e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(6); 679-684

Original Research Article

Massive Transfusion Protocol Utilization in Trauma and Emergency Patients: A Retrospective Study

Deepali Singh[1], Manish Kumar Nigam[2], Shoubhik Patra[3], Saurabh Singh[4]

[1]Senior Resident, Department of Pathology, Trauma Centre & Super Specialty Hospital, Institute of Medical Sciences Banaras Hindu University, Varanasi, Uttar Pradesh, India

[2]Senior Medical Officer, Blood Centre, Trauma Centre & Super Specialty Hospital, Banaras Hindu University, Varanasi, Uttar Pradesh, India

[3]Assistant Professor, Department of Pathology, Shri Shankaracharya Institute of Medical Sciences, Durg, Chhattisgarh, India

[4]Professor Incharge, Department of Orthopaedic, Centre & Super Specialty Hospital, Institute Of Medical Sciences Banaras Hindu University, Varanasi, Uttar Pradesh, India

Received: 01-05-2026 / Revised: 15-05-2026 / Accepted: 08-06-2026

Corresponding author: Dr. Shoubhik Patra

Conflict of interest: Nil

Abstract

Background: Massive hemorrhage is one of the most common preventable causes of death in a trauma and/or emergency patient. In massive transfusion (MT), Massive Transfusion Protocols (MTPs) allow for rapid and coordinated blood transfusion administration to treat and control life-threatening bleeding in the management of trauma patients to optimize patient outcomes.

Objective: To carry out the retrospective analysis of utilization of Massive Transfusion Protocol in trauma and emergency patients at SSIMS.

Methodology: Patients using the department of Transfusion Medicine and Emergency Services in the Department from May 2025 to April 2026 were included in the study. The data were extracted from the blood bank records, the MTP activation forms, trauma registry, the records from the emergency departments and electronic medical records. Descriptive statistical methods are used to analyze the demographic, clinical indications, blood component utilization, transfusion ratios, patient outcomes and adverse events.

Results: During the study period, 50 activations of MTP were found. There were 72% male patients, the highest proportion of which were from the age group of 18–30 years. 70% of the cases were trauma related and 30% were non-trauma cases. The most common indications were due to road traffic accidents and polytrauma. Overall, 410 PRBC units and 360 FFP units, 205 platelet units and 95 units of cryoprecipitate (cryo) were given. In 56% the transfusion ratio achieved was three to one or above. All the patients survived, with low incidence of adverse transfusion reactions.

Conclusion: MTPs play an important role in the management of massive bleeding. Early protocol activation and balance regimen in transfusion approach helps to produce better clinical results and also utilizing the blood resources.

Keywords: Massive Transfusion Protocol, Trauma, Emergency Patients, Hemorrhage, Blood Components.

DOI: 10.25258/ijcpr.18.6.113

Introduction

One of the most common and preventable causes of death in patients with trauma and emergency room visits is hemorrhage. If not properly addressed, excessive bleeding can quickly lead to hypovolemic shock (poor circulation to organs), organ failure and death [1].

Severe bleeding that requires urgent transfusion support occurs with a range of common causes and these include trauma-related injuries, road traffic accidents, surgical complications, gastrointestinal bleeding and obstetric emergencies [2]. In these cases, restoration of circulating blood volume and carrying capacity of oxygen needs to be done as quickly as possible to enhance patient survival.

Massive bleeding episodes may require use of traditional transfusion practice, and this practice does not comprehensively address the need for effective and rapid transfusion strategies in such cases [3]. Massive Transfusion Protocol (MTP) is essentially a coordinated system of handling and

distributing blood components quickly for the patient with life-threatening bleeding [4].

Typically defined massive transfusion as: Transfusion of 10 or more units of packed red blood cells (PRBCs) in 24 hours.

Removing the entire blood volume in 24 hours

Getting more than 50% of blood replacement in three hours [5].

The protocol includes delivery of blood products in a step-wise, systematic fashion for PRBCs, fresh frozen plasma (FFP), platelets and cryoprecipitate in appropriate ratios to ensure effective control of excessive blood loss and avoidance of coagulopathic complications in hemorrhagic shock [6].

