Original Article

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Quick Response Code:

Website: www.ijhonline.org

DOI: 10.4103/ijh.ijh_31_21

Improving detection rates of suspected acute transfusion reactions through active surveillance

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Submission: 14-07-2021
Revised: 27-08-2021
Accepted: 27-08-2021
Published: 01-12-2021

Abstract:

BACKGROUND: Tracking transfusion reactions is essential to improve patient safety. Under-reporting of transfusion reactions was suspected in our institution. To evaluate this phenomenon, we followed an active surveillance protocol for transfusion reactions for 3 months in 2016 and compared transfusion reaction rates during that period with 2015 and 2017.

METHODS: The study was carried out in a tertiary care hospital over 3 months in 2016. Investigators visited hospital units and collected data on all patients who received a transfusion in the preceding 24 h. Further details were obtained about all cases that are suspected to have had a transfusion reaction. Transfusion reactions were defined according to the definitions provided by National Healthcare Safety Network Biovigilance Component Hemovigilance Module Surveillance Protocol 2016. Rates that were obtained through active surveillance were compared through appropriate statistical methods with transfusion reaction rates obtained through passive reporting from 2015 and 2017.

RESULTS: During the study period, a total of 47 transfusion reactions were captured through active surveillance and passive reporting (transfusion reaction rate 0.79%). There was a statistically significant difference between these rates in comparison with rates detected in similar months from 2015 (0.26%) and 2017 (0.17%).

CONCLUSIONS: Active surveillance for transfusion reactions is an effective method for improving rates of the detection of suspected transfusion reactions. The phenomenon of under-reporting of transfusion reactions requires thorough evaluation by transfusion medicine professionals to introduce targeted solutions and improve reporting rates.

Keywords:

Hemovigilance, transfusion reactions, transfusion medicine

Introduction

Transfusion of blood components is a common intervention among hospitalized patients.[1] Transfusion may be associated with many potential complications [Table 1]. Despite the tremendous improvement in the incidence of transfusion-transmitted infections, noninfectious complications (such as hemolytic transfusion reactions, transfusion-associated circulatory overload [TACO], and transfusion-related acute lung injury [TRALI]) constitute serious threats to patient safety.[2]

When undesirable responses that are temporally associated with a transfusion occur, it may not be always possible for the bedside healthcare professionals to determine the type of transfusion reaction or even its imputability (certainty the reaction is related to the transfusion). The results of some of the investigations may not be immediately available, and management is typically supportive. These factors may

How to cite this article: Badawi MA, Saaty R, Altayyari ST, Khalil R, Moria F, Zaher G, *et al*. Improving detection rates of suspected acute transfusion reactions through active surveillance. Iraqi J Hematol 2021;10:165-9.

Table 1: Potential transfusion complications (transfusion reactions)

Onset	Mechanism	Type
Acute transfusion complications (usually occuring during the transfusion or within 24 h)	Immune	TRALI
		Acute hemolytic transfusion reaction
		Febrile nonhemolytic transfusion reaction
		Allergic
		Anaphylactic
	Infectious	Bacteria
	Other	TACO
		Hypotension
		Hyperkalemia
Delayed transfusion complications (beyond 24 h. Presents within days to years)	Immune	Delayed hemolytic transfusion reaction
		Alloimmunization
		Transfusion-associated graft versus host disease
		Post transfusion purpura
	Infectious	Viruses
		Prions
		Parasites
	Other	Iron overload
		Immune modulation

TRALI=Transfusion-related acute lung injury, TACO=Transfusion-associated circyulatory overload

cause some healthcare providers to overlook the aspect of notifying and reporting suspected transfusion reactions to the hospital transfusion service. However, reporting suspected transfusion reactions is always required to allow protection of other patients from similar incidents or taking measures to prevent recurrence of the same reaction to the patient in the future.[3-5]

Recognition, tracking, and monitoring of all suspected transfusion reactions are essential, ideally through a comprehensive hemovigilance program, monitoring all undesirable effects along the transfusion chain.[6] This allows for thorough analysis of complications and generation of recommendations that are expected to improve patient safety.

Our institution has been monitoring transfusion reactions as part of an institution-based hemovigilance system.[7] It has been shown that the rates of reported suspected transfusion reactions are below benchmarking levels. This was suspected to be a result of under-recognition and/or under-reporting, which may be expected when hospital transfusion services rely on bedside healthcare professionals to report adverse events (passive surveillance or passive reporting). An alternative approach, active surveillance, entails that the hospital transfusion service actively "searches" for possible reactions through evaluation of patients after transfusion. When compared with passive reporting, the active surveillance approach is associated with significantly higher costs and time requirements but has been shown to yield more complete information about transfusion reactions in other institutions. In a publication from the University of North Carolina Hospitals, the incidence of platelet-associated TACO with active surveillance was 36 times more often than the incidence with passive reporting.[8] One out of four TRALI cases and 5.1% of TACO cases detected by active surveillance were reported in a large study from four tertiary care academic centers from the United States.[9] In another report from North India, 32.8% of transfusion reactions detected through active surveillance were left unreported.[10]

The aim of this study was to investigate whether the low rates of reported suspected transfusion reactions are secondary to under-reporting (or under-recognition). To evaluate this phenomenon, we followed an active surveillance protocol for transfusion reactions for 3 months in 2016 and compared transfusion reactions rates during that period with 2015 and 2017.

Methods

The cross-sectional study was carried out in King Abdulaziz University Hospital in Jeddah, Saudi Arabia. This is a tertiary care academic hospital with around 600-beded capacity. Hospital transfusion policy defines suspected transfusion reactions as any adverse effects that are temporally related to transfusion of blood components. The policy mandates reporting of all suspected transfusion reactions by a nurse or a physician through the hospital information system (HIS). In this project, transfusion reactions reported in this manner are referred to as those detected through passive reporting.

During the active surveillance period (throughout the months of August, November, and December 2016), an investigator visited the critical care, medical, and surgical units daily. Patients who received a transfusion of any blood component within the previous 24 h were reviewed, and the following data were documented: patient demographics, blood component received, number of units received, time of beginning and ending of transfusion, underlying conditions, reason for transfusion, vital signs, oxygen saturation, and progress notes over 24 h from the initiation of transfusion. If a patient is suspected to have experienced an adverse transfusion reaction, based on review of vital signs and progress notes, further details were obtained about the case, including onset of symptoms, fluid balance, and central venous pressure if available. It was also noted whether the patient received diuretics or had heart failure or renal injury. Other laboratory and radiological investigations were reviewed including brain natriuretic peptide, pre- and post-transfusion ejection fraction, and chest X-ray if available.

Vital signs changes that were considered significant by the investigators were those described in the National Healthcare Safety Network Biovigilance Component Hemovigilance Module Surveillance Protocol 2016 (NHSN Biovigilance Component Hemovigilance Module Surveillance Protocol), including oral temperature of ≥38°C, drop in systolic blood pressure ≥30 mmHg and systolic blood pressure ≤80 mmHg, and PaO_2/FiO_2 ≤300 mmHg, or oxygen saturation <90% on room air.

All suspected transfusion reactions, whether detected by active surveillance or passive reporting, were reviewed by a transfusion medicine physician. Transfusion reactions were evaluated according to the definitions provided by the NHSN Biovigilance Component Hemovigilance Module Surveillance Protocol 2016.

Rates of transfusion reactions that were obtained during the study period in 2016 (active surveillance and passive reporting combined) were compared with transfusion reaction rates obtained in corresponding months from 2015 and 2017 (through passive reporting). Data during the active surveillance period are compared with the previous year to illustrate the need for the study and are compared with the data from the following year to investigate whether the improved detection (if present) is sustainable without active surveillance.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) software (version 16, SPSS, Inc., Chicago, IL, USA). Chi-square test was used to assess the difference between the transfusion reaction rates from the different years.

Ethical approval was obtained from the ethics committee in our institution.

Results

During the study period, 5971 transfusion episodes took place in our hospital, with 241 of those taking place in the visited units, and those were followed and reviewed by the investigators. Through active surveillance, it was detected that 20 patients had fever in the first 24 h from the start of transfusion. In six of these patients, the onset of fever preceded the transfusion. Other suspected reactions included four patients who had simple allergic reactions, two patients with hypotension, four who had features consistent with transfusion associated circulatory overload, and five who had respiratory changes that was not classifiable to TACO or TRALI. From the visited units, only three reactions were reported (all febrile).

During the same period, nurses and treating physicians reported 12 transfusion reactions from other hospital units. These included 5 simple allergic reactions and 7 febrile reactions. Table 2 summarizes key data from the study period in 2016.

