REUE | Original article

# Analysis and 6-month mortality of patients attended by prehospital emergency services with severe hemorrhage in a Spanish province

Rubén Viejo-Moreno[1-3], Elena Moratilla-López[1,2], Raquel Grado-Sanz[1,2], Sandra Castro-Correro[1,2], Antonio Cid-Dorribo[1,2], Waleska Chas-Brami[3], Enrique Galván-Muñoz[1]

**INTRODUCTION.** Hemorrhage continues to be a major cause of mortality in both medical and traumatic conditions. Early identification and optimal prehospital treatment are essential to improve outcomes. This study aimed to analyze the clinical course and 6-month mortality in patients with severe hemorrhage (SH) treated by prehospital emergency services in a Spanish province.

**MATERIAL AND METHODS.** We conducted a retrospective observational study from January 2020 through December 2024, including patients treated by advanced prehospital emergency units for medical or trauma-related SH. Severe hemorrhage was defined as requiring at least 3 units of packed red blood cells within the first 6 hours of hospital care. Demographic variables, hemorrhage source, prehospital and hospital treatments, length of stay, and 6-month mortality were analyzed as well.

**RESULTS.** During the study period, a total of 145 patients with SH who received hospital transfusion after prehospital emergency care were identified; 71 % were trauma-related and 29 % medical. The overall 6-month mortality rate was 26.2 %, with no significant differences across groups (trauma 32 %, medical 25 %). Factors associated with higher mortality included shock index (SI), lower Glasgow Coma Scale (GCS) scores, need for prehospital orotracheal intubation, longer response time, elevated lactate levels, and longer time to first hospital transfusion.

**CONCLUSIONS.** SH in our setting is associated with high mortality. Future studies should assess the impact of implementing point-of-care tools for early stratification and expanding the availability of blood components in advanced prehospital units to improve patient outcomes.

**Keywords:** Hemorrhagic shock. Hypovolemia. Massive transfusion. Massive hemorrhage. Gastrointestinal bleeding. Emergency medical services.

## *Asistencia inicial y mortalidad a los 6 meses de los pacientes atendidos por un Sistema de Emergencias Médicas con hemorragia grave*

**INTRODUCTION.** La identificación precoz y el tratamiento óptimo en el ámbito prehospitalario de las hemorragias graves (HG), son fundamentales para mejorar el pronóstico. Este estudio tiene como objetivo analizar la asistencia inicial, evolución clínica y la mortalidad a los 6 meses en pacientes con HG atendidos por los servicios de emergencias prehospitalarias en una provincia española.

**MATERIAL Y MÉTODOS.** Estudio observacional retrospectivo (enero de 2020 a diciembre de 2024), de pacientes atendidos por un servicio de emergencias prehospitalarios medicalizados con HG médica o secundaria a traumatismo. Se consideró como HG a pacientes que precisaron, al menos, 3 concentrados de hematíes en las primeras 6 horas de su atención hospitalaria. Se analizaron variables demográficas, origen de la hemorragia, tratamiento prehospitalario y hospitalarios, tiempo de ingreso y mortalidad a los 6 meses.

**RESULTADOS.** Se estudiaron 145 pacientes, 71 % de origen traumático y 29 % por patologías médicas. La mortalidad global a los 6 meses fue del 26,2 %, sin diferencias estadísticamente significativas entre los grupos (traumático: 32 %, médico: 25 %, p = 0,46). Entre los factores asociados a mayor mortalidad, se identificaron el índice de *shock*, menor puntuación en la Escala de Coma de Glasgow, necesidad de intubación orotraqueal en el ámbito prehospitalario, mayor tiempo de llegada al incidente, niveles elevados de lactato, y el tiempo hasta la primera transfusión hospitalaria.

**CONCLUSIONES.** La HG en nuestro medio presenta una elevada mortalidad. Serían convenientes estudios que determinen el impacto de la implementación de *point-of-care* que permitan estratificar a estos pacientes, así como la extensión de la disponibilidad de hemocomponentes en las ambulancias, en la mejora de los resultados de los pacientes con HG.

**Palabras clave:** *Shock* hemorrágico. Hipovolemia. Transfusión masiva. Hemorragia masiva. Hemorragia digestiva. Servicios de emergencias médicas.

