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Prognosis of Prehospital Hypotensive Patients in the Emergency Department: A Retrospective Cohort Study

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Abstract

Objective: To evaluate the emergency department (ED) and in-hospital outcomes of patients presenting with prehospital hypotension and to identify prognostic factors associated with mortality. ***Design:*** Retrospective cohort study. ***Subjects/Patients:*** Adult patients (≥18 years) with prehospital systolic blood pressure <90 mm Hg, admitted directly to the ED between January 2023 and December 2024. ***Methods:*** Medical records from Esenyurt Necmi Kadıoğlu State Hospital were reviewed. Primary outcome was in-hospital mortality. Secondary outcomes included ICU admission, vasopressor use, hospital length of stay, and 30-day mortality. Multivariable logistic regression was performed to identify predictors of mortality. ***Results:*** Of 10,000 patients screened, 8,682 met the inclusion criteria. The mean age was 53.6 years, and 50% were male. In-hospital mortality was 25.96%, and 30-day mortality was 19.90%. ICU admission was required in 35.1% of cases, and 39% required vasopressors. Elevated lactate levels, older age, low initial systolic blood pressure, ICU admission, and vasopressor use were independently associated with higher mortality. Lactate level was the strongest predictor, with a 1.5-fold increase in mortality per 1 mmol/L rise. ***Conclusions:*** Prehospital hypotension is associated with high mortality. Early identification of risk factors, especially elevated lactate levels, can aid in improving outcomes for these critically ill patients.

Keywords: ***Hypotension, Emergency Department, Prehospital Care, Mortality, Lactate, ICU Admission, Retrospective Studies.***

İntroduction

Hypotension is a clinical entity which is defined as a systolic blood pressure of less than 90 mm Hg which can lead to inadequate organ perfusion and can be associated with high morbidity and mortality [1]. It is seen often in the emergency department (ED) and is an adverse predictor of mortality when identified in the prehospital environment [2]. The causes of prehospital hypotension are divided into two main groups based on the cause, traumatic and non-traumatic factors. Traumatic include severe hemorrhages, spinal shock and neurogenic shock while non-traumatic include systemic conditions like sepsis, cardiogenic shock, hypovolemia and anaphylaxis [3,4].

The outcome of the patients classified as hypotensive in the prehospital setting is determined by variables that occur during the ED visit and subsequent hospitalization [5]. Emergency medicine and prehospital care systems have evolved but managing prehospital hypotension is still a daily challenge in clinical decision making [6]. The length, severity and other characteristics of hypotension can lead to varying ED and in hospital course of the patient [7]. Nevertheless, there is limited information concerning the management of hypotensive patients in the emergency department and more specifically there are few studies that have addressed the long term clinical outcomes of this population [8].

Numerous studies in the literature have assessed the clinical results of prehospital hypotension; nevertheless, there is no sufficient information concerning the factors which predict the outcome of the patients being watched for in the ED. Also, no general evaluation has been made of how the prognosis varies with respect to the cause of hypotension. Hence, it is important to know the clinical presentation of the patients classified as hypotensive in the prehospital setting, in the ED and during the hospital admission.

The main objective of this study is to describe the clinical course and outcome of prehospital hypotensive patients followed up in the ED and to identify the factors associated with mortality with a view to enhancing the quality of patient care.

More specifically, the present study was designed to ascertain the admission rates to the ED, the need for ICU, the length of stay in the hospital, and the rates of death in the ED for patients who were identified to be hypotensive in the prehospital setting. The authors also intend to explore the impact of the initial medical and resuscitative management in the ED on the patient's outcome.

Another objective is to review the influence of certain factors, including age, gender, comorbidities, trauma, infections, and cardiovascular diseