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Retrospective evaluation of Transfusion Transmissible infections in Discarded Blood Units: A 5-year analysis from a regional Blood Centre at Bundi, Rajasthan

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Abstract: This study retrospectively analyses data on discarded blood units due to positivity for Transfusion-Transmissible infections (TTIs) at Regional Blood Centre of Pt. B.S. Sharma General Hospital, Bundi, Rajasthan, from January 2020 to December 2024. The objective was to determine the prevalence and trends of HIV, HCV, HBsAg, VDRL (syphilis), and Malarial Parasite (M.P.) among discarded donated blood units. Data were sourced from the Blood Centre annual discard reports. Over the five years, a total of 38,678 blood units were collected, with 1,031 units (2.67%) discarded due to TTI positivity. Hepatitis B surface antigen (HBsAg) was the most common reason for discarding units, accounting for 825 discard units (80.02%of all discards, 2.13% of total collections). The number of HIV-positive discards were 32, HCV was 37, VDRL was 134, and Malaria Parasite was 3. This emphasizes the critical need for robust and sustained screening protocols, while also identifying key areas for focused public health interventions to lower the burden of transfusion-transmitted infections (TTIs) in the donor population. These efforts are in alignment with both national and global strategies aimed at ensuring the highest standards of blood safety.

Keywords: Blood Safety Transfusion-Transmissible Infections, HIV, HCV, HBsAg, VDRL, Malaria, Blood Bank, Rajasthan, India.

Introduction

Safe blood transfusion is a pivotal element of modern healthcare systems, indispensable for managing various medical and surgical conditions (WorldHealthOrganisation,2021).[1,15] Despite its life-saving potential, blood transfusion carries an inherent risk of transmitting infections, collectively known as transfusion-transmissible infections (TTIs).[2,3,4,5] Globally, the primary TTIs of concern include Human Immunodeficiency Virus (HIV), Hepatitis C Virus (HCV), Hepatitis B Virus (HBsAg), syphilis (commonly screened using VDRL or RPR tests), and, in
malaria-endemic regions, Plasmodium species (Pallavi et al.,2011). [6,7,8,9,10] Ensuring the safety of blood supply through mandatory and meticulous screening of all donated Blood Units for these infectious markers is a fundamental public health mandate (Shankarkumar, 2014) [.5,11,12]

Analysis of data about discarded blood units due to TTI positivity offers crucial epidemiological insights into the prevalence of these infections among blood donors, who are generally perceived as a healthier subset of the general population (Pahuja et al., 2015).[9] Tracking these trends over time is essential for evaluating the efficacy of existing public health strategies, donor education programs, and screening technologies (Makroo et al., 2013).[6] This study aimed to analyze data on discarded blood units from the Blood Centre of Pt. B.S. Sharma General Hospital, Bundi, Rajasthan. Spanning a period of five years, this analysis seeks to uncover the prevalence and evolving trends of key transfusion-transmitted infections, thereby offering valuable insights into regional blood safety challenges.

Objectives

The primary objectives of this study are:

- To quantify the total number of blood units collected and the number of units discarded due to TTI positivity annually from 2020 to 2024, based on the local Blood Centre records.
- To determine the annual and cumulative prevalence of HIV, HBsAg, VDRL and Malaria Parasite (M.P.) among the discarded blood units.
- To identify specific trends in these TTIs over the five years with in this specific setting.
- To calculate the overall discard rate due to TTI positivity during the study period.

Methodology

This study employed are retrospective descriptive design. Data were meticulously extracted from a series of unpublished annual reports titled "Discarded Blood - Due to Positive," covering the calendar years 2020 through 2024. These reports were generated by the Office of the Medical Officer, Pt. B.S. Sharma General Hospital, Bundi, Rajasthan. The reports provided monthly and consolidated annual figures for:

- Total blood units collected.
- Number of units discarded due to HIV positivity.
- Number of units discarded due to HCV positivity.

- Number of units discarded due to HBsAg positivity.
- Number of units discarded due to VDRL reactivity.
- Number of units discarded due to Malaria Parasite (M.P.) detection.
- Total units discarded annually due to any TTI positivity.

The extracted data were compiled into a data base for analysis. Descriptive statistics, including frequencies and percentages, were calculated to ascertain the prevalence of each TTIs among the discarded units and relative to the total blood collections. Temporal trends for each TTI over the five-year duration were observed and documented. The overall discard rate was determined using the formula: Discard\Rate= (\frac {Total\Units\ Discarded} {Total\Units\Collected}) \times 100 Ethical considerations for this type of retrospective record review typically involve ensuring data anonymization, which was inherent in the summary nature of the reports used.

Results

As per the compiled annual reports from the Blood Bank Pt.B. S. Sharma General Hospital, Bundi, collected a total of 38,678 blood units were collected over the five years from 2020 to 2024. Out of these, 1,031 units were identified as positive for one or more TTIs and subsequently discarded. This corresponds to an overall TTI-related discard rate of approximately 2.67 %.

