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PREVALANCE OF TRANSFUSION TRANSMITTED INFECTION AMONG HEALTHY MALE BLOOD DONOR IN DISTRIC SKARDU, GILGIT BALTISTAN, PAKISTAN

Musharraf Hussain[*1], Irfan Ali[2], Mehdi Ali[3], Wajahat Ali[4], Imran Ali[5], Dr Nasir Riaz[6]

[1,3]Department of Medical Lab Technology, Hazara University Mansehra Pakistan
[2]Department of Biological Sciences, National University of Medical Sciences Rawalpindi Pakistan
[4]Department of Microbiology, Hazara University, Mansehra Pakistan
[5]Department of Biotechnology and Genetics, Hazara University Mansehra Pakistan
[6]Department of Microbiology, Hazara University Mansehra Pakistan

[1]musharafmosavi@gmail.com , [2]irfanalishigari786@gmail.com , [3]mehdiali4455@gmail.com, [4]wajeehwajahat@gmail.com, [5]imranaligolvi@gmail.com, [6]nasirriaz@gmail.com

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Corresponding Author: *
Musharraf Hussain

Abstract

This research was conducted to assess the prevalence of transfusion-transmitted infections (TTIs), including Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV), Syphilis, and Malaria, among healthy blood donors in Skardu, Baltistan. A total of 1400 healthy blood donors were examined using the Immuno-chromatographic technique (ICT) at the Regional Blood Center RHQ Hospital Skardu Baltistan from 26 August 2022 to 26 August 2023. The findings indicate that HBV is the most prevalent than other TTIs among healthy blood donors in this region, with a prevalence rate of 0.49%. This study underscores the importance of rigorous donor evaluation and screening procedures to enhance recipient safety and minimize the transmission of TTIs during blood transfusions.

INTRODUCTION

Background

Transfusion Transmitted infections (TTIs) are infections that can be transmitted from one person to another via contaminated blood or blood products. The term "blood transfusion infections" includes a number of disorders, the most common of which being hepatitis B virus (HBV), human immunodeficiency virus (HIV-I/II), hepatitis (HCV), and syphilis. TTIs such as HBV, HCV, HIV-I/II, malaria parasite (MP), and syphilis, or VDRL, are required to be tested before blood transfusion in several nations throughout the world. In addition to the significance of blood groups in blood transfusion, different blood groups are associated with different human infections, particularly TTIs, which pose serious risks and play a key role in blood transfusion.
(Bihl, Castelli, Marincola, Dodd, & Brander, 2007) (Das & Kumar, 2012)

Blood transfusions are an effective treatment for saving lives over the world. It is an essential component of surgical treatment because transfusion serves numerous vital purposes. However, there is a risk in transfusion caused by transfusion-transmitted infections (TTIs) via blood products from donor to a recipient. (Seitz, Heiden, & Hemotherapy, 2010).

One of the greatest milestones accomplished in the 20th century is the evolution of modern blood transfusion medicine (Wondimu, Addis, Moges, & Shiferaw, 2013). Every year, 1millions of lives

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are saved worldwide by therapeutic blood transfusions. However, it is not without risk, and according to an estimate, every donated blood unit has a 1% chance of transmitting infections, resulting in transfusion-related mortality and morbidity (Negash, Ayalew, Geremew, & Workineh, 2019). Blood safety is a very important factor in transfusion treatment. Transfusion-transmitted infections (TTIs) threaten blood safety and are serious issues for both patients and healthcare providers.

According to the World Health Organization (WHO), safe blood is a universal right. A nationwide program is an essential component in the process of obtaining safe blood, and it must involve effective donor selection, hiring, retention, and education. This will reduce donations from donors who may spread infections to recipients. At the same time, it is critical to assess the prevalence and risk factors for TTIs in the general population.

Minimizing the risk of transfusion-transmitted infections (TTIs) depends on selecting safe donors, including microbiological screening, and avoiding unnecessary transfusions. It is critical to identify the proper indication for transfusion in order to reduce the risk of infection. Because we have very limited resources of blood and blood products, and a minor risk of infection will always exist, it is critical to prevent any unnecessary transfusions in order to reduce the occurrence of TTI. Every year, more than 90 million units of blood are collected globally. Each transfusion poses a risk of transmitting blood-borne infections. WHO recommends an integrated strategy to improve blood transfusion safety, which includes establishing well-organized blood transfusion services, focusing on blood donation from voluntary non-remunerated donors, screening donated blood for at least the five major transfusion transmitted infections (TTIs) employing quality-assured assays, rational blood use, and the implementation of effective quality control systems. Selection of blood donors with low TTI risk, followed by effective laboratory screening, is the essential element of the process, as it has lowered risks of transmission to very low levels in the last 20 years (Organization, 2010).

According to the World Health Organization (WHO), 118.2 million blood donations are collected globally with 58% in low- and middle-income (from, 2020)

Even though blood donation might improve the quality lives for patients, it is still one of the most common ways for infectious pathogens to spread. Transfusion-transmitted infections (TTIs) remain a major issue for patients, physicians, and legislators who want to ensure a safe blood supply. TTIs mostly include human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), Treponema pallidum (the cause of syphilis), and malaria parasites. (Saba et al., 2021). The WHO recommends that all blood donations must be tested for these five infectious agents. Transfusion of contaminated blood and blood components raises the risk of morbidity and mortality associated with blood transfusions. This has far-reaching effects for the patient, as well as their family and communities. The economic consequences of TTIs include, but are not limited to, the need for medical treatment, increasing levels of dependency, and the loss of useful workforce, laying significant loads on the already overburdened health and social services, as well as the national budget (Buseri, Muhibi, & Jeremiah, 2009).

Blood safety is of utmost importance in transfusion medicine. Transfusion-transmitted infections (TTIs) hamper blood safety and cause a serious public health problem (Bihl et al., 2007).A person can transmit an infection during its asymptomatic phase and so transfusion can contribute to an increase of infection in the population. Unsafe blood transfusion proves very costly for both the recipient and society at large. Screening TTI is also essential for blood transfusion safety and for protecting human life (Nagalo et al., 2011). Blood transfusion is a life-saving procedure but can cause acute and delayed complications. Blood donors are the resources of a safe supply of blood and blood products (Anjali, Issac, Anjali, & Anish, 2012). Complications of blood transfusions may be mild

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or can be life-threatening and hence meticulous pre transfusion testing and screening for transfusion-transmissible infections is mandatory (Pallavi, Ganesh, Jayashree, Manjunath, & transfusion, 2011). These infections endanger blood safety, so blood transfusion services must provide a safe, adequate, accessible, and efficient blood supply at all levels. All of these transfusion-transmitted infections result in long-term viremia and a carrier or latent state. These infections can also result in fatal, chronic, and life-threatening diseases. The TTIs include the human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and syphilis. 12.5% of patients who received blood transfusions are at risk for post-transfusion hepatitis (Tessema et al., 2010). To reduce risk of TTIs, careful selection of donors is needed so that the blood is safe and is not collected from the people who are likely to be carriers of infectious agents.

Although there are early incidents in medical history that describe attempts to treat patients using either human or animal blood products, transfusion medicine is a relatively recent specialty that has just emerged in the latter half of the twentieth century. However, it quickly became obvious that these therapeutic procedures had their own issues, such as the (in-)compatibility of red blood cells and plasma between donors and recipients, and the risk of transferring infectious infections.

(Pittman, 1953). Although transfusion-transmitted infection (TTI) risk was once thought to be unavoidable by both patients and doctors, low-risk blood supplies are now expected. Blood banks and those industries that produce plasma have been actively pursuing ways to lower the dangers of TTI since the early 1960s. Donor exclusion standards, specifically, have been in place since the beginning and include things like a history of hepatitis or transfusions within the previous six months. Pathogen inactivation techniques, donor appraisal, and laboratory screening tests are now recognized as essential strategies to lower the risk of TTI, although they do not totally eliminate it. Transfusion medicine has evolved to include safer products at a continually rising cost due to these advancements, which has resulted in significant variations in transfusion product safety between wealthy and poor countries.

Blood Bank

A blood bank is a place where collects, processes, tests, stores, and distributes blood and blood products for transfusions. Blood banks play a critical role in healthcare by ensuring that blood is available for patients who need it for various medical conditions, surgeries, accidents, or illnesses. Here's an overview of the key aspects of blood banks:

Functions of a Blood Bank

1. **Collection**: Blood is collected from voluntary donors through various blood drives and donation centers.
2. **Processing**: After collection, blood is separated into its components (red cells, white cells, plasma, platelets) to be used for different medical needs.
3. **Testing**: All donated blood undergoes rigorous testing for blood type and infectious diseases to ensure safety.
4. **Storage**: Blood components are stored under specific conditions to preserve their viability until they are needed.
5. **Distribution**: Blood products are distributed to hospitals and clinics where they are used for patient care.

Types of Blood Donors Based on Donors

Blood donors come in several varieties, such as autologous, volunteer, replacement, and family donors. The World Health Organization (WHO) recommends that countries strive for self-sufficiency and encourage voluntary, anonymous, and unidentified blood donation in order to ensure the sufficient and safe quality of blood products. A study found that donors who get compensation have a higher risk of contracting diseases that are transmissible by transfusion {Waheed, 2015 #8}.

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According to WHO data, 25% of blood donations in Pakistan come from volunteers, 10% come from professionals, and 65% come from replacement donors. This emphasizes how crucial it is to encourage voluntary blood donations in order to improve the security and accessibility of blood supplies. {Manzoor, 2009 #9}.

According to the World Health Organization (WHO), Red Cross, and Red Crescent Societies, there are three categories of blood donations: voluntary, replacement, or paid donation {Mahfouz, 2021 #3}.

Volunteer Blood Donors

Donors donate blood voluntarily and without expectation of payment or personal benefit. Typically, they give blood at blood banks, blood drives, or hospitals.

Replacement Donors

Usually a friend or family member, replacement donors provide blood to replace that which a certain patient has used. They might not give blood on a regular basis, just when a friend or relative is in need of a transfusion. They assist in providing blood when needed right away, particularly during emergencies or surgeries.

Paid Donors

Individuals who donate blood get paid financially or receive additional advantages. To ensure a secure blood supply, certain governments and areas prohibit paid donations. Although paid donations can boost the availability of blood, they raise serious ethical and safety issues.

In order to treat clinical diseases including hemorrhagic shock, trauma, and other clinical states of chronic or acute blood loss, blood and blood components are absolutely necessary. (Uma, 2013).

Providing sufficient, secure, accessible blood is challenging in developing nations {Allain, 2019 #10}. More than 112 million units of blood are drawn annually, with high-income countries providing roughly half of the blood. Furthermore, high-income countries have donation rates that are, on average, nine times higher than those of low- and middle-income countries (LMICs) {Beyene, 2020 #1}.

The majority of blood used in hospitals across various nations comes from replacement donors who give when a friend or relative is in need. However, the most reliable method of providing the country's blood transfusion needs is through voluntary donation. {Mohammed, 2018 #4}. The safest blood donors are those who give freely once or twice a year since they are not motivated to give false information {Anwer, 2016 #5}.

Types of Blood Transfusion Based on Patient Needs

A necessary medical procedure known as a blood transfusion is the transfer of blood or blood components from one person (the donor) to another (the recipient) in order to treat a variety of diseases or meet the demands of a particular patient. Depending on the patient's condition, different types of blood transfusions may be needed, and medical professionals must carefully assess each patient's needs to give the most suitable and efficient care.

The patient's blood type is one of the most important elements that defines the type of blood transfusion {Bediako, 2021 #6}. Various blood transfusions may be necessary for patients depending on their individual requirements, such as the need for platelets, plasma, or red blood cells. For example, patients with bleeding disorders may need platelet or plasma transfusions to address coagulation concerns, while those with anemia may need red blood cell transfusions to boost their hemoglobin levels {Friedman, 1979 #7}

1. **Whole Blood Donors**: Donors who give whole blood, which is later separated into its components (red cells, plasma, platelets).
2. **Plasma Donors**: Donors who give plasma, the liquid part of blood that is used for various medical treatments.

3. **Platelet Donors**: Donors who give platelets, which are critical for clotting and are often needed by cancer patients.

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4.**Double Red Cell Donors**: Donors who give two units of red blood cells in one donation session using a special machine.

In addition, the patient's condition may affect the timing and frequency of blood transfusions. Certain individuals could need immediate transfusions to treat life-threatening conditions such significant blood loss {Stanworth, 2022 #8}. Conversely, those suffering from long-term diseases like specific forms of cancer or kidney disease would need to plan regular transfusions in order to keep their health and control their symptoms {Krahulik, 1930 #9}.

The healthcare provider must take into consideration both the possible hazards and advantages of blood transfusion as well as to the patient's individual demands. Blood transfusions carry some risk, even though they can save lives. Medical professionals must assess the advantages and disadvantages of each procedure, including the possibility of infection, allergic responses, and complications from the transfusion. Healthcare professionals are adopting a more conservative approach to blood transfusion as evidence-based techniques in transfusion medicine continue to develop. They are emphasizing minimizing the loss of blood, optimizing the use of blood products, and utilizing alternative therapies, such as iron supplementation and erythropoietin-stimulating agents, to lessen the need for blood transfusions. {O'Malley, 2017 #10}.

Adverse Reactions to Transfusion of Blood and Blood Products

Blood transfusions and blood products are vital medical interventions that have the potential to save lives, but they are not without risk. Patients may have adverse responses that could be anything from minor to fatal. Numerous causes, such as blood donor and recipient incompatibility, allergic reactions, bacterial infection, and circulatory overload, might result in these adverse effects. Hemolytic responses are among the most frequent adverse effects of blood transfusions. They happen when the recipient's immune system destroys the donor's red blood cells because it identifies them as alien. Severe symptoms like fever, chills, pain, and in extreme situations, organ failure and death, may result from this. {Rutter, 2018 #7}.

The wide range of immunologic and metabolic alterations which take occur during or following the infusion of a blood product is considered an adverse effect from transfusion or transfusion reaction. The following list contains four categories of transfusion-related side effects. Acute transfusion reactions happen during or shortly after a transfusion, while delayed transfusion reactions happen after the transfusion is finished. There could be hours or years of delay.

Acute immunologic transfusion reactions

The presence of antibodies that trigger an immunological response in the plasma of either the donor or the recipient is the cause of acute immunologic transfusion responses. An acute immunologic transfusion reaction can have quick, frequently permanent, and occasionally fatal consequences. According to current theories regarding the pathophysiology of acute hemolytic transfusion reaction in humans, hemolysis causes the release of cytokines, including complement, endothelium-derived relaxing factor (nitric oxide), endothelin, and tumor necrosis factor. This leads to the clinical syndrome of dissemination of intravascular coagulation, shock, and acute renal failure. {Bianco, 2007 #8}. The best example of an acute hemolytic transfusion reaction in veterinary medicine is the administration of type A red blood cells to a type B.

Delayed immunologic transfusion reactions

There are four types of delayed immunologic transfusion reactions: post-transfusion purpura, delayed hemolytic, transfusion-induced immunosuppression, and graft-versus-host disease. Neither blood typing nor cross matching can stop these reactions. People who have already been sensitized to allogenic red blood cell antigens through transfusion or pregnancy will continue to experience delayed hemolytic transfusion responses. The recipient of compatible blood may acquire antibodies against any one of the hundreds of red blood cell

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antigens on the transfused cells, even though the patient has been given suitable blood. A well-known side effect of red cell transfusion in humans is a delayed hemolytic transfusion reaction, which happens 7 to 10 days after a transfusion due to an anamnestic reaction to the antigens on the transfused red blood cells. Although it hasn't been documented in dogs, there's no reason it couldn't happen. In humans, fever is the most typical indicator of a delayed hemolytic transfusion reaction. It is also possible to observe icterus 4–7 days after a transfusion. Hemophilia A dog that has received previous transfusions and develops post-transfusion purpura is the sole case of delayed immunologic transfusion reaction that has been reported in veterinary medicine. {Wardrop, 1997 #9}.

Acute non-immunologic transfusion reactions

Red blood cell morphological alterations during administration, storage, or collection are the primary cause of acute non-immunologic transfusion responses. Changes in Blood Associated with Collection an adverse transfusion reaction may arise from improper blood collection. When blood is drawn from an unscreened donor, germs, spirochetes, or protozoa may be transferred, which may eventually cause the recipient's body to exhibit clinical symptoms of the afflicted disease. Shock from transfusion of bacterially contaminated blood is treated empirically with antibiotics based on Gram stain results, volume expansion, and presser agents.{Hohenhaus, 1997 #10}.

Blood Changes Associated with Storage Red blood cells lose some of their ATP content during storage, and some of them experience hemolysis, which causes potassium to escape into the storage medium. Patients getting large volume transfusions of preserved blood may develop hyperkalemia as a result of the increased potassium in the storage medium. Hyperkalemia can rarely result with a large-volume transfusion of stored blood unless the patient already has hyperkalemia or is experiencing renal failure. {Jutkowitz, 2002 #2}.