**Author Affiliations:** [1]Gerencia de Urgencias, Emergencias y Transporte Sanitario (GUETS) – Servicio de salud de Castilla la Mancha (SESCAM), Spain. [2]Grupo de trabajo y comisión clínica de trauma. GUETS – SESCAM, Spain. [3]Unidad de Cuidados intensivos, Hospital Universitario de Guadalajara, Spain.
**Corresponding Author:** Rubén Viejo Moreno. Gerencia de Urgencias, Emergencias y Trasporte Sanitario del SESCAM. Base de la UVI móvil de Guadalajara. Paseo de la estación 2. 19002 Guadalajara, Spain.
**E-mail:** rviejo@yahoo.es
**Article Information:** Received: 16-6-2025. Accepted: 18-9-2025. *Online:* 26-9-2025.
**Editor in Charge:** Guillermo Burillo-Putze.



© SEMES

## Introduction

Hemorrhage causes approximately 1,9 million deaths per year worldwide, with 80 % occurring due to trauma.[1] Most of these deaths occur in the prehospital phase or during the first hours after hospital admission.[2,3] Approximately 35 % could be preventable.[4]

The prognosis of hemorrhage is strongly influenced by the quality of initial resuscitation. Early and appropriate restoration of blood volume, aimed at optimizing tissue oxygenation and promoting hemostasis without delaying bleeding control,[5] constitutes the cornerstone of treatment, with a direct relationship between delayed resuscitation and increased mortality.[6] Emergency medical services (EMS) provide the first medical care at the most critical phase of hemorrhage, which also represents the optimal therapeutic window. The implementation of bleeding control strategies and damage control resuscitation (DCR) has become part of current recommendations.[7,8] Prehospital DCR, known as remote damage control resuscitation,[9,10] includes early control of compressible hemorrhage, restricted crystalloid administration, and hemostatic and metabolic resuscitation of the patient[11] These recommendations are progressively being incorporated into EMS systems through DCR protocols that include early transfusion of blood and blood products.[12]

Evaluation of the care process—specifically, the clinical management of patients with severe hemorrhage (SH)—is recommended by clinical practice guidelines to further improve outcomes.[10] Therefore, the primary objective of this study was to describe the characteristics, treatment, and prognostic factors of patients with traumatic and medical SH initially treated by a land-based EMS-P unit.

## Materials and methods

### Study design and clinical setting

We conducted a retrospective observational study of patients who received transfusion in hospital for SH due to trauma or any medical cause and who were initially treated by a land-based EMS-P unit from January 2020 through December 2024. Prehospital care data were extracted from the clinical reports of physicians and nurses assigned to advanced mobile emergency units (AMEU), whereas treatments, lengths of stay, and clinical outcomes were obtained from the electronic hospital health record.

The Emergency, Urgent Care, and Medical Transport Directorate (GUETS) belongs to the Castile–La Mancha Health Service (SESCAM) (Spain). Through this system, health care and transport are provided for out-of-hospital emergencies throughout Castile–La Mancha. The service includes 26 AMEUs, 4 advanced life support units with nursing staff, 82 basic life support ambulances, 56 urgent care ambulances, and 4 physician-staffed helicopters. Additional support is provided by primary care emergency services. Regional emergency management is coordinated by the Emergency Coordination Center (CCU), located in Toledo (Spain).

Guadalajara (Spain) is one of the 5 provinces of Castile–La Mancha, located in the northeastern region, covering an area of 12 167 km$^2$ and inhabited by 265 588 residents.[13] Four AMEU teams—each composed of a physician, a nurse, and two emergency medical technicians—provide initial treatment and transport for emergency patients. Additional air support is available through medical helicopters based in Cuenca and Toledo, the former equipped with red blood cell transfusion capability.

During the study period, AMEUs did not have ultrasound equipment, blood gas analyzers, or Sengstaken–Blakemore tubes.

The province has a single secondary-level hospital, equipped with a blood bank, on-site coverage for all surgical specialties (except neurosurgery, cardiac surgery, and thoracic surgery), and on-call services for interventional radiology, vascular surgery, gastroenterology, and pulmonology.

### Definitions and time intervals

Traumatic hemorrhage was defined as bleeding resulting from energy transfer between two or more elements, producing external or internal bleeding in the torso or extremities. Medical hemorrhage included bleeding of gastrointestinal, airway, gynecologic, or aortic origin, bleeding secondary to hematologic disorders in oncologic diseases, or any spontaneous hemorrhage. SH was defined as the need for at least 3 units of red blood cells within the first 6 hours of hospital care.[14]

AMEU response time was defined as the interval from dispatch notification to patient contact. On-scene time was defined as the interval from patient contact to initiation of transport to the hospital. Transport time was defined as the interval from ambulance departure until hospital arrival.

Time to transfusion was defined as the interval from activation of the AMEU until the moment of the first transfusion.

Inclusion criteria were patients aged 16 to 80 years with sSH who were transfused in hospital and had received initial care from AMEUs. Exclusion criteria were patients arriving at the ED in cardiac arrest without resuscitation attempts and declared dead on arrival, patients transferred secondarily to hospitals outside the autonomous community, patients treated by HEMS, and those for whom 6-month clinical follow-up could not be completed.

The following variables were collected: epidemiologic data (age and sex), bleeding origin (traumatic hemorrhage [TH] or medical hemorrhage [MH]), initial shock index (SI) (heart rate divided by systolic blood pressure), initial Glasgow Coma Scale (GCS) score, and prehospital EMS-P treatments. Time intervals were analyzed for incident arrival, on-scene care, and transport to hospital. Upon arrival at the emergency department, hemoglobin, lactate, international normalized ratio (INR), and fibrinogen levels were recorded. Additionally, time to first transfusion, volume of packed red blood cells, and need for fibrinogen, prothrombin complex, and calcium replacement were documented.



© SEMES

Finally, length of stay and clinical status (alive or deceased) at 180 days were recorded.

### Statistical methods

Quantitative variables were expressed as mean ± standard deviation or median and interquartile range (IQR). Comparisons were performed using the Mann–Whitney U test. Qualitative variables were expressed as absolute frequency and percentage, and associations were analyzed using the chi-square test. Unadjusted 6-month mortality associated with bleeding type was estimated using the Kaplan–Meier method, with differences evaluated using the log-rank test. Mortality predictors were identified by forward multivariable regression, with mortality as the dependent variable and inclusion of all variables with $P < .05$ in univariate analysis. The study was approved by the Ethics Committee of the *Hospital Universitario de Guadalajara*, and informed consent was waived (Ref. CEIm: 2024-14-EO).

## Results

During the study period, a total of 13 353 emergencies were managed by the 4 AMEUs. Of these, 213 (1,6 %) were SH cases treated in hospital, and 145 (1,1 %) were finally analyzed: 103 TH and 42 MH cases (Table 1).

General patient characteristics and prehospital treatment are shown in Table 2. Regarding prehospital bleeding control, pelvic binders were used in 62 patients (90-19 %), 12 tourniquets were applied in 10 patients (9.78 %), and gauze packing and bandaging were performed in 17 patients (16.5 %).

Tranexamic acid was administered to 83 TH patients (80.6 %) and 24 MH patients (57.1 %). Somatostatin was administered in 18 patients (66.6 %) with GI bleeding.

Laboratory values on arrival, transfusion volumes, time to transfusion, and in-hospital fibrinogen and calcium replacement are shown in Table 3. Overall length of stay was 18.3 days (IQR, 6.0–26.5), 19.5 days (IQR, 3.8–30.1) in TH patients, and 12.0 days (IQR, 6.5–23.0) in MH patients [OR, 1.08 (1.04–1.13); $P = .017$].

The 6-month mortality rate was 26.2 % (Figure 1). TH resulted in 33 deaths (32.0 %) and MH in 11 deaths (25.0 %), with no statistically significant difference ($P = .466$).

In multivariate analysis, shock index, GCS score, orotracheal intubation, and prehospital arrival time were associated with mortality. Similarly, lactate levels and time to first transfusion were associated with mortality in the hospital setting (Table 4).

The most frequent cause of death in TH patients was central nervous system injury, whereas in MH patients it was post-intervention rebleeding (Table 5).

## Discussion

This study provides a comprehensive overview of prehospital management of critically ill hemorrhagic patients and their 6-month mortality. One in four patients died following SH. Arrival time, shock index, initial GCS, need for orotracheal intubation, lactate levels, and time to initiation of hospital transfusion were all associated with mortality, which was 26.2 % overall. These results are slightly lower than the 33 % reported by Angerman *et al.*,[15] likely due to inclusion of cardiac arrest patients and longer prehospital times in their cohort. Yliharju *et al.*[16] reported mortality near 20 %, with more favorable physiologic profiles and earlier transfusion, approximately 24 minutes sooner than in our cohort.