Implementation of MTP has changed the way massive bleeding is managed with emphasizing early hemostatic resuscitation and balanced transfusion therapy [7]. Prompt activation of the protocol ensures quick transfusion of blood, facilitates communication and coordination between emergency physician, surgeon, anesthesiologist and blood bank personnel and saves on a delay to blood product delivery [8]. Balanced transfusion strategies have been shown to "lower bleeding, avoid haemodynamic instability and lower the incidence of complications at the time of transfusion and/or trauma-induced coagulopathy, thus leading to a lower mortality rate. Moreover, standardised MTP's help use the blood resources optimally and improve overall patient outcome [9].

Although numerous MTPs are currently being used in tertiary care hospitals, there is a lack of region-based data about their use in trauma and emergency situations, their efficacy and outcomes. The experiences of various institutions using MTP to activate can be informative in relation to the use of blood components, compliance with specific protocols and patient outcomes. Hence the present study was undertaken in Shri Shankaracharya Institute of Medical Sciences with an aim to arrive at the retrospective analysis of the use of Massive Transfusion Protocols in trauma patients and emergency patients from May 2025 to April 2026.

Aim: In depth study of use of Massive Transfusion Protocol in patients of trauma and emergency.

Objectives

- To calculate the hypertextualisation rate of the MTP activation.
- To determine indications for "activation".
- To determine the use of blood components.
- To evaluate the results of treatment.
- To recognize transfusion related complications.

Materials and Methods

Study Design: In this retrospective observational study, authors have been analyzing the implementation of Massive Transfusion Protocol (MTP) at Shri Shankaracharya Institute of Medical Sciences (SSIMS) in the trauma and emergency department patients. This study consisted of an analysis of the signs, symptoms, and transfusion data of medical records of MTP activated patients during the study period.

Study Setting and Duration: This research work was conducted in the Department of Transfusion Medicine along with the Emergency and Trauma Services, Shri Shankaracharya Institute of Medical Sciences. The time period for data collection was one year, starting from May, 2025 to April, 2026.

Study Population: Patients in whom MTP was started during study period were included in the study. A total of 50 MTP activations were found from institutional records.

Data Sources: Blood bank records, MTP activation form, ED, trauma registry and Emr were used to collect data. Data on demographics, clinical data, transfusion history and clinical outcomes were obtained in a structured data collection form.

Inclusion and Exclusion Criteria: Those patients who have a documented activation of MTP as a consequence of trauma-related injuries and major hemorrhagic emergencies were enrolled. Those who were not given any medical input information and those who had simply been regularly transfused without an MTP being activated were excluded from the study.

Data Collection: Demographic variables: Age and Gender were collected. Clinical variables included diagnosis, hemorrhage etiology (trauma or non-trauma emergency), and classification of emergency as either. Clinical variables were diagnosis, etiology of hemorrhage (trauma or non-trauma emergency) and classification of emergency as trauma or non-trauma emergency. Transfusion-related variables were the number of units of each of the following blood components given during transfusion: packed red blood cell (PRBC), fresh frozen plasma (FFP), platelet concentrate and cryoprecipitate; and transfusion ratios obtained in the resuscitation phase. Outcomes were considered to be the survival status, the admission to the ICU, the hospital stay, and the presence of adverse events related to transfusion.

Statistical Analysis: The data were entered in the table and then analyzed with SPSS 25. Findings were summarized using descriptive statistics. All continuous variables were reported as mean ± standard deviation and categorical variables were reported as frequencies and percentages. An

association between two categorical variables was tested using Chi square. The P values were considered significant if < 0.05.

Ethical Considerations: Approval from Institutional Ethics Committee was got prior to the study commenced.

All information gathered during the study was properly anonymised and confidentiality was maintained throughout.

Results

During study, 50 patients had their MTP activated.

