

Letter
to Editors


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Managing Transfusion Service in Disasters

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Abstract

Disasters, which may be natural or manmade, can happen unexpectedly, with an urgent increase in demand for health services including blood service. Many casualties undergo transfusions and massive blood transfusion is a common scenario in a disaster. In multiple trauma, requiring massive blood transfusion, each haematological parameter has its target to achieve with correct blood component transfusion. Hence, it is undebatable that the necessity of blood components shoots in a such situation.

Publications share the contribution of blood service in disasters, explaining the importance of preparedness. Blood collection, processing, transportation, and distribution should be properly planned. Therefore, experience from past incidences is critical in developing a such protocol. Every aspect of blood transfusion including patient identification, compatibility testing and administration is challenging in a disaster situation. Coordination with other centres is also a crucial point. Well-established IT systems enhance blood inventory management and redistribution in an emergency.

The disaster management plan, which must include a multidisciplinary approach, should be established in every transfusion service, and regular training programmes, drills, audits, and revising help to improve disaster management.

Keywords: Blood bank, disasters, mass casualty incidents, massive bleeding, blood supply.

INTRODUCTION

Mass casualty events can occur due to natural disasters or as a human activity such as bomb blasts and they suddenly increase the demands in health care facilities. A considerable number of casualties could be admitted to the trauma units resulting in challenges to health care providers [1]. Importantly, most trauma patients require blood components for their survival. In a bleeding patient the use of blood is essential as it cannot be replaced by any pharmacological agent [2]. Casualties with multiple injuries frequently experience major haemorrhage, requiring massive

blood transfusion in which all blood products are essential without replacing only red cells.

Managing a disaster is critical for transfusion services as blood components are scarce resources that have a limited supply, since they cannot be synthetically produced. Transfusion service is responsible for ensuring the availability, quality, safety and accessibility of blood products. Delivering transfusion services in disasters is challenging as most disasters are unpredictable and the demand of blood is not defined. On the other hand, maintaining an extra stock of blood



products will result in increased wastage due to outdating, because blood products have a limited self-life. Hence management of blood transfusion service in disasters needs action plan to work together with national emergency preparedness and response plan. Pre-organized protocols and guidelines would be helpful and past experience is beneficial for emergency preparedness [1]. Objective of this article is to collect available literature to develop an action plan on the basis of blood product supply in a mass casualty.

CASE SCENARIO

On 21st of April 2019, Easter Sunday, Sri Lanka faced a series of terrorist attacks. Several churches and leading hotels in Colombo and Batticaloa, which were crowded with celebrating Easter were targeted by a group of terrorists. Suicide bombers were able to blast bombs, causing 259 deaths and casualties including children [3].

Injured victims were brought to hospitals including the Accident & Emergency department of National Hospital of Sri Lanka, Lady Ridgeway Hospital for children, Teaching Hospital, Batticaloa, A significant number of blood products were issued from the respective blood banks. For instance, blood bank of the Accident & Emergency department of the National Hospital of Sri Lanka issued 131 units of red cells, 70 units of fresh frozen plasma (FFP), and 62 units of platelets [4]. In Batticaloa, where only one church was targeted by the terrorists, victims were admitted to Teaching Hospital, Batticaloa and there were 22 red cell unit issues from the blood bank [4]. Blood product supply was a challenge due to sudden increase of blood demand; however, blood products were redistributed from the unaffected areas as an immediate measure. Apart from the blood products, other limitations were human resources and equipment.

On the other hand, there were many voluntary blood donors at the blood bank. Altruistic reasons made a large number of people come and donate blood following that incident. This crowd could not be managed in the blood bank. Blood bank staff was mainly involved in the process of providing blood. Therefore, handling blood donors was difficult. Furthermore, being crowded is not

advisable as this could be another target by the terrorists.

Subsequently, during the next couple of weeks with curfews and other regulations by the government, the number of donations experienced a dramatic reduction resulting in critical blood stock levels. Therefore, public awareness programme was needed to improve blood stocks in the country.