In our series, patients with MH presented with older age, lower SI, and higher GCS scores compared with TH. This finding may be explained by the intrinsic characteristics of this patient group. Older age at the time of hemorrhage may be associated with factors not analyzed in this study, such as prior treatment with negative chronotropic agents or the presence of chronic anemia, which is more frequent in older individuals and could favor greater physiological tolerance to hemorrhage. In addition, advanced age is associated with relevant physiological changes, such as reduced myocardial sensitivity to catecholamines, increased atherosclerosis, and vascular resistance, which may reduce the tendency to develop tachycardia and hypotension.[17] Because of the multiple confounding factors influencing the SI, its prognostic value in MH may be limited.[18] However, given the ease of SI calculation, it continues to be recommended for screening patients at risk of SH.[10]

Continued reliance on classic clinical criteria to predict SH is precarious and ineffective.[19] In our series, we were unable to measure end-tidal carbon dioxide ($PETCO_2$); however, this parameter, which is related to pulmonary hypoperfusion and reduced cardiac output, has demonstrated high sensitivity for predicting mortality.[20]

The combination of calculated and measured parameters may be more useful than isolated classic clinical parameters. Thus, an elevated SI associated with a lactate level > 4 mmol/L may provide greater predictive value for massive transfusion and mortality.[21] Therefore, while physiological variables may allow suspicion of severe hemorrhage, lactate enables a more precise assessment of the cellular impact of macrohemodynamic changes.

Table 1. Source of hemorrhage

| | Patients (n) | Percentage (%) |
|---|---|---|
| Traumatic hemorrhage | 103 | 71 |
| Thorax | 12 | 11.6 |
| Abdomen | 28 | 27.2 |
| Pelvis | 19 | 18.5 |
| Neck | 1 | 1 |
| Extremities | 12 | 11.6 |
| More than two regions | 32 | 31.1 |
| Medical hemorrhage | 42 | 29 |
| Gastrointestinal | 27 | 64.2 |
| Aorta | 4 | 9.5 |
| Gynecologic | 16 | 37.1 |
| ENT / Pulmonary | 16 | 37.1 |
| Oncologic | 2 | 4.8 |
| Others* | 2 | 2.2 |
| **Total** | **145** | **100** |

Severe hemorrhage sources initially managed by advanced life support ambulances.
*Others: spontaneous retroperitoneal bleeding, rupture of varicose vein.



© SEMES

Table 2. Characteristics of patients with severe hemorrhage

| | Total N = 145 | TH 103 (71 %) | MH 42 (29 %) | OR | *P* value |
|---|---|---|---|---|---|
| Sex | | | | | .98 |
| Male, n (%) | 100 (69) | 71 (68.9) | 29 (69) | | |
| Age, years [median (IQR)] | 54.0 (43.8-68.6) | 51 (41.9-60.4) | 67 (58.4-77) | 0.9 (0.93-0.97) | **.000** |
| Shock index [median (IQR)] | 1 (0.99-1.3) | 1.1 (1-1.2) | 1 (0.8-1.2) | 0.1 (0-0.2) | **.009** |
| Glasgow Coma Scale [median (IQR)] | 13.0 (12.0-14.0) | 13.0 (11.0-14.0) | 14 (13.0-14.0) | 0.6 (0.53-0.89) | **.006** |
| ≥2 peripheral IV lines (≤18G), n (%) | 86 (59.3 %) | 59 (57.3 %) | 27 (64.3 %) | | .436 |
| Endotracheal intubation, n (%) | 120 (82.8 %) | 93 (90.3 %) | 27 (64.3 %) | | |
| Prehospital | 65 (56 %) | 58 (63 %) | 7 (29.2 %) | 5.2 (2.09-12.81) | **.000** |
| In hospital | 51 (44 %) | 34 (37 %) | 17 (70.8 %) | 4.1 (1.56-11) | **.003** |
| Crystalloids (mL) [median (IQR)] | 1.000 (750-1.500) | 1.000 (750-1.500) | 1.250 (750-1.500) | 0.99 (0.99-1) | .078 |
| Norepinephrine, n (%) | 52 (36.1 %) | 42 (41.2 %) | 10 (23.8 %) | 2.2 (1.05-5.05) | **.047** |
| Response time (min) [median (IQR)] | 14.0 /11-17.3) | 14.0 (11) | 12.5 (10.0-17.0) | 1.08 (1-1.17) | **.043** |
| On-scene time (min) [median (IQR)] | 26.0 (22-31.5) | 28.0 (26) | 20.0 (19.0-23.0) | 1.2 (1.13-1.32) | **.000** |
| Transport time (min) [median (IQR)] | 20.5 (15.5-25.5) | 21 (16.0-27) | 18 (13-22.2) | 1.1 (1-1.11) | **.047** |