Administration-Associated Changes in Blood

Large-volume transfusion administration can have many kinds of adverse effects. The use of citrate as an anticoagulant may combine with calcium or magnesium and cause ionized hypocalcemia or ionized hypomagnesemia, which can cause myocardial dysfunction, cardiac arrest, and tetany. {Killen, 1971 #3}.

Delayed non-immunologic transfusion reactions

Human immunodeficiency virus, hepatitis virus, and cytomegalovirus infections have been reported as post-transfusion effects in humans. Hemochromatosis is one late transfusion-related effect that has been documented in veterinary medicine {Sprague, 2003 #4}.

The World Health Organization mandate that All blood donations are required to undergo screening for HIV, HBV, HCV, malaria, and syphilis. The WHO mandate also specifies screening for local diseases in some countries. As a result, all blood donations in Pakistan need to be checked for malaria.

Research objectives

The objective of this research is following.

- To determine the prevalence of transfusion-transmissible infections (TTIs) such as HIV, HBV, HCV, malaria, and syphilis among healthy male blood donors in Skardu Baltistan.
- To determine the most common types of TTIs detected among healthy male blood donors in the Skardu Baltistan.

Research Gap

There is a lack of comprehensive data and previous studies on the prevalence of TTIs among healthy blood donors specifically in Skardu Baltistan, hindering efforts to implement targeted interventions and improve blood safety in the region.

Significance of the Study

This study on prevalence of transfusion transmitted infections among healthy male blood donors of Skardu Baltistan is apparently be beneficial for public health and up gradation of

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health care services in the area. Key Contribution and Implications of the Study.

Identification of TTIs Prevalence Rates

The research aims to provide insights into the prevalence rates of transfusion-transmissible infections (TTIs) such as HIV, HBV, HCV, malaria, and syphilis among healthy male blood donors in Skardu Baltistan. By analyzing the collected data, the study is expected to reveal the proportion of donors carrying these infections, thus highlighting the magnitude of the issue in the region.

Identification of Common TTIs

Through the investigation, the study intends to identify the most common types of TTIs detected among blood donors in Skardu Baltistan. This identification can help prioritize preventive measures and allocate resources efficiently to mitigate the transmission of these infections through blood transfusion.

Public Health Impact

The significance of this research has grave public health implications with regards to the health and safety of blood transfusion services in Skardu Baltistan being directly addressed. The prevalence of TTIs among blood donors can be determined which would help in appreciating the problem so that suitable interventional strategies could be carried out. This will, in turn, lead to the overall health of both blood donors and blood recipients by decreasing the rate of transfusion-transmitted infections in the society.

Improved Blood Safety

The outcomes of the research will provide an extensive understanding of the various kinds and rates of TTIs among blood donors in Skardu Baltistan. Healthcare authorities require this information in order to create and implement effective screening processes and preventative measures. By decreasing the transmission of blood-borne illnesses, improved blood safety protocols based on study findings will ensure safer transfusion techniques.

Contribution to the Knowledge Base

This study fills a critical gap in the existing literature on the frequency of TTIs among healthy blood donors in Skardu Baltistan. The study's extensive data on this topic will contribute to the larger body of knowledge in transfusion medicine and public health. The findings can help to shape future research and evidence-based approaches, encouraging a better knowledge of blood safety issues in similar settings.

Data for Policy Development

The results of this research will help policymakers create and carry out recommendations for blood donation, screening, and transfusion processes. By implementing based on evidence rules, the study will contribute to safer procedures in healthcare, ultimately enhancing blood safety standards and saving public health.

Understanding on Blood Safety Methods

The study's findings will provide significant insight into contemporary blood safety practices in Skardu Baltistan. Understanding the prevalence of TTIs and the efficacy of screening methods would enable recommendations to improve blood safety procedures. This will mitigate the risk of transfusion-transmitted illnesses, supporting safer transfusion practices within the region.

In this research we will investigate the prevalence of TTIs and common TTIs among healthy male blood donors in Skardu Baltistan, shedding light on potential risks and informing strategies for safer blood transfusion practices in the region.

LITERATURE REVIEW

Existing literature highlights the global prevalence of TTIs and the importance of rigorous blood screening measures. However, limited studies focus specifically on the prevalence of TTIs among healthy male blood donors in Skardu Baltistan, requiring further research to address this gap.

The global and national prevalence of transfusion-transmitted infections (TTIs) among blood donors varies significantly across different regions and countries. Here is a comprehensive

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overview of the prevalence and trends of TTIs among blood donors globally and nationally.

Global Prevalence of Transfusion-Transmissible Infections (TTIs) among Blood Donors

The global prevalence of transfusion-transmitted infections (TTIs) among blood donations varies significantly across different regions and income groups. According to the World Health Organization (WHO) reports from 2018, the median prevalence of TTIs in blood donations is as follows:

- **HIV**: 0.002% (interquartile range (IQR): 0.001% – 0.01%)
- **HBV**: 0.02% (IQR: 0.005% – 0.12%)
- **HCV**: 0.007% (IQR: 0.002% – 0.06%)
- **Syphilis**: 0.02% (IQR: 0.003% – 0.12%)

High-Income Countries

In high-income countries, the prevalence of TTIs is generally low, with the median prevalence of HIV, HBV, HCV, and syphilis being 0.002%, 0.02%, 0.007%, and 0.02%, respectively {Mohammed, 2023 #5}.

Low- and Middle-Income Countries

In low- and middle-income countries, the prevalence of TTIs is higher, with the median prevalence of HIV, HBV, HCV, and syphilis being 0.70%, 2.81%, 1.00%, and 0.90%, respectively {Qadir, 2023 #6}

Reasons for Higher Prevalence

The average prevalence rate of TTIs is generally higher in low-income countries compared to high-income countries, likely due to factors such as:

- Precarious health services
- Poorer hygiene habits
- Cultural factors
- Limitations in detection techniques

National Prevalence of TTIs Among Healthy Blood Donors

Transfusion-transmitted infections (TTIs) pose a significant challenge to the safety of blood supply globally. Countries with limited resources often struggle to implement comprehensive screening and testing protocols, leading to an increased risk of transfusion-transmitted infections (TTIs).