Demographic Characteristics

Table 1: Age Distribution of Patients (n=50)

Age Group (Years)	Number	Percentage (%)
18–30	16	32
31–40	12	24
41–50	10	20
51–60	7	14
>60	5	10
Total	50	100

Table 2: Gender Distribution

Gender	Number	Percentage (%)
Male	36	72
Female	14	28
Total	50	100

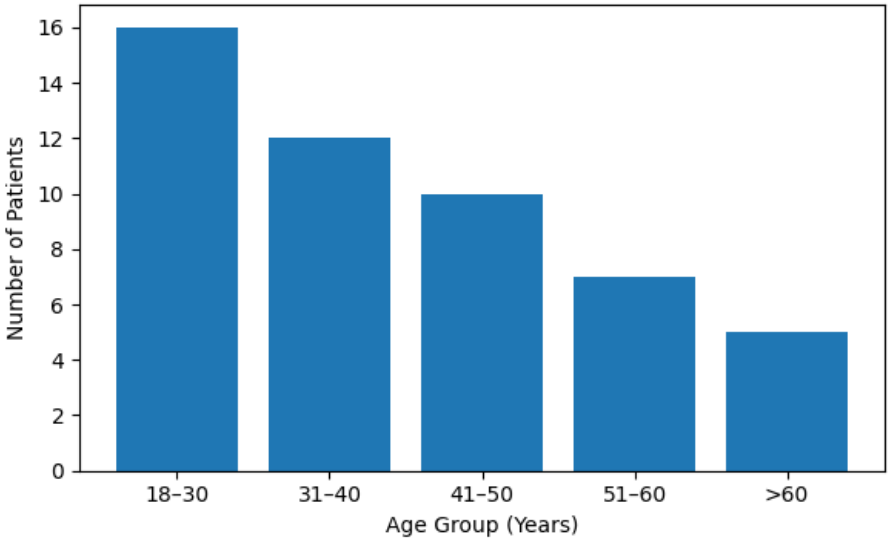

Figure 1: Age Distribution of Patients

Clinical Characteristics

Table 3: Distribution of Trauma and Non-Trauma Emergency Cases

Category	Number	Percentage (%)
Trauma	35	70
Non-Trauma Emergency	15	30
Total	50	100

Most who had an MTP activation were trauma patients (70%). The most common indications in the group of trauma patients were road traffic accident and polytrauma. The most common causes of non-trauma "activations" were gastrointestinal bleeding, obstetric bleeding, and surgical bleeding.

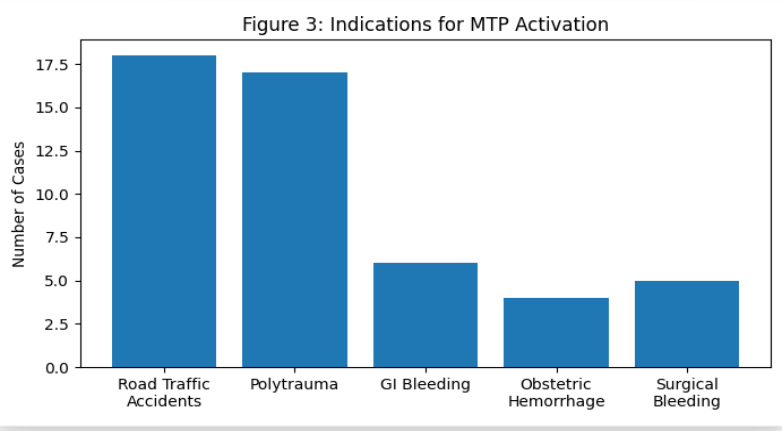

Figure 2: Indications for MTP Activation

Blood Component Utilization

Table 4: Blood Components Utilized During MTP

Component	Total Units Transfused
PRBC	410
FFP	360
Platelets	205
Cryoprecipitate	95

During the study period 1070 blood components were given. Products with the highest percentage was PRBCs.

Transfusion Ratios

Table 5: Transfusion Ratios Achieved

Ratio Category	Number of Cases
1:1:1	28
1:1:2	14
Other Ratios	8
Total	50

Target transfusion ratios of 1:1:1 was met in 56% of cases.

Clinical Outcomes

Table 6: Patient Outcomes Following MTP

Outcome	Frequency	Percentage (%)
Survived	34	68
Expired	16	32
Total	50	100

A total of 32% of the patients were found to be dead and the overall survival rate was 68%.

