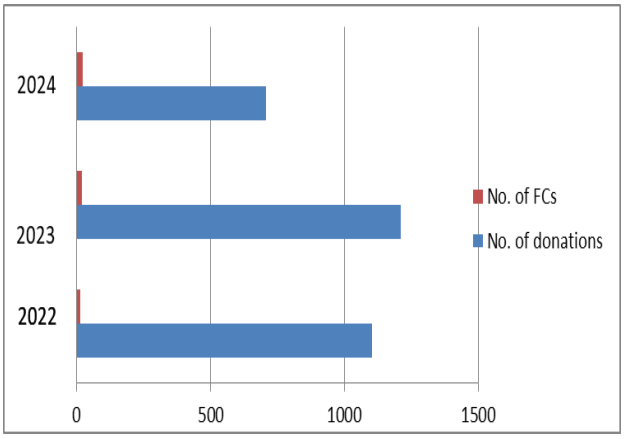

Figure 1. Distribution of Cases based on Year

Distribution of collection failures according to donor age is shown in Table 2 and Figure 2. A higher frequency of collection failures during blood donation was recorded in donors of age 26 – 35 years (median age of 28). Namely, the total of 13 collection failures were recorded in the 18–25 age group and the total of 15 collection failures were recorded in the 26–35 age group. This relation is much smaller in the 35–46, 46–55 and > 56 age groups: 10, 11 and 6 cases respectively.

Table 2: Distribution of Failure Collection based on Donor Age

Age	**No of cases**
18-25	13
26-35	15
36-45	10
46-55	11
>56	6

Figure 2. Distribution of Failure Collection based on Age

Three causes accounted for 78% of collection failures: Insufficient blood flow (22 cases, 40%) resulting in low volume collection, discontinued donation due to prolonged duration (12 cases, 22%) and hematoma at the puncture site (9 cases, i.e., 16%). Other causes accounting for 22% of collection failures: donation discontinued due to fatigue (5 cases, 9%), due to loss of consciousness (6 cases, 11%) and double venepuncture (1 case, i.e., 2%). All collection failure causes with an overview of their frequency are shown collectively in Table 3 and Figure 3.

Table 3. Distribution of Cases Depending upon the Cause of Donor Collection Failure in Relation to Gender

Types of Collection failure	**Males**	**Females**	**Total percentage**
Donation discontinued due to fatigue	4	1	9%
Donation discontinued due to a loss of consciousness	6	0	11%
Donation discontinued due to insufficient blood flow	20	2	40%
Donation discontinued due to hematoma	7	2	16%
Donation discontinued due to prolonged duration	10	2	22%
Double puncture	1	0	2%

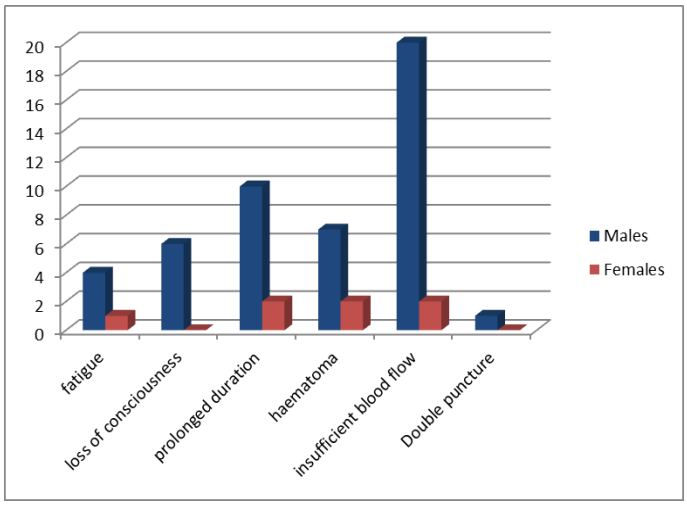

Figure 3. Distribution of Cases Depending upon the Cause of Donor Collection Failure in Relation to Gender

Cause of collection failures in relation to donor age analysed. Total 13 collection failures were recorded in the 18–25 age group, of which donor adverse reactions were 5 cases (38.6%) and 7 cases of venipuncture technique complications (61.4%) and the total of 15 collection failures were recorded in the 26–35 age group, out of which 4 (26.7%) were caused by donor reactions and 73.3% due to venipuncture technique complication. Donor reactions at 35–46, 46–55 and > 56 age groups: 1 (10%) out of 10, 1 (9%) out of 11 and no donor adverse reactions noted out of 6 cases respectively. Collection failure due to venipuncture complications at 35–46, 46–55 and > 56 age groups: 9 (90%) out of 10, 10 (90%) out of 11 and all 6 cases respectively (Table 4 and Figure 4).