Table 3 summarizes the number of transfused blood components during the active surveillance period (August, November, and December 2016), in addition to the number of transfusion reactions identified through active surveillance and those passively reported. In Table 3, data from the same months in 2015 and 2017 are shown for comparison.

The rate of transfusion reactions (all reactions/number of blood components in a specific time period multiplied by 100) was 0.79% in 2016, significantly higher than the rates from 2015 and 2017 ($P < 0.001$).

Discussion

In this study, we identify a significant difference in rates of transfusion reactions when active surveillance is implemented. The results of this study are consistent with other studies performed in other institutions.[8,11]

There are many potential reasons for under-reporting transfusion reactions. A study from Namibia identified a number of such reasons including not recognizing transfusion reactions, false impressions from healthcare providers that only severe reactions require reporting, efforts required to report, and fear of repercussions for reporting.[12] From our experience, we also identified cases where transfusion reactions were not reported if the adverse symptoms temporally related to transfusion could have been explained by the patient's underlying condition. Since imputability may not be easily ascertained at the time of the event, we encourage healthcare providers to report all adverse events, keeping imputability to be assessed retrospectively by the transfusion medicine physician after careful evaluation of the case and results of investigations.

Active surveillance shows an improvement in the detection of potential adverse transfusion reactions and their reporting to transfusion medicine laboratories. This is certainly time-consuming but can be performed

Table 2: Transfusions and reactions during the study period in 2016

	Data from visited units	Date from other hospital units	Data from the hospital
Transfusions	241	5730	5971
Reactions only detected by active surveillance	32	-	32
Reactions reported through passive reporting	3	12	15
All transfuion reactions	35	12	47

Table 3: Comparison of rates of suspected transfusion reactions reported through passive reporting and active surveillance

	Transfusion reactions	Transfusion episodes	Percentage of total reactions to total transfusion episodes	*P*
Period 1	12	4554	0.26	<0.001*
Period 2	47**	5971	0.79	
Period 3	9	5294	0.17	<0.001*

*Significant using Chi-square test at <0.05 level, **Thirty-two reactions were detected by active surveillance only. Total number of transfusions and rates of suspected transfusion reactions detected through active surveillance and passive reporting during the study period and rates from same months in previous and following year. Period 1: August, November, and December 2015, Period 2: August, November, and December 2016, Period 3: August, November, and December 2017

through a transfusion safety officer or a transfusion nurse. Implementation of a comprehensive electronic medical record may allow review of data of patients who received transfusions by a dedicated staff member without leaving the transfusion medicine laboratory. Specific case detection algorithms, e.g., classification and regression tree analyses, may also be successfully utilized.[13] Other interventions that were proven to improve transfusion reactions reporting include allowing all healthcare providers, including transfusion medicine laboratory staff to initiate a report for a transfusion reaction,[14] and improving the process for initiating the transfusion reaction report.[14,15]

The results of this project were utilized to illustrate the need to improve reporting practices to healthcare providers in our institution. In addition, it encouraged the transfusion medicine laboratory to revise the process of reporting transfusion reactions through HIS. This included providing all categories of healthcare providers with access to reporting screens, automatic retrieval of all relevant clinical data by HIS to accompany the report, and trimming the screens that need to be filled by the healthcare providers when a report is created. Hiring a transfusion safety officer is also planned.

Our study has a number of limitations. Active surveillance was restricted to a few hospital units for feasibility reasons. A number of clinical/laboratory features that may indicate transfusion reactions were not included in the surveillance protocol (such as hemoglobinuria or development of positive direct antiglobulin test). Despite these restrictions, suspected acute transfusion reactions were significantly high during the study period. We did not focus on imputability while capturing events. The rationale was the intent to encourage clinical teams to report all adverse events that are temporally related to transfusion as suspected transfusion reactions. Clinical teams are assured that the physicians at the transfusion services laboratory will be evaluating each case to evaluate the likelihood it is a complication of the transfusion. The goal of the study was to capture all changes in patients' conditions that may be related to transfusion. In addition, the head nurses from the participating units were not blinded to the presence of the investigators in the units on daily basis. Despite the emphasis from the team of investigators that clinical teams should continue to report transfusion reactions through HIS, we wonder if the presence of the team of investigators reassured some of the staff on the units that reactions are captured and do not require reporting through HIS. Finally, this study did not shed light on the reasons behind low reporting, whether most cases were not recognized as possible transfusion reactions or recognized but not reported. Future projects may be helpful in that regard.