According to WHO reports in 2018, the prevalence of HIV, HBV, HCV and syphilis infections among blood donations collected globally varies from 0.003% to 1.08%, 0.03% to 3.70%, 0.02% to 1.03% and 0.05% to 0.90% respectively, with lower prevalence in high-income countries {Organization, 2017 #2}.

In the United States, blood donor screening and testing are well-established, with the prevalence of transfusion-transmissible infections (TTIs) among healthy blood donors being relatively low. In contrast, countries like China, India, and Iran face greater challenges in ensuring the safety of their blood supply {Epstein, 2020 #10}. While progress has been made in increasing voluntary blood donation, more work is needed to reach the World Health Organization's goal of 100% voluntary blood donation by 2020.

Prevalence of TTIs in USA

A study of over 12 million blood donations in the U.S. found an overall TTI prevalence of 0.17%. The prevalence was 0.08% for hepatitis B virus (HBV), 0.05% for hepatitis C virus (HCV), and 0.02% for HIV {Adu-Poku, 2020 #1}.

Prevalence of TTIs in China

A national survey of over 1.4 million blood donors in China reported an overall TTI prevalence of 1.06%. The prevalence was 0.57% for HBV, 0.27% for HCV, and 0.06% for HIV {Xu, 2019 #3}

Prevalence of TTIs in India

Studies indicate a higher prevalence of TTIs among blood donors in India, with HIV at 0.24%, HBV at 1.41%, HCV at 0.42%, and syphilis at 0.28% {Makroo, 2015 #7}

Prevalence of TTIs in Pakistan

Hepatitis C Virus (HCV) was the most prevalent TTI, with a prevalence ranging from 1.4% to 1.5%. Hepatitis B Virus (HBV) prevalence ranged from 0.68% to 3.91%.HIV prevalence was reported between 0.02% to 0.26%. Syphilis

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prevalence ranged from 0.89% to 0.9%. Malaria prevalence was around 1.2%{Sabir, 2023 #4}

These studies highlight the significant variation in TTIs prevalence across different countries, likely influenced by factors such as donor screening practices, socioeconomic conditions, and disease endemicity. The United States generally has a lower TTI prevalence compared to other countries like China, India, Iran and Pakistan. Ongoing surveillance and targeted interventions are crucial to ensure the safety of the blood supply globally.

METHOLODOLOGY

A cross-sectional study of blood donors who visited the RHQ Hospital in Skardu between August 26, 2022, and August 26, 2023 was conducted. Every donor gave their informed consent. Blood donors' names, ages, sexes, dates of birth, marital status, and phone numbers were noted, and they were assigned a special identification number. Each prospective donor had to fill out a comprehensive health history form before to the donation. This form asked about their general health, lifestyle, past and present feverish diseases, weight loss, persistent illnesses, unusual or excessive bleeding, drug history, tattoos, dental work, previous blood donations or transfusions, immigration or travel history, sexual history, and risky behaviors. These answers were followed by brief private interviews. After that, blood donors underwent tests for syphilis, HIV, HBV, HCV and Malaria.

Study Area (District Skardu)

Skardu, a beautiful area in the Gilgit-Baltistan region of Pakistan, is known for its stunning landscapes and high mountains. However, it faces challenges in healthcare, especially with blood transfusions, which are important in emergencies, surgeries, and for people with certain health conditions.

In Skardu, getting safe and timely blood transfusions can be difficult. The rough terrain and limited roads make it hard to set up and maintain blood banks. Transporting blood to remote areas is challenging, especially during bad weather. Hospitals and clinics in Skardu often don't have the necessary equipment, trained staff, or proper storage for blood transfusions. Getting people to donate blood can be hard because there isn't much awareness and there are misconceptions about donating. It's also tough to store blood safely, as it needs to be kept cold, and this can be difficult in remote areas, increasing the risk of the blood going bad.

To improve blood transfusion services in Skardu, several things are needed. Better healthcare infrastructure, including well-equipped blood banks and improved transportation. Awareness campaigns to educate people about the importance of blood donation and to clear up any misunderstandings. Training for healthcare workers so they can handle blood transfusions safely. And partnerships between local authorities, healthcare providers, and NGOs to create a strong network for blood donation and transfusion services. By doing these things, Skardu can improve its blood transfusion services, ensuring that people have access to this vital healthcare service and ultimately improving health outcomes in the area.

Study Period (August 2022-August 2023)

The choice of the study period, spanning from August 26, 2022, to August 26, 2023 is a strategic decision aimed at capturing to determine the prevalence and common TTIs among healthy male blood donors in Skardu, Gilgit Baltistan. The delineation of this specific timeframe because I was doing internship during that timeframe.

Data collection

In this study, the blood center site was located in RHQ Hospital Skardu, Gilgit Baltistan and the unpaid donation data of 1400 individuals were recorded in this blood center between 26 August 2022 and 26 August 2023.

Serology Screening test

Screening for HBsAg, Anti HCV, HIV Ag/Ab (HIV-1/HIV-2) and malaria was done by immune chromatographic tests. RPR test was done for screening for Syphilis. All reactive results were

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repeated on the same sample using ELISA method for HBsAg , Anti-HCV and HIV.

Blood donor's selection criteria

Donors were chosen based on the WHO's "Standing Operating Procedures for Blood Transfusion," which outlines the ideal donor standards. Blood donors who met the requirements listed below were accepted.

- Age: 18 to 60 years.
- Weight: not less than 45 kg.
- Temperature: below 99.5°F.
- Pulse: 60-100 bpm.
- Blood pressure: Systolic 100-180 mmHg, Diastolic 60-100 mmHg.
- Hemoglobin level: Male ≥ 12 g/dl, Female ≥ 11.5 g/dl.
- No puncture site, scar mark on arms or forearms indicative of professional donors or intravenous drug users.
- Should be free from respiratory diseases, skin diseases specially at the site of phlebotomy and TTIs.

