Review Article
Incidence of adverse reaction in blood donation: a systematic review

Moslem Taheri Soodejani1, Ali Akbar Haghdooost2, Maryam Okhovati3, Farzaneh Zolala2, Mohammad Reza Baneshi4, Abbas Sedaghat5, Seyyed Mohammad Tabatabaei6,7

1Research Center of Prevention and Epidemiology of Non-Communicable Disease, Department of Biostatistics and Epidemiology, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran; 2HIV/STI Surveillance Research Center, WHO Collaborating Center for HIV Surveillance, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran; 3Medical Library and Information Sciences Department, Faculty of Management and Information Science, Kerman University of Medical Sciences, Kerman, Iran; 4Modeling in Health Research Center, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran; 5Blood Transfusion Research Center, High Institute for Research and Education in Transfusion Medicine, Tehran, Iran; 6Department of Medical Informatics, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran; 7Clinical Research Development Unit, Imam Reza Hospital, Mashhad University of Medical Sciences, Mashhad, Iran

Received June 5, 2020; Accepted August 17, 2020; Epub October 15, 2020; Published October 30, 2020

Abstract: There are a lot of reports related to adverse reactions post blood donation. The present study is designed to investigate the incidence of adverse reactions in blood donation around the world. This research was conducted through searching databases such as PubMed, Web of Science, Scopus, EmBase, Ovid, as well as the specialized journal of TRANSFUSION without any time limit by using the keywords including “Adverse Event”, “Adverse Effect”, “Adverse Reaction”, “Complication”, “Side Effect”, “Vasovagal Reaction”, “Local Reaction”, “General Reaction”, “Allergic Reaction”, “Blood Donor”, and “Blood Donation”. In the initial search, 7054 documents were found, of which 2517 duplicates were excluded. After screening the remaining 4,537 documents, 97 one were reviewed for quality assessment, of which 30 with the appropriate quality were selected for the review process. The results of the study showed that the reactions caused by blood donation are very different. Most reactions were systemic, and ranged from 0.08 to 13 percent in different countries. The incidence of adverse reactions in blood donation differ across the countries which might be related to the donors’ characteristics. The difference did even existed in studies conducted in the same country and the same year. This suggests that many factors can cause adverse reactions in blood donation, and that a wide range of them investigated in one study, most of which were systemic.

Keywords: Adverse event, adverse effect, adverse reaction, complication, side effect, vasovagal reaction, local reaction, general reaction, allergic reaction, blood donor, blood donation

Introduction

Blood transfusion is known as a key component in every healthcare system which saves millions lives around the world each year [1]. About 30% of all people have had a need to receive blood or its products during their life [2].

Although blood donation is a very low risk procedure, the incidence of some adverse reactions is inevitable which is the most important factor in reducing the donor’s desire to donate again. This would be an obstacle against providing healthy and sufficient blood. Therefore, eliminating or reducing these factors by means of prevention, can help to achieve this goal [3].

Various adverse reactions may occur post blood donation, all of which are divided into two categories of local and systemic reactions [4]. Local reactions include hematoma, hemorrhage, bruising, and associated inflammation, while systemic reactions associated with dizziness, hyperventilation, pallor, bruising, and similar sings [5].

Although the incidence of adverse reactions in blood donation is related to many factors, the sexual distribution of donors, as well as dona-
Incidence of adverse reaction in blood donation

...tion type (First, Regular) and race are the most affecting factors [6-9]. In this study, a systematic review has been done on the incidence of adverse reactions in blood donation in different countries around the world and the incidence, as well as participation rate of women and first donors have been extracted.

**Materials and methods**

**Search strategy**

To investigate adverse reactions in blood donation occurred all over the world, electronic databases, reports and documents published by various organizations was searched using keywords including “Adverse Event”, “Adverse Effect”, “Adverse Reaction”, “Complication”, “Side Effect”, “Vasovagal Reaction”, “Local Reaction”, “General Reaction”, “Allergic Reaction”, “Blood Donor” and “Blood Donation”. Different Databases such as PubMed, Web of Science, Scopus, EmBase, Ovid, as well as the specialized journal of TRANSFUSION were searched without any time limits.

**Inclusion and exclusion criteria**

All documents published in Persian and English that possibly contained the estimation of the incidence of adverse reactions in blood donation, such as cohort and cross-sectional studies without any time limits, were considered as inclusion criteria in this step.

Reviews, case-reports and the studies with poor quality which was not possible to extract their data used for estimation of the incidence of adverse reactions in blood donation were excluded.

**Quality assessment**

The quality of the articles was assessed using the Joanna Briggs Institute checklists for cross-sectional and cohort studies [10]. According to the Quality Assessment Checklist, studies with a score of less than 5 were excluded. In some studies, more than one article was published at a same year and in a same country using data collected from the same sources, but different results were reported. In such studies, if there were annual reports from the ministry or any other international organization, it was considered as the main one and others were excluded as duplicates.