Characteristics of prehospital treatments and times in patients with severe hemorrhage.
TH: traumatic hemorrhage; MH: medical hemorrhage; IQR: interquartile range; G: gauge; OR: odds ratio.
Bold values indicate statistical significance (*P* < .05).

Given that clinical suspicion of severe hemorrhage in the prehospital setting appears to be suboptimal, the incorporation of point-of-care devices in the prehospital environment, such as blood gas and lactate analyzers or ultrasonography, may assist in assessing severity and improving therapeutic decision-making in the out-of-hospital setting.[22]

In our study, most patients received approximately one liter of crystalloids, with early initiation of norepinephrine in 40 % of cases. This crystalloid-sparing practice in the absence of transfusion follows the principles of the DCR strategy.[10,11]

However, time to transfusion was a predictor associated with mortality. It has been established that for each minute of delay in resuscitation of patients with severe hemorrhage, mortality increases by 5 %.[6] Our ambulances lacked blood components for volume replacement. The HEMS of Castile-La Mancha are pioneers in our country[12] by allowing 24/7 transfusion and the possibility of functioning as airborne blood banks. Muñoz *et al.* recently published their initial experience with prehospital transfusion in Andalusia, showing favorable safety data and potential benefit.[23] It would be advisable to remove existing barriers and expand the availability of blood components nationwide, focusing efforts where access remains limited.[24]

Multiple organ failure, refractory shock, and hypoxic encephalopathy were the main causes of death. It is known that a large proportion of both early and late deaths are related to the timeliness of resuscitation and quality of care.[25,26] In fact, universal availability of blood components in EMS systems could prevent more than 5,000 deaths annually in the United States alone.[27] Local feasibility studies in Spain regarding transfusion availability in mobile intensive care units are warranted, as this practice is already a reality in other EMS systems with potential associated benefit.[16,28]

Finally, prehospital orotracheal intubation was associated with mortality in our study. It is possible that the most severely ill patients with poorer prognosis required this intervention. However, limited current availability of blood components or antidotes to reverse drug-induced coagulopathies in our setting, or care based on the classic "ABC" approach rather than the contemporary "C-ABC" strategy,[29] may also have influenced outcomes.

Currently, a brief period of resuscitation — preferably with blood components — is recommended before airway management in patients in shock, and when these are unavailable, the risk-benefit of delaying intubation until hospital arrival should be considered.[30]

The main limitation of this study is its single-center design. In addition, ground units did not have ultrasound,

Table 3. Laboratory values and in-hospital hemorrhage treatment

| | Total N = 145 | TH N = 103 | MH N = 42 | OR | *P* value |
|---|---|---|---|---|---|
| Hemoglobin, g/dL [median (IQR)] | 9.2 (7.9.10.9) | 10.0 (8.8-11.2) | 7.9 (7.0.9.2) | 1.5 (1.27.1.89) | .000 |
| International normalized ratio (INR) [median (IQR)] | 1.6 (1.4.1.86) | 1.6 (1.4.1.7) | 1.7 (1.44.1.90) | | .079 |
| Fibrinogen level, g/L [median (IQR)] | 1.8 (1.4.2.1) | 1.8 (1.3.2.1) | 1.8 (1.6.2.5) | | .098 |
| Lactate, mmol/L [median (IQR)] | 4.1 (3.4.6) | 4.3 (3.4.8) | 4.0 (2.8.6) | 1.1 (1.01.1.28) | **.038** |
| Red blood cell units, n [median (IQR)] | 4.0 (3.0.6.0) | 4.0 (3.0.6.0) | 3.0 (3.0.4.0) | 1.3 (1.05.1.57) | **.017** |
| Time to transfusion, min [median (IQR)] | 78 (70) | 76.0 (72.105) | 81.5 (64) | 1.02 (1.01.1.04) | **.024** |
| Fibrinogen concentrate, n (%) | 108 (74.5) | 85 (82.5) | 23 (54.8) | 3.9 (1.77 -8.61) | **.000** |
| Prothrombin complex concentrate, n (%) | 14 (9.6) | 9 (8.7) | 5 (11.6) | | .999 |
| Calcium, n (%) | 114 (78.6) | 85 (82.5) | 29 (69.0) | | .096 |

TH: traumatic hemorrhage; MH: medical hemorrhage; IQR: interquartile range; OR: odds ratio.
Bold values indicate statistical significance (*P* < .05).