DISCUSSION

World Health Organization (WHO) defines a disaster as a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its resources [5]. Disasters can happen due to natural causes like earthquakes, floods, Tsunami and land sliding. Moreover, there are manmade incidences, such as road traffic accidents and bombing attacks that can result in casualties. At a health care institute, where those casualties are managed, professionals face many problems. Managing a large number of casualties in a such situation needs proper planning in every discipline.

There are many challenges to manage the transfusion department in a disaster [1]. Undoubtedly demand for blood supply will experience a sudden increase as there are many casualties. Function of blood is essential and acute severe blood loss endangers the life. Simple volume replacement with fluids does not improve the tissue oxygenation in a significant haemorrhage and blood transfusion is essential. Furthermore, there are no artificially made agents that can be used as blood products as well [2]. Hence, with a large number of casualties the increased demand for blood is undebatable.

Transfusion practice plays an important role as many patients require blood products including replacing massive haemorrhage which is defined as loss of one blood volume in 24 hours or loss of 50% of blood volume in 3 hours or a blood loss at a rate of 150ml per minute [6]. During massive transfusion, there is coagulopathy secondary to tissue injury, hypoperfusion, dilution and

consumption of clotting factors and platelets. Combination of coagulopathy, hypothermia, and acidosis affect the outcome of the patient adversely [7].

Regarding red cell transfusion, which is the most important for tissue perfusion, red cell transfusion should not be delayed. In a very urgent situation in which blood transfusion is required immediately and if the patient's blood group is not known, it is acceptable to issue Group O un-cross matched red cells [6]. Female patients of reproductive age must be provided with group O Rh D negative red cells in such a situation to avoid Rh D sensitization. ABO group-specific red cells can be given when the blood group of the patient is identified, which can be usually done within few minutes. This could be done as immediately as possible to reduce the issuing of group O red cells. A rapid rate of administration of red cells than the normal rate is usually practiced in a such situation [8]. As far as platelets are concerned, platelet count should be maintained above the critical level of $50 \times 10^9/l$ in massive haemorrhage [6]. Hence, platelet transfusion can be considered if the count is $75 \times 10^9/l$. Dilution of coagulation factors with volume replacement during fluid resuscitation can cause Coagulation factor deficiency leading to coagulopathy. This will be aggravated if the patient was treated only with red cells. Therefore, transfusion of fresh frozen plasma (FFP) is essential in massive blood transfusion. activated partial thromboplastin time (APTT) and prothrombin time (PT) to 1.5 times the mean normal values are associated with increased risk of bleeding and could be corrected with transfusion of plasma which contains clotting factors [10]. Furthermore, fibrinogen level of below 1.0 g/l can be corrected with cryoprecipitate [6]. Attention should be made to prevent and treat complications such as hypothermia, acidosis, and hypocalcaemia. Early communication with all clinical specialties is crucial in a such situation. Permanent local protocols for the management of massive haemorrhage should be available in all hospitals and all relevant staff must be educated about the protocols. Periodical 'drills' are useful to improve the clinical practice in such situations and to monitor the efficiency of the available facilities [1]. Regular reviews of such events should be conducted, to assess the success

and deficits and protocols can be updated effectively.

In transfusion practice, positive patient identification is the foremost as transfusion of incompatible cause transfusion reactions which can be even fatal. However, in a mass casualty, most of the time patients' identification could not be achieved with their names, making positive patient identification a challenge. Therefore, an identification number could be used for this purpose, which should be clearly visible. In an unconscious patient, minimum patient identifiers are a unique number and the gender [9]. Dann EJ et al in their publication have recommended large-sized printed numbers, wrist bands and barcodes for positive patient identification in a mass casualty [10].