**Data extraction**

Various data such as the place of the study and the publication year as well as more specialized one such as the study type, the number of blood donations, the number of adverse reactions by type, the number of donations by sex and the number of donations by type were extracted from studies.

**Statistical analysis**

Cohen’s kappa was used to calculate the agreement between two researchers which is a statistical coefficient that represents the degree of accuracy and reliability in a statistical classification. This statistic was introduced by Jacob Cohen in the journal of Educational and Psychological Measurement in 1960 (Formula 1).

Formula 1: \( k = \frac{D - P_e}{1 - P_e} \)

In this formula, \( p_o \) is the relative observed agreement among raters, and \( p_e \) is the hypothetical probability of chance agreement.

**Results**

In the initial search, 7054 documents were found, of which 2517 were excluded as duplicates. After screening the remaining 4537 documents, 97 ones were reviewed for quality assessment, out of which, 30 documents with appropriate quality were finally selected for systematic review (Figure 1). Document extraction and quality assessment were performed by two researchers (MTS & MO) independently. The average agreement between the two researchers in document selection, quality assessment and data extraction was good (Cohen’s unweighted \( k = 0.85 \)).

**Adverse reactions in blood donation**

The incidence of adverse reactions in blood donation were explored continent by continent. In the latest study in the United States of America, which was published in 2016, 30,868 blood donations were investigated, of which 0.34% had caused systemic reactions in blood donors. In this study, the proportion of women among donors was 46% [9].

In Europe, one of the most recent studies on the incidence of adverse reactions in blood...
Incidence of adverse reaction in blood donation

Donation was conducted in Germany. The study, which was done in 2012 on 928,411 donations, revealed that adverse reactions had occurred in 0.7% of all blood donations. In this study, women and first donors made up 47.8% and 82% of all donors, respectively [11].

In Asia, India was the country with the most researches done related to adverse reactions in blood donation. Their latest study was conducted in 2017 on 1095 blood donations, the results of which showed that 10.2% of the total blood donations caused adverse reactions including 8.7% of local and 1.5% of systemic reactions. In this study, women and first donors made up 2.9% and 31.8% of all donors, respectively [12].

In Nigeria, as an African country, a study was conducted in 2017 on 459 blood donations, 5% of which caused adverse reactions. Moreover, 2.2% of the reactions were local and 2.8% were systemic [13].

Table 1 shows more details about all studies included in the systematic review.

**Discussion**

The results of current study showed that the incidence of adverse reactions in blood donation can be very different from one country to another. Besides, this difference even exists in the studies conducted in a same country. For example, it did also exist in the results of studies conducted in two consecutive years (2011 and 2012) in India. The reported incidence rate of adverse reactions in blood donation was 0.59% in the earlier study [4], while it was 2.35% in the other one [14].

The difference in these numbers could be due to the wide range of reactions that have been investigated, as well as the population being studied. This differences seems to be inevitable as it did exist in all reactions as well as systemic and local ones in different countries.

The highest and lowest reported incidence rate for total adverse reactions was in Japan at 6% and India at 0.03%, respectively.

On the other hand, most of the reported reactions were systemic but there was significant differences between the numbers, since, in Iran, it was 13%, while it was 0.88% in Greece.

There are many factors that can cause systemic reactions, the most important of which are age, sex, biological features, stress, fluid intake, as well as proper nutrition and adequate sleep before donating blood [6-8, 15, 16].

The incidence of local reactions differs across the countries due to their direct relationship with the quantity of human resources, the quality of infrastructure and the number of donors. However, the results of this study showed that local reactions were less common than systemic ones.

**Limitations of the study**

Given the heterogeneity across the studies, it was not possible to perform meta-analysis and as a result, it was not possible to calculate a total number for adverse reactions in blood donation.
Incidence of adverse reaction in blood donation