Pre-donation testing

Pre-donation testing protocols included a health history interview, a brief physical examination, and quick testing. Eligible donors had to pass these tests if they were first-time or repeat donors (with a history of blood donation and an interval of more than 183 days). The health history questionnaire was used to gather information on donation histories, medical histories, and risk behavior. It also allowed for the detection of weight, temperature, blood pressure, and heart rate. The fast testing consisted of four components: ABO blood type. The donation was canceled if the pre-donation testing produced any aberrant results; otherwise, it would proceed.

Sample collection

The process of gathering and testing blood samples was carried out with highest biosafety and according to infection control guidelines. As per standard operating procedure (SOP), all volunteer and replacement blood donors who show up at the blood bank are screened and educated before giving blood.

Blood samples were collected in 5-ml vacutainers from volunteers by venipuncture and stored at 4°C. Serum was separated by centrifugation at 3000 × g for 5min and then used for screening.

Frequency of Transfusion-Transmissible Infections

The frequency (in percent) for any particular TTI in individual study was calculated as total number of donors with reactive TTI/total donor population screened multiplied by 100. We calculated the cumulative frequency of TTIs in the donor population, ie, the total number of donors reactive for a particular TTI in individual studies divided by the total donor population of all studies screened.

Data analysis

For data analysis the MS Excel is used. Summary of statistics such as frequency, percentage were presented using tables, boxplots and graphs.

Ethical statements

The data was obtained after approval Manager Blood bank RHQ Hospital Skardu, Gilgit Baltistan ,biggest hospital in Baltistan region. Written informed consent was obtained from all participants before the interview and venous blood collection. All participants were informed that their blood samples would be tested for TTIs and they would receive the results after testing. A code used to replace the donor names, and any results were kept strictly confidential in protection of participant privacy rights.

RESULT AND DISCUSSION

Between August 26, 2022, and August 26, 2023, Regional Blood Centre at RHQ Hospital in Skardu processed total 1400 blood donations. Among these, 97% came from replacement donors, while 3% originated from voluntary non-remunerated blood donors (VNRBD). The prevalence rates for HBV, HCV, HIV, Syphilis, and Malaria were 0.5%, 0.07%, 0.14%, 0%, and 0% respectively.

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Table I: Overview of selected diseases in selected papulation.

Test	Total	Positive	Percentage %
HBsAg (ICT)	1400	07	0.5%
Anti- HCV (ICT)	1400	01	0.07%
Anti-HIV (ICT)	1400	02	0.14%
Syphilis (RPR)	1400	00	0.0%
Malaria Parasite (ICT)	1400	00	0.0%

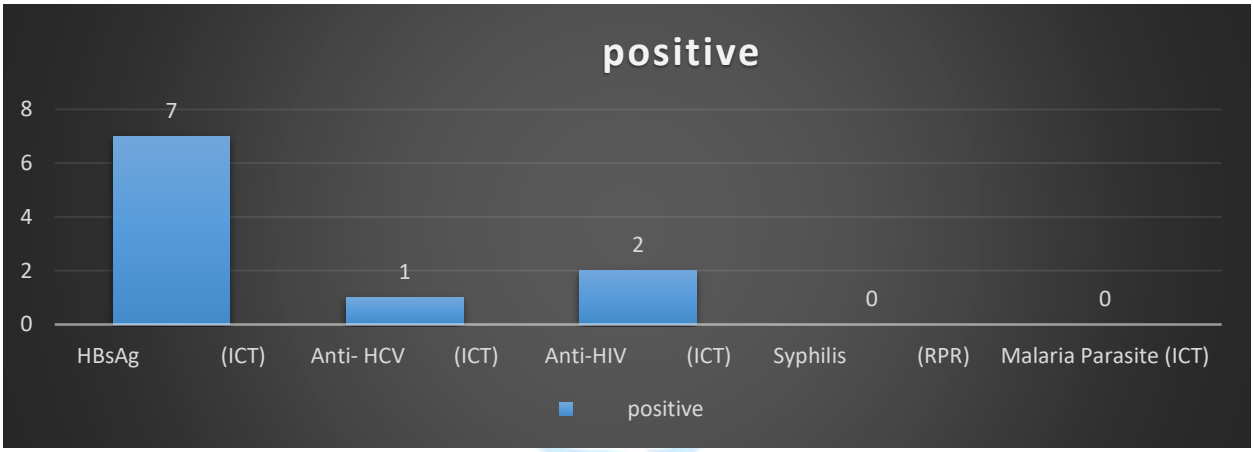

Figure:1 - showing positive rate of TTI among healthy blood donors in Skardu Baltistan.

Overall Irregular fluctuation has been seen of all TTI in blood donors in study 1 year. Within our study, it was observed that the prevalence rate of HBsAg infection is high than other TTIs among healthy male blood donors in Skardu Baltistan.

Table.2 Showing Monthly Report of positive and negative test rate in healthy male donors

Months	Total	HBV (+)	HBV (-)	HCV (+)	HCV (-)	HIV (+)	HIV (-)	Syphilis (+)	Syphilis (-)	Malaria (+)	Malaria (-)
August	37	00	37	00	37	00	37	00	37	00	37
Sept	67	02	65	00	67	00	67	00	67	00	67
Oct	40	01	39	00	40	00	40	00	40	00	40
Nov	57	00	57	00	57	00	57	00	57	00	57
Dec	87	01	86	00	87	01	86	00	87	00	87
Jan	90	00	90	00	90	00	90	00	90	00	90
Feb	152	00	152	00	152	00	152	00	152	00	152
March	235	01	234	00	235	00	235	00	235	00	235
April	117	01	116	00	117	00	117	00	117	00	117
May	145	00	145	01	144	00	145	00	145	00	145
June	105	00	105	00	105	00	105	00	105	00	105
July	172	01	171	00	172	01	171	00	172	00	172
August	133	00	133	00	133	00	133	00	133	00	133

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Pakistan has a poorly regulated, demand-driven fragmented Blood Transfusion system based on more than 1800 public hospital- based or free-standing private blood banks (BBs) (Zaheer, 2014 #1).