There are several published cases regarding blood usage in disasters. A study based on a series of bombing attacks from 2000 to 2005 in Israel has shown that around one-third of hospitalized patients received blood transfusions, most of which were during the first two hours [11]. 10.2% of admitted patients have undergone massive transfusion. This is the biggest challenge for the transfusion team. A mass casualty incident occurred due to a bomb blast in London in 2005, has resulted National Blood Service to issue 1455 blood components including, 978 units of red cells (RC), 36 doses of platelets, 141 units of fresh frozen plasma (FFP) and 300 doses of cryoprecipitate [12]. This article shows that keeping only red cell concentrates would not be helpful in a mass casualty. They have concluded that all blood products are essential in managing a bleeding trauma patient and an adequate amount of those products should be available to handle a disaster situation. If any blood bank cannot store a considerable amount, there should be a nearest centre to get down blood products, provided that the transport facilities are available promptly.

An article published regarding a mass shooting that happened in 2017 in the United States which led to 58 deaths and more than 600 casualties out of which 68 were critically ill, has revealed usage of 500 blood components [13]. They have shown a transfusion ratio of red blood cell-to-plasma-to-platelet ratio of 1:0.54:0.81. Importantly, they

have highlighted that call for blood donors is not necessary urgently as 17% of collected blood on that day was discarded. Therefore, this study has emphasized the importance of strengthening the routine blood collection, as urgent blood collection maybe not appropriate in a disaster situation.

In terms of coordination among blood centres, an article on a situation caused by an earthquake in Japan in 2011 has shown the importance of nationally coordinated redistribution of blood components [14]. They have highlighted the importance of preparedness and central coordination. A study published by Doughty H et al has highlighted the computer-based system to improve stock management in those conditions while improving the redistribution [15]. They have also discussed emergency donor calling and alternatives for transfusion. Simon Glasgow et al have shown the importance of an automated system to redistribute the blood stocks for trauma centres [16]. In that publication, they have described a computerized simulation model in a trauma center in the United Kingdom that has shown the efficacy of prioritizing. A study published in 2018 by Simonetti A et al has demonstrated the desirable outcome of blood utilization with inter-center coordination [17]. Patrick Melmer et al in a review article have emphasized the importance of a multidisciplinary, approach in managing scenarios during an unexpected event resulting in a large number of casualties [18].

Furthermore, there are several aspects to address in establishing a protocol. In an article published in the journal of the American Society for Clinical Laboratory Science in October 2017, Alyse N. Gschwender and Laurie Gillard have concluded that disaster plan should include determining the demand of blood products, communication plan, human resource management and donor recruitment [19].

Moreover, these guidelines are needed to be reviewed periodically and even after an incident, to enhance the system. A pilot study in Italy, which was conducted to assess the preparedness of transfusion centres, has shown the success applying of a checklist of the American Association of Blood Bank (AABB) in the evaluation of

preparedness [20]. AABB checklist includes areas of risks assessment, communication and coordination with others, blood inventory management, transport facilities, management of blood donors, safety and security, staff management, documentation, computerization and handling media.

Sri Lanka is a country that had witnessed a three-decade civil war, in which terrorists made bomb attacks against civilians in every part of the country. Although the war ended in 2009, the Easter attack in April 2019 shows the importance of preparedness for a disaster including a bombing attack. Issuing of a significant higher number of blood units as in this case is not always possible without proper action plan. As any hospital cannot work alone in a mass casualty event, it is important to work with other institutes [18]. Sri Lanka has a nationally coordinated blood transfusion service, which enables it to work island-wide; therefore, communication has made easier for blood redistribution. However, transport facilities must be available and properly coordinated. The incident reveals the importance of preparedness and prompt action and developing protocols for emergency is crucial for transfusion service as for any health institute.

CONCLUSION

In conclusion, transfusion services are directly affected by disasters as result of increasing the demand for blood products. Therefore, a disaster management plan should be available in transfusion services for emergency preparedness. Establishing such a protocol is a multidisciplinary approach and includes gathering information from past experience, published guidelines, checklists and research data. Strengthening such a plan could be achieved by awareness and training programmes. Those protocols can be reviewed regularly in order to improve the effectiveness.

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Author Contributions

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Ethics approval and consent to participate

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Competing interests

None

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