Table1: Annual Blood Collections and Discards due to TTI Positivity with Percentage Breakdown of Discards (2020-2024) at Pt. B.S. Sharma General Hospital, Bundi

Year	Blood Collection (n)	HIV (n)	HIV (% of discards)	HCV (n)	HCV (% of discards)	HBsAg(n)	HBsAg (% of discards)	VDRL (n)	VDRL (% of discards)	M.P. (n)	M.P. (% of discards)	Total Discarded (n)	DiscardRate (% of Collections)
2020	7383	5	2.49%	2	1.00%	170	84.58 %	24	11.94 %	0	0.00%	201	2.72%
2021	7524	6	3.05%	5	2.54%	182	92.39 %	4	2.03%	0	0.00%	197	2.62%
2022	8910	12	4.90%	13	5.31%	196	80.00 %	24	9.80%	0	0.00%	245	2.75%
2023	8007	6	2.61%	15	6.52%	162	70.43 %	45	19.57 %	2	0.87%	230	2.87%
2024	6854	3	1.90%	2	1.27%	115	72.78 %	37	23.42 %	1	0.63%	158	2.30%
TOTAL	**38678**	**32**	**3.10%**	**37**	**3.59%**	**825**	**80.02 %**	**134**	**13.00 %**	**3**	**0.29%**	**1031**	**2.67% (Overall)**

(Source: Compiled from annual reports (2020-2024), Office of the Medical Officer, Blood Bank, Pt. B.S. Sharma General Hospital, Bundi, Rajasthan)

Prevalence of Specific TTIs among Discarded Units

HBsAg was consistently the most frequent TTI leading to the discard of blood units throughout the study period.

- **HBsAg:** A total of 825 units were discarded due to HBsAg positivity. This represents 80.02% of all discarded units and 2.13% of the total blood collections. The peak year for HBsAg-positive discards was 2022 (196 units).
- **VDRL:** VDRL reactivity was the second most common cause for discard, with 134 units identified (13.00% of all discards,0.35%oftotalcollections). A significant increase was noted in 2023 (45 cases) and 2024 (37 cases).
- **HCV:**37units were discarded due to HCV positivity (3.59% of all discards,0.10% of total collections). The highest annual count for HCV was in 2023 (15 units).
- **HIV:**32 units were discarded due to HIV positivity (3.10% of all discards,0.08% of total collections). The year 2022 recorded the highest number of HIV cases (12 units).
- **Malaria Parasite (M.P.):** Malaria was the least common TTI identified, with only 3 positive units discarded over the five years (0.29 % of all discards, 0.008 % of total collections).

Discussion

The five-year analysis of discarded blood units from the Bundi blood bank reveals an overall TTI-related discard rate of 2.67 %. This rate, while specific to this center, aligns with the range reported in various Indian studies, although regional variations are common (Giri et al., 2012; Sharma et al., 2019).[4,9,13] The predominant factor for discarding blood units was HBsAg positivity, accounting for 80.02% of all discards. This high prevalence of HBsAg is a persistent challenge in India, reflecting the endemicity of Hepatitis B infection in the

country (Chandra et al., 2009; Murhekar et al., 2022).[2,8,14] The peak in HBsAg discards in 2022, coinciding with peak discards among other studies. Collections warrant continuous monitoring.[8,15]

VDRL reactivity, indicative of syphilis, was the second leading cause for discard. The notable rise in VDRL reactive units in 2023 and 2024 is a point of concern and may suggest an increasing trend or changes in the donor population characteristics for this specific region, a phenomenon also observed in other localized studies (Patel et al., 2018).[11]

The prevalence of HIV (0.08%of total collections) and HCV (0.10%of total collections) among discarded units, though lower than HBsAg, underscores the undiminished importance of screening for these viral infections, which have severe long-term health consequences (Soodet al., 2021).[14] The peak for HIV discards in 2022 and HCV in 2023 from this dataset needs to be contextualized with local public health data, if available. The extremely low detection rate for malaria parasites is positive but necessitates sustained vigilance in screening, particularly given its endemicity in parts of India (Meena et al., 2016).[7]

The annual variations in blood collection volumes and discard rates could be influenced by numerous factors not detailed in the summary reports, such as donor awareness campaigns, seasonal effects on donor availability, changes in screening kit sensitivity or specificity over time, and broader public health events(Kakkar et al.,2014).[5] The decrease in the discard rate in 2024, despite lower collections, is an interesting observation that could be due to a multitude of factors, including potentially more effective pre-donation counselling or a shift in the demographic of the donating population.

Effective blood donor management, including robust pre-donation counselling and screening, plays a vital role in reducing TTI prevalence among actual donations (Arora et al.,2010)[1,2,3]. The data from this center can contribute to the larger national picture compiled by entities like the National AIDS Control Organization (NACO) regarding TTI trends.

Limitations:

This study is based on retrospective data from a single regional blood bank, and its findings may not be directly generalizable to other regions of Rajasthan or India, given the known heterogeneity in TTI prevalence (Garg et al., 2009). The data reflect TTIs only in units that were ultimately discarded and do not capture information on donors deferred pre-donation or the true prevalence in the screened donor pool if different testing algorithms were used. Furthermore, the absence of demographic data (age, sex, donation history-first-time vs. repeat donor) for the TTI-positive units limits a more in-depth analysis of risk factors.

Conclusion

The analysis of discarded blood units at the Pt. B.S. Sharma General Hospital Blood Bank in Bundi, Rajasthan, for the period 2020-2024, highlights a consistent challenge posed by TTIs, with an overall discard rate of 2.67%. HBsAg remains the most significant contributor to these discards. The observed fluctuations in specific TTIs, especially VDRL, emphasize the dynamic nature of infection trends and the imperative for continuous surveillance and adaptive public health strategies. These findings reinforce the critical importance of comprehensive donor education, stringent donor selection criteria based on updated epidemiological data, and the consistent application of high-quality screening assays to maintain the safety of the blood supply. Further studies incorporating donor demographics and risk factor analysis would be beneficial for tailoring more effective TTI prevention and control programs in the region.

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