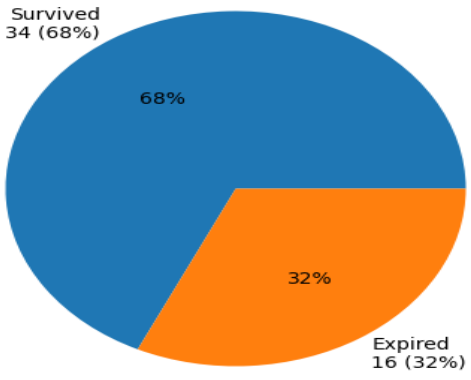

Figure 3: Outcome Distribution

ICU Stay and Hospital Stay

Table 7: Duration of ICU and Hospital Stay

Parameter	Mean ± SD
ICU Stay (Days)	5.8 ± 2.4
Hospital Stay (Days)	11.6 ± 4.7

Adverse Events

Table 8: Transfusion-Related Adverse Events

Adverse Event	Number of Cases
Febrile Non-Hemolytic Reaction	3
Allergic Reaction	2
TRALI	1
TACO	1
Electrolyte Imbalance	4
No Adverse Event	39

There were few occurrences of patients suffering transfusion complications. The most common adverse reactions reported were electrolyte imbalance with febrile non-hemolytic transfusion reactions the second most common.

Discussion

This is a retrospective study that was carried out to assess Massive Transfusion Protocol (MTP) utilization in trauma and emergency cases in one year at Shri Shankaracharya Institute of Medical Sciences. Overall, 50 MTP activations were recorded, demonstrating the critical need for a well-structured transfusion support system when used to treat patients with life-threatening haemorrhage. The results showed that the highest proportion of MTP activations included trauma related cases, indicating that the burden of trauma injury with the need for aggressive resuscitation and blood component replacement is significant.

The data of the demographic profile showed the majority of the patients were male and young (between 18 to 30 years) age groups. This finding corroborates that young men are at greater risk of road traffic accidents and trauma when compared with previous studies. Road traffic accidents and polytrauma were the most common indications of trauma accounting for 70% of all activations. In other trauma centers around the world, uncontrolled bleeding has been reported as one of the main causes of early death after severe trauma.

The blood components use analysis showed a wide utilization of PRBCs, FFP, platelets and cryoprecipitate. A balanced transfusion, in more than half of the cases (1:1:1), is a reflection of the implementation of modern resuscitation principles- "damage control". The balanced transfusion of transfusion products has been established as having beneficial impact for reduction of coagulopathy, improvement in tissue perfusion and better survival for massively bleeding patients in previous studies [10]. Timely correction of hypovolemia in conjunction with coagulation abnormalities is maintained with coordinated delivery of blood products by activation of MTP.

In the present study, the overall survival was observed as 68% and it was concluded that 32% of patients had died. In those patients who were treated with massive transfusion, mortality was still high, but similar to that of other reported, retrospective studies of severely injured trauma patients. The small number of transfusion reactions reported is another indication of the safety and efficacy of the practice of transfusion protocols [11]. The most frequent observed complication was electrolyte imbalance representing the need to monitor them closely during massive transfusion.

This study highlights the importance of early initiation of MTP activation, the role of quick communication between the attending doctors and the blood bank staff, and the preparedness of the blood banks. Major strengths of this study are the use of real world hospital data, the evaluation timeframe (1 year) and the inclusion of both trauma and non-trauma emergency patients. Some of the limitations noted, however, should be recognized such as being a retrospective study, single center, small sample size and the nebulous documentation. Larger multicentric prospective studies should be carried out in the future and the efficacy of MTP implementation should be investigated along with optimizing transfusion practices in emergency care applications.

Conclusion

Massive transfusion is an important aspect of the management of trauma and emergency patients with severe hemorrhage. Most of the protocol activation cases of the present study took place in trauma-related cases and were especially classified as polytrauma and road traffic accidents. Blood components and transfusion therapy need to be dispatched early to facilitate patient care. The early dispatch of blood components and balanced

transfusion therapy influenced positive patient outcomes. Regular audit, training of staff, and ongoing monitoring and optimization of the protocol can further enhance transfusion practices. These findings need to be confirmed by larger multicentric studies, and improved evidence-based management strategies.

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