These units provide all services of the vein-to-vein transfusion chain, ranging from typing, cross-matching, donor screening, collection, storage and distribution of blood to the patients. There is inadequate initial screening of donors for high-risk behaviors due to inadequate training of blood bank staff. Limited knowledge of donors about their health and medical problems also increases the risk of TTIs. Pakistan lacks a universal quality-assured serological screening process. In many blood banks, poor quality, cheap and rapid manual methods are being used for quick screening along with poor laboratory practices {Waheed, 2019 #1}. This can lead to a significant probability of missing an infection in the donor population with a multifold increased risk of transmission to transfusion recipients. Rates of voluntary donations are meager accounting for less than 13% of all donations. This is due to a lack of infrastructure, poor educational status and cultural beliefs of the general population {Mumtaz, 2012 #2}.

According to a global status report (2016) by the WHO on blood safety and availability, the proportion of donations that screened TTIs in Pakistan were 100% for HIV, HBV, HCV and only 66% for syphilis and malaria. The seroprevalence of HBV in blood donors varied from 1.55% to 3.76%, HCV from 2.55% to 7.23%, HIV from 0 0.01% to 0.04% and syphilis varied from 0.59% to 1.16% {Jefferies, 2018 #3}.

The Regional Blood Centre at RHQ Hospital in Skardu, Pakistan, processed a total of 1400 blood donations between August 26, 2022, and August 26, 2023. This significant volume of blood donations underscores the importance of blood transfusion services in supporting patients globally. However, the risk of transmitting blood-borne infectious agents (BBIs) through contaminated blood remains a crucial challenge for blood transfusion services, particularly in low-income countries like Pakistan. The prevalence rates for various BBIs in the donated blood were 0.5% for HBV, 0.07% for HCV, 0.14% for HIV, and 0% for Malaria and Syphilis. These rates are relatively low compared to global trends.

Prevalence of Total TTIs

In our study, we established that the overall collective prevalence of TTIs in donated blood was 0.71 %. This finding compares favorably to an earlier study from Lahore, Pakistan which reported a percentage prevalence of 4.0%. However, it is less than the results reported from previous local studies in the country. For example, earlier studies from Karachi, Islamabad, and Faisalabad reported a seroprevalence of 5.8% 14.34% and 6.55% respectively {Arshad, 2016 #4}. In contrast, lower prevalence was reported in two earlier studies both undertaken in Islamabad (3.72%) and (3.27%) {Awan, 2018 #6}.

When compared globally, studies from Nigeria (14.96%) {Okoroiwu, 2018 #7} Albania (7.4%), {Durro, 2010 #8} Ethiopia (11.5%),{Mohammed, 2016 #9} and Sudan (20.1%) reported a higher overall TTI prevalence rate comparatively. Whereas studies from India (0.6%) {Fernandes, 2010 #10} and Iran (0.25%) {Farshadpour, 2016 #3} have reported a lower prevalence rate compared with our findings.

Another significant outcome of the present study was that the frequency of TTIs in replacement donors was comparatively higher. A similar finding has been reported by scientists working elsewhere{Durro,2010} {Mohammed, 2016 #9},{Fernandes, 2010 #10}. Therefore, the replacement donors are considered potentially at high risk of transmitting TTIs. This fact has been attributed to numerous predisposing factors, for example, the likelihood of providing false answers to a history questionnaire by family replacement donors, hence hiding information on matters that result in further inquiry so restraining the protection level of behavioral screening {Sabino, 2012 #5}.

Considerable differences related to seroprevalence and trends of specific TTIs was witnessed, e.g., the most common type of TTI in our study was hepatitis B whereas earlier studies had observed higher prevalence for hepatitis C.

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Prevalence of Hepatitis C

According to our study, the overall frequency of hepatitis C was 0.07%. This was lower than results from earlier national studies which displayed 1.7% {Arshad, 2016 #6}, 8.34%, {Waheed, 2015 #8} 3.24%, and 2.62%. When compared with global studies, the prevalence was lower when compared with those reported from Egypt (4.3%), Kenya (3.21%), and Sudan (3.4%) {Onyango, 2018 #7} while it was higher when compared with studies from Iran (0.05%) {Niazkar, 2020 #8} and India (0.06%) {Fernandes, 2010 #10}.

Prevalence of Hepatitis B

The overall prevalence of hepatitis B in our study was 0.5%. This was lower when compared with some local studies which displayed 0.9%, 1.84% {Arshad, 2016 #6} 1.29%, and 1.10% {Saeed, 2017 #9}. This finding may indicate the likelihood that the prevalence of HBV in the general healthy population is relatively low. Our findings were on the lower side when compared with studies from Sudan (11.7%), Tanzania (8.8%) {Matee, 2006 #10} Iran (0.13%) {Niazkar, 2020 #8}, Brazil (1.63%) {Pessoni, 2019 #1}, and Bangladesh (1.4%) {Rudra, 2010 #2}.