© SEMES

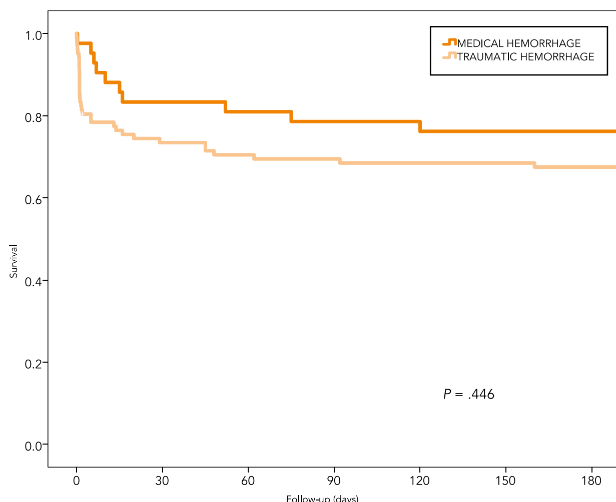


Figure 1. Kaplan–Meier survival curve at 180 days.

Table 4. Multivariable analysis of factors associated with mortality

| | Odds ratio | P value |
|---|---|---|
| Age | 0.991 (0.957-1.026) | .598 |
| **Shock Index** | **0.047 (0.004-0.622)** | **.02** |
| **Glasgow Coma Scale** | **0.520 (.0353-0.766)** | **.02** |
| **Prehospital intubation** | **0.059 (0.010-0.347)** | **.002** |
| **Arrival time** | **0.864 (0.726-0.997)** | **.047** |
| Time on scene | 0.977 (0.892-1.069) | .725 |
| Transport time | 1.011 (0.929-1.100) | .803 |
| Hemoglobin | 0.801 (0.585-1.096) | .166 |
| **Lactate** | **1.357 (1.039-1.773)** | **.025** |
| **Time to transfusion** | **1.070 (1.016-1.147)** | **.035** |
| Number of packed red blood cell units | 1 (0.999-1.001) | .407 |
| Fibrinogen concentrate | 0.829 (0.283-4.834) | .692 |

Bold values indicate statistical significance ($P < .05$).

Table 5. Causes of mortality by group

| | Traumatic Hemorrhage N = 33 n (%) | Medical Hemorrhage N = 11 n (%) |
|---|---|---|
| Refractory hemorrhagic shock | 9 (27.27) | 2 (18.18) |
| Brain death | 10 (30.3) | – |
| Multiple organ dysfunction | 6 (18.18) | 2 (18.18) |
| Anoxic encephalopathy | 4 (12.1) | – |
| Acute cerebrovascular accident | 2 (6.06) | – |
| Respiratory failure | – | 1 (9.09) |
| Pulmonary embolism | 1 (3.03) | – |
| Rebleeding | – | 3 (27.27) |
| Intestinal ischemia | – | 1 (9.09) |
| Cardiogenic shock | – | 1 (9.09) |
| End-stage disease | 1 (3.03) | 1 (9.09) |

dry chemistry analysis, or hemorrhage control devices such as the Sengstaken-Blakemore tube; therefore, these findings may not be applicable to other EMS systems or regions. Furthermore, the small sample size may have limited statistical power. Validated severity scales were not collected due to the diversity of bleeding etiologies, preventing estimation of mortality probability. Other hospital treatments and complications were not considered, which could have affected prognosis. The retrospective design may also introduce unintentional bias.

In conclusion, SH in our setting is associated with high mortality. Time to incident arrival, SI, initial GCS score, need for intubation, lactate levels, and time to transfusion were factors associated with mortality. Further studies are warranted to assess the impact of implementing point-of-care devices for patient stratification and expanding blood component availability in mobile intensive care units to improve outcomes in patients with severe hemorrhage.