<table>
<thead>
<tr>
<th>Country (Year)</th>
<th>Sample Size</th>
<th>% of Blood Donation in women</th>
<th>% of Blood Donation in first Donors</th>
<th>Incidence of Adverse Reaction</th>
<th>Document Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iran (2005) [8]</td>
<td>554</td>
<td>6</td>
<td>13</td>
<td>-</td>
<td>Medium</td>
</tr>
<tr>
<td>Saudi Arabia (2017) [15]</td>
<td>18936</td>
<td>1.4</td>
<td>47</td>
<td>-</td>
<td>High</td>
</tr>
<tr>
<td>Nigeria (2017) [13]</td>
<td>459</td>
<td>10</td>
<td>-</td>
<td>0.022</td>
<td>Medium</td>
</tr>
<tr>
<td>USA (2009) [17]</td>
<td>4348686</td>
<td>49</td>
<td>19</td>
<td>0.015</td>
<td>High</td>
</tr>
<tr>
<td>India (2015) [18]</td>
<td>29524</td>
<td>17.5</td>
<td>26.4</td>
<td>0.0017</td>
<td>High</td>
</tr>
<tr>
<td>USA (2005) [19]</td>
<td>89544</td>
<td>52</td>
<td>29</td>
<td>-</td>
<td>High</td>
</tr>
<tr>
<td>Italy (2002) [20]</td>
<td>94522</td>
<td>8.6</td>
<td>19.5</td>
<td>0.004</td>
<td>High</td>
</tr>
<tr>
<td>USA (2009) [22]</td>
<td>793293</td>
<td>48</td>
<td>21</td>
<td>-</td>
<td>High</td>
</tr>
<tr>
<td>India (2014) [23]</td>
<td>88201</td>
<td>39</td>
<td>35</td>
<td>-</td>
<td>High</td>
</tr>
<tr>
<td>India (2012) [14]</td>
<td>22587</td>
<td>0.57</td>
<td>29.8</td>
<td>0.008</td>
<td>High</td>
</tr>
<tr>
<td>India (2017) [7]</td>
<td>1000</td>
<td>15</td>
<td>53</td>
<td>-</td>
<td>Medium</td>
</tr>
<tr>
<td>Pakistan (2016) [25]</td>
<td>41579</td>
<td>0.02</td>
<td>-</td>
<td>0.0002</td>
<td>High</td>
</tr>
<tr>
<td>USA (2009) [26]</td>
<td>422231</td>
<td>57.8</td>
<td>24.6</td>
<td>-</td>
<td>High</td>
</tr>
<tr>
<td>India (2008) [27]</td>
<td>30370</td>
<td>3.1</td>
<td>87.2</td>
<td>-</td>
<td>High</td>
</tr>
<tr>
<td>Germany (2015) [11]</td>
<td>928411</td>
<td>47.8</td>
<td>82</td>
<td>-</td>
<td>High</td>
</tr>
<tr>
<td>India (2017) [12]</td>
<td>1095</td>
<td>2.9</td>
<td>31.8</td>
<td>0.087</td>
<td>High</td>
</tr>
<tr>
<td>Greece (2005) [28]</td>
<td>12198</td>
<td>24</td>
<td>19.2</td>
<td>-</td>
<td>High</td>
</tr>
<tr>
<td>Italy (2007) [29]</td>
<td>4906</td>
<td>24.2</td>
<td>-</td>
<td>0.012</td>
<td>High</td>
</tr>
<tr>
<td>India (2011) [4]</td>
<td>19045</td>
<td>23.1</td>
<td>87.9</td>
<td>0.001</td>
<td>High</td>
</tr>
<tr>
<td>Iran (2010) [30]</td>
<td>5285</td>
<td>26.5</td>
<td>18</td>
<td>0.02</td>
<td>Medium</td>
</tr>
<tr>
<td>Iran (2018) [31]</td>
<td>25891</td>
<td>7</td>
<td>21</td>
<td>-</td>
<td>High</td>
</tr>
<tr>
<td>Netherland (2012) [32]</td>
<td>12051</td>
<td>46</td>
<td>-</td>
<td>0.047</td>
<td>High</td>
</tr>
<tr>
<td>USA (2008) [33]</td>
<td>6014472</td>
<td>-</td>
<td>-</td>
<td>0.01</td>
<td>High</td>
</tr>
<tr>
<td>Japan (2017) [34]</td>
<td>4105</td>
<td>71</td>
<td>-</td>
<td>0.02</td>
<td>High</td>
</tr>
<tr>
<td>USA (2015) [35]</td>
<td>1865544</td>
<td>47.5</td>
<td>15.2</td>
<td>0.003</td>
<td>High</td>
</tr>
<tr>
<td>USA (2016) [9]</td>
<td>30868</td>
<td>46</td>
<td>-</td>
<td>0.0034</td>
<td>High</td>
</tr>
<tr>
<td>Italy (2010) [36]</td>
<td>893323</td>
<td>30</td>
<td>-</td>
<td>0.001</td>
<td>High</td>
</tr>
</tbody>
</table>

**Conclusion**

The incidence of adverse reactions in blood donation vary from one country to another, and this might be related to the characteristics of their donors. This difference even existed in different studies conducted in a same country and a same year since many factors can cause adverse reactions in blood donation and also wide range of them are investigated in one study. Moreover, it should be noted that most reported adverse reactions in blood donation were systemic.

**Acknowledgements**

This Article is a result of PhD thesis and has been ethically approved by the ethic committee of the Kerman University of Medical Sciences, Iran (Ethical Code: IR.KMU.REC.1397.401).

**Disclosure of conflict of interest**

None.

**Address correspondence to:** Seyyed Mohammad Tabatabaei, Department of Medical Informatics, School of Medicine, Mashhad University of Medical
References


Incidence of adverse reaction in blood donation