Prevalence of HIV

The Total prevalence of HIV in the present study was 0.14%. This percentage is significantly higher when compared with previous local studies which have reported a prevalence of 0.04% {Arshad, 2016 #6}, 0.02 {Saeed, 2017 #3}, 0.07 and 0.13%.43. Two studies even reported a zero prevalence for HIV in blood donors. Similarly, studies from Iran (0.002%), Saudi Arabia (0.13%) {Alaidarous, 2018 #5}, Bangladesh (0.03%) {Rudra, 2010 #6}, Libya (0.014%) and Egypt (0.00%) reported a low prevalence of HIV comparatively. Our findings were on the lower side when compared with studies from Ethiopia (2.6%) {Negash, 2019 #7}, Cameroon (4.44%) {Fouelifack Ymele, 2012 #8}, and South Africa (1.13%) {Vermeulen, 2017 #9}.

Prevalence of Syphilis

The positivity of syphilis in our study was 0%. This finding lower compares favorably to earlier local studies 0.89% and 0.91% {Sultan, 2016 #10}. However, the finding was comparatively lower compared with other local studies which reported a rising prevalence trend for syphilis 1.1%,6 2.1% {Arshad, 2016 #6}, and 1.55% {Saeed, 2017 #9}. A national survey recently conducted by the national blood transfusion program, however, reported a low prevalence rate of 0.72% {Waheed, 2020}. Studies from several African countries have observed a high prevalence, for instance, Burkina Faso (1.5%) {Bisseye, 2013 #1}, Nigeria, (3.1%) {Okoroiwu, 2018 #2}, and Angola (20.0%) {Quintas E, 2018} while data from developed countries indicate a low prevalence comparatively, Qatar (0.43) {Aabdien, 2020 #3}, Iran (0%) {Niazkar, 2020 #4}, United States of America (0.16%) {Kane, 2015 #5}, and Italy (0.031%) {Drago, 2014 #6}.

Prevalence of Malaria

The malaria positivity in the present study was 0%. Earlier studies from Pakistan have reported a comparatively higher results of 0.16 and 0.10% {Saeed, 2017 #7}. A high prevalence was reported by Arshad et al 0.07% from Karachi and (0.89%) from Faisalabad compared to our result. The current lower prevalence finding validates the presumption that malaria poses less risk to blood safety in the Skardu region by virtue of lesser frequency. Nevertheless, it has to be screened and proper medical history taken before the donation.

Conclusion

TTI rates fluctuate yearly, however its significant rate demands further research to identify risk factors and develop intervention measures. To reduce the incidence of TTIs, recommendations include promoting voluntary blood donation, sensitizing and engaging more female donors, screening donated blood with highly precise assays, and performing more research using nucleic acid technology. The current data will probably to assist policymakers develop a plan of action and promote effective management in

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blood facilities. The occurrence of TTIs in blood donors, who are typically considered healthy, highlights the prevalence of these infectious agents in our community.

Limitations

The samples from blood donors were examined using serological testing in the current investigation. To lower the risk of HIV, hepatitis B, and hepatitis C transmission in seronegative donors, a sensitive screening test is required. By shortening the duration of early disease, the application of ELISA and nucleic acid testing (NAT) to serological screening reduces the probability of TTI transmission. Many rich nations have made NAT obligatory for regular blood donor screening. Eight blood centers in Pakistan screen patients for hepatitis B and C using NAT technology, which has been shown to be more effective than serological testing alone.

Recommendations for Safe Blood Screening and Transfusion

Ensuring the safety and effectiveness of blood screening and transfusion processes is crucial for protecting both donors and recipients. The following recommendations outline best practices to enhance the safety and quality of these procedures:

1. Donor Selection

- **Medical History and Risk Assessment:** Thoroughly assess potential donors through detailed questionnaires and medical histories to identify any risk factors for transfusion-transmissible infections (TTIs).
- **Physical Examination:** Conduct a brief physical examination to ensure the donor is in good health and meets the necessary criteria (age, weight, hemoglobin levels).

2. Blood Collection

- **Sterile Techniques:** Utilize aseptic techniques during blood collection to prevent contamination.
- **Qualified Personnel:** Ensure that only trained and certified personnel perform blood collection.

3. Blood Screening

- **Comprehensive Testing:** Test all collected blood for TTIs, including HIV, hepatitis B and C, syphilis, and other region-specific infections.
- **Nucleic Acid Testing (NAT):** Incorporate NAT to detect viral genetic material, which can identify infections earlier than traditional antibody tests.

- **Quality Control:** Implement stringent quality control measures to ensure the accuracy and reliability of test results.

4. Blood Processing and Storage

- **Component Separation:** Process blood into components (red cells, plasma, platelets) to allow for targeted treatment and efficient use of donations.
- **Proper Storage:** Store blood and its components at appropriate temperatures and conditions to maintain their viability and safety.
- **Inventory Management:** Monitor blood inventory closely to reduce wastage and ensure availability of blood types in demand.

5. Transfusion Practices

- **Cross matching:** Perform compatibility testing between donor and recipient blood to prevent adverse reactions.
- **Patient Identification:** Use strict patient identification protocols to ensure that the correct blood is transfused to the intended recipient.
- **Informed Consent:** Obtain informed consent from patients or their guardians after explaining the benefits and risks associated with transfusion.

6. Adverse Reaction Management

- **Immediate Response:** Establish protocols for the prompt identification and management of transfusion reactions.
- **Reporting and Documentation:** Document all transfusion reactions thoroughly and report them to relevant health authorities for further investigation and preventive measures.

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7. Training and Education

- **Continuous Training:** Provide ongoing education and training for all staff involved in blood collection, screening, and transfusion.
- **Public Awareness:** Educate the public about the importance of safe blood donation and transfusion practices.

8. Regulatory Compliance

- **Adhere to Guidelines:** Follow national and international guidelines and regulations for blood screening and transfusion.
- **Accreditation:** Obtain and maintain accreditation from recognized bodies to ensure adherence to high standards of practice.

9. Monitoring and Evaluation

- **Regular Audits:** Conduct regular audits of blood bank operations and transfusion practices to identify areas for improvement.
- **Data Analysis:** Analyze data on transfusion outcomes and adverse events to inform policy and practice changes.

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