## ARTICLE INFORMATION

**Conflict of Interest Disclosures:** None reported.

**Funding:** The authors declare the non-existence of funding in relation to this article.

**Ethical Responsibilities:** The authors have confirmed the maintenance of confidentiality and respect for the patient rights, agreement of publication, and transfer of rights to Revista Española de Urgencias y Emergencias.

**Data Availability:** Data are available upon reasonable request to the corresponding author.

**Author Contributions (CRediT):** RVM: Conceptualization, methodology, original manuscript drafting, investigation, data management, and analysis. EML, RGS: Conceptualization, methodology, and manuscript drafting. SCC, WCB: Investigation, data management, and analysis. ACD: Critical intellectual revision, supervision, and validation. EGM: Data visualization, editing, and manuscript translation.

**Use of Generative AI Tools:** The authors declare that no AI tools were used in manuscript preparation.

**Article not commissioned by the Editorial Board and with external peer review.**

**Note of the editors:** This is a BOWMAN-generated English translation of the officially indexed Spanish-language article, which should be cited as Rev Esp Urg Emerg. 2026;5:24-29. In this translated version, the editors have supervised the process; however, it cannot be ruled out that some errors resulting from the artificial intelligence translation process may have gone unnoticed.

## REFERENCES

1. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012;380:2095-128.
2. Tisherman SA, Schmicker RH, Brasel KJ, Bulger EM, Kerby JD, Minei JP, et al. Detailed description of all deaths in both the shock and traumatic brain injury hypertonic saline trials of the Resuscitation Outcomes Consortium. Ann Surg. 2015;261:586-90.
3. Brohi K, Gruen RL, Holcomb JB. Why are bleeding trauma patients still dying?. Intensive Care Med. 2019;45:709-11.
4. Kalkwarf KJ, Drake SA, Yang Y, Thetford C, Myers L, Brock M, et al. Bleeding to death in a big city: an analysis of all trauma deaths from haemorrhage in a metropolitan area during 1 year. J Trauma Acute Care Surg. 2020;89:716-22.
5. Shah A, Kerner V, Stanworth SJ, Agarwal S. Major haemorrhage: past, present and future. Anaesthesia. 2023;78:93-104.
6. Meyer DE, Vincent LE, Fox EE, O'Keeffe T, Inaba K, Bulger E, et al. Every minute counts: Time to delivery of initial massive transfusion cooler and its impact on mortality. J Trauma Acute Care Surg. 2017;83:19-24.
7. Prehospital Hemorrhage Control and Treatment by Clinicians: A Joint Position Statement. Ann Emerg Med. 2023;82:e1-e8.
8. Cole E, Weaver A, Gall L, West A, Nevin D, Tallach R, et al. A Decade of Damage Control Resuscitation: New Transfusion Practice, New Survivors, New Directions. Ann Surg. 2021;273:1215-20.
9. Jenkins DH, Rappold JF, Badloe JF, Berséus O, Blackbourne CL, Brohi KH, et al. THOR position paper on remote damage control resuscitation: definitions, current practice and knowledge gaps. Shock. 2014;41:3-12.
10. Rossaint R, Afshari A, Bouillon B, Cerny V, Cimpoesu D, Curry N, et al. The European guideline on management of major bleeding and coagulopathy following trauma: sixth edition. Crit Care. 2023;27:80.
11. Lammers DT, Holcomb JB. Damage control resuscitation in adult trauma patients: What you need to know. J Trauma Acute Care Surg. 2023;95:464-71.
12. Consejería de Sanidad. Castilla-La Mancha supera las 100 transfusiones sanguíneas en helicóptero sanitario, marcando un hito en la