In conclusion, healthcare providers from all disciplines must be aware of the need to report all suspected transfusion reactions to the hospital transfusion service. Transfusion medicine professionals are faced with the need to find solutions to the issues of under-recognition and under-reporting. Active surveillance, coupled with continuous education, may improve recognition and reporting of transfusion reactions, translating into improved patient safety.

Conclusions

Transfusion reactions are common complications to blood transfusion. An essential part of their management is reporting them to the hospital transfusion service. Reliance on passive reporting alone may result in under-reporting, and consideration must be made for capturing these events through other modalities, including active surveillance.

Acknowledgments

The authors would like to thank the Nursing Department in King Abdulaziz University Hospital for their support.

Financial support and sponsorship

This study was not funded.

Conflicts of interest

There are no conflicts of interest.

References

1. Pfuntner A, Wier L, Stocks C. Most Frequent Procedures Performed in U.S. Hospitals, 2011. Available from: https://www.ncbi.nlm.nih.gov/books/NBK174682/. [Last accessed on 2019 Jul 24].
2. Bolton-Maggs P, Poles D, Watt A, *et al*. on behalf of the Serious Hazards of Transfusion (SHOT) steering group. The 2017 annual SHOT report (2018).https://b-s-h.org.uk/media/16506/shot-report-2017.pdf.[Last accessed on 2021 Aug 15].
3. Clarke G. Investigation and management of non-infectious transfusion reactions. ISBT Sci Ser 2017;12:80-6.
4. Delaney M, Wendel S, Bercovitz RS, Cid J, Cohn C, Dunbar NM, *et al*. Transfusion reactions: Prevention, diagnosis, and treatment. Lancet 2016;388:2825-36.
5. Hillis C, Heddle N, Shih A. Best practices in the differential diagnosis and reporting of acute transfusion reactions. Int J Clin Transfus Med 2016;4:1-14.
6. de Vries RR, Faber JC, Strengers PF, Board of the International Haemovigilance Network. Haemovigilance: An effective tool for improving transfusion practice. Vox Sang 2011;100:60-7.
7. Hindawi SI, Badawi MA, Raj ET, Gholam KA, Al-Weail SO, Azher F. The use of transfusion quality indicators as a tool for hemovigilance system implementation at a tertiary care center in Saudi Arabia. Saudi Med J 2016;37:538-43.
8. Raval JS, Mazepa MA, Russell SL, Immel CC, Whinna HC, Park YA. Passive reporting greatly underestimates the rate of transfusion-associated circulatory overload after platelet transfusion. Vox Sang 2015;108:387-92.
9. Hendrickson JE, Roubinian NH, Chowdhury D, Brambilla D, Murphy EL, Wu Y, *et al*. Incidence of transfusion reactions: A multicenter study utilizing systematic active surveillance and expert adjudication. Transfusion 2016;56:2587-96.
10. Agnihotri N, Agnihotri A. Active hemovigilance significantly improves reporting of acute non-infectious adverse reactions to blood transfusion. Indian J Hematol Blood Transfus 2016;32:335-42.
11. Narvios AB, Lichtiger B, Neumann JL. Underreporting of minor transfusion reactions in cancer patients. MedGenMed 2004;6:17.
12. Basavaraju SV, Lohrke B, Pitman JP, Pathak SR, Meza BP, Shiraishi RW, *et al*. Knowledge and barriers related to reporting of acute transfusion reactions among healthcare workers in Namibia. Transfus Med 2013;23:367-9.
13. Clifford L, Singh A, Wilson GA, Toy P, Gajic O, Malinchoc M, *et al*. Electronic health record surveillance algorithms facilitate the detection of transfusion-related pulmonary complications. Transfusion 2013;53:1205-16.
14. St Bernard R, Yan M, Ning S, Escorcia A, Pendergrast JM, Cserti-Gazdewich C. Sustained and significant increase in reporting of transfusion reactions with the implementation of an electronic reporting system. Transfusion 2016;56:1247-8.
15. Rashid A, Agha MA, Minhas S, Nepal B, Nusrat N. Steps taken to alleviate under-reporting of transfusion reactions at a public sector hospital in Pakistan. Blood Res 2016;51:290-2.