Table 4. Distribution of Types of Failure Collection based on Age

Types of collection failures	18-25	26-35	36-45	46-55	56 and above
Fatigue	2	2	1	0	0
Loss of consciousness	3	2	0	1	0
Insufficient blood flow	4	5	4	5	4
Hematoma	2	4	2	1	0
Prolonged duration	2	2	3	4	1
Double puncture	0	0	0	0	1

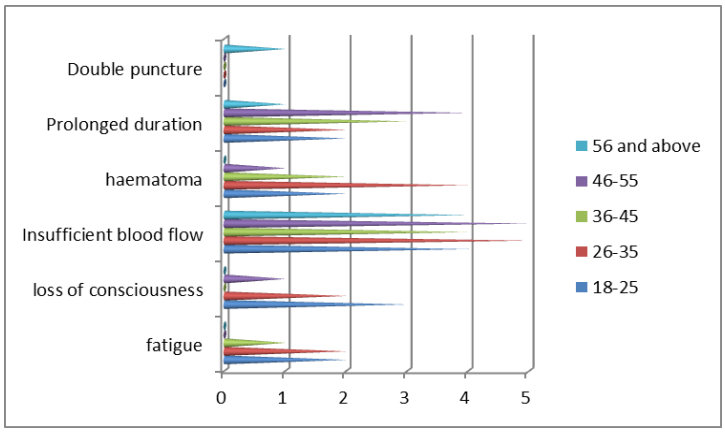

Figure. Distribution of Cases of Failure Collection based on Age

Discussion

Despite regular occurrences on collection failures in blood centres, there is limited literature on these failure occurrences during the collection of blood and blood components [1,4]. Most of the existing research comes from studies on donor vigilance, which mainly concentrate on adverse reactions and complications experienced by blood donors [1,5].

In our study, we have analysed various types of collection failures, as well as donor characteristics and factors affecting their occurrence on a sample of 3020 blood donations. Those donations were retrospectively collected in the period from Jan 2022 to July 2024. Out of 3020 collections, 55 were reported to be failed collections. Of which 7 are females and 48 are males.

In our study we found that the main cause for donor failure collection is due to prolonged duration and insufficient blood flow accounting for 62% of all causes. Cause for donation failure due to prolonged duration and insufficient or low volume collection cannot be determined. But few studies stated that vasovagal response of individuals results in low blood pressure and lower heart rate results in increased time duration of collection and low volume collection [6,7,8,]. Selection of appropriate veins for blood collection is also important in-order to avoid low volume collection [3]. These causes of failure collections are encountered mostly in younger age group donors in our study i.e. from 18 to 35 years of age where vasovagal reactions will be frequently encountered.

Other causes of failure collections encountered in our study are donor reactions such as fatigue and loss of consciousness accounting for 20% of all causes, these adverse reactions have occurred as a result of anxiety [9]. This type of collection failure emphasises the importance of taking measures to provide a comfortable and relaxed atmosphere during blood donation, especially to the more vulnerable population of younger donors as well as to ensure proper fluid intake pre and post donation [10,11]. Hematoma complication and double puncture causes mostly occur as a result of insufficient skills of staff in venipuncture technique [10,12,13]. But, double puncture cause of failure in our study was reported in an old male of age above 56 years, which occurred due to reduced elasticity and fragility of veins as a result of the ageing process [14,15].

The analysis revealed that the root causes of donor collection failures in the blood centre can be broadly categorised into three primary areas [16,17]. Firstly, Donor related factors emerged as the most prevalent cause of collection failures. These included difficulties in locating suitable veins or instances where veins collapsed during the collection process as well as cases where donors experienced fainting, dizziness, or anxiety, leading to the termination of the collection process [18]. Secondly, Procedural errors which primarily involve the instances of improper technique during needle insertion, resulting in hematomas or insufficient blood flow and non-compliance with established standard operating procedures by staff, such as improper donor positioning or inadequate preparation of the collection site [18,19]. Lastly, Environmental, included adverse environmental conditions like temperature and humidity that impacted both donor comfort and equipment performance as well as high levels of noise or other distractions in the collection area that impacted both staff concentration and donor comfort [20].

Based on the identified root causes, the following corrective measures are proposed to enhance the success rates of blood collections. Enhancing pre-donation screening processes is essential, as it would allow for a more rigorous assessment of vein and potential donor anxiety, thereby reducing the likelihood of failures

related to donor specific factors. Additionally, providing comprehensive educational materials to donors about the donation process can help alleviate anxiety and improve their overall experience. Staff training is another critical area of focus. Regular training sessions should be conducted to ensure that staff are proficient in correct needle insertion techniques and fully understand the importance of adhering to established protocols. Periodic audits of these protocols can also help to ensure that they reflect the latest best practices and incorporate lessons learned from previous failures. Environmental control measures are equally important. Maintaining optimal temperature and humidity levels in the collection area can enhance both donor comfort and equipment functionality. Additionally, designing the collection area to minimise noise and other distractions can significantly improve the focus and performance of both staff and donors.

Conclusion

This retrospective study provides a comprehensive analysis of the root causes of donor collection failures in a blood bank setting. By systematically identifying and categorising these causes, the study offers actionable insights and proposes targeted measures to improve blood collection processes. Implementing these corrective actions can significantly enhance donor experience, increase the efficiency of blood collection, and contribute to a more stable and reliable blood component supply. Future research should focus on monitoring the effectiveness of these interventions and exploring additional strategies to further reduce the incidence of donor collection failures.

Conflict of Interest

None

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None

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