© SEMES

atención de emergencias en España. (Accessed 25 May 2025). Available at: https:// www.castillalamancha.es/actualidad/notasde prensa/castilla-la-mancha-supera-las-100-transfusiones-sangu%C3%ADneas-en-helic% C3%B3ptero-sanitario-marcando-un-hito
13. Instituto nacional de estadística (España). Cifras oficiales de población resultantes de la revisión del Padrón municipal a 1 de enero. (Accessed 25 December 2024). Available at: https://www.ine.es/jaxiT3/Datos.htm?t=2872.
14. Lin VS, Sun E, Yau S, Abeyakoon C, Seamer G, Bhopal S, et al. Definitions of massive transfusion in adults with critical bleeding: a systematic review. Crit Care. 2023;27:265.
15. Ångerman S, Kirves H, Nurmi J. Characteristics of Nontrauma Patients Receiving Prehospital Blood Transfusion with the Same Triggers as Trauma Patients: A Retrospective Observational Cohort Study. Prehosp Emerg Care. 2022;26:263-71.
16. Yliharju H, Jama T, Nordquist H. Initial experiences of prehospital blood product transfusions between 2016 and 2020 in Päijät-Häme hospital district, Finland. Scand J Trauma Resusc Emerg Med. 2022;30:39.
17. Heffernan DS, Thakkar RK, Monaghan SF, Ravindran R, Adams CA Jr, Kozloff MS, et al. Normal presenting vital signs are unreliable in geriatric blunt trauma victims. J Trauma. 2010;69:813-20.
18. Saffouri E, Blackwell C, Laursen SB, Laine L, Dalton HR, Ngu J, et al. The Shock Index is not accurate at predicting outcomes in patients with upper gastrointestinal bleeding. Aliment Pharmacol Ther. 2020;51:253-60.
19. Wohlgemut JM, Marsden MER, Stoner RS, Pisirir E, Kyrimi E, Grier G, et al. Diagnostic accuracy of clinical examination to identify life- and limb-threatening injuries in trauma patients. Scand J Trauma Resusc Emerg Med. 2023;31:18.
20. Al-Aomar S, AlSamhori JF, Alzghoul H, Al-Ghraibeh H, Al-Majali G, Tarras S, et al. Evaluating the utility of end-tidal CO2 as a predictor of mortality in trauma victims: A systematic review and meta-analysis. Am J Surg. 2025;240:116130.
21. Gaessler H, Helm M, Kulla M, Hossfeld B, Riedel J, Kerschowski J, et al. Prehospital predictors of the need for transfusion in patients with major trauma. Eur J Trauma Emerg Surg. 2023;49:803-12.
22. Stojek L, Bieler D, Neubert A, Ahnert T, Imach S. The potential of point-of-care diagnostics to optimise prehospital trauma triage: a systematic review of literature. Eur J Trauma Emerg Surg. 2023;49:1727-39.
23. Muñoz-Álvarez E, Soto-García R, García-Márquez V, Quirós-Delgado L, Fernández-Herrera MD, Romero-Olóriz C. Transfusión extrahospitalaria en el shock hemorrágico grave: experiencia inicial del primer helicóptero medicali zado con capacidad transfusional de Andalucía. Rev Esp Urg Emerg. 2024;3:163-71.
24. Chaefer RM, Bank EA, Krohmer JR, Haskell A, Taylor AL, Jenkins DH, et al. Removing the barriers to prehospital blood: A roadmap to success. J Trauma Acute Care Surg. 2024;97(2S Suppl 1):S138-S144.
25. Deeb AP, Guyette FX, Daley BJ, Miller RS, Harbrecht BG, Claridge JA, et al. Time to early resuscitative intervention association with mortality in trauma patients at risk for hemorrhage. J Trauma Acute Care Surg. 2023;94:504-12.
26. Gunst M, Ghaemmaghami V, Gruszecki A, Urban J, Frankel H, Shafi S. Changing epidemiology of trauma deaths leads to a bimodal distribution. Proc (Bayl Univ Med Cent). 2010;23:349-54.
27. Nationwide estimates of potential lives saved with prehospital blood transfusions. Transfusion. 2025;65(Suppl 1):S14-S22.
28. Daniel Y, Derkenne C, Corcostegui SP, Jost D, Martinaud C, Travers S, et al. Mobile blood depots in ground ambulances in compliance with French legislation: A feasibility study. Transfusion. 2023;63:1481-7.
29. Breeding T, Martinez B, Katz J, Kim J, Havron W, Hoops H, et al. CAB versus ABC approach for resuscitation of patients following traumatic injury: Toward improving patient safety and survival. Am J Emerg Med. 2023;68:28-32.
30. Ferrada P, Shafique S, Brenner M, Burlew C, Catena F, Coleman J, et al. Prioritizing circulation over airway to improve survival in trauma patients with exsanguinating injuries: a world society of emergency surgery-panamerican trauma consensus statement. World J Emerg Surg. 2025;20:4.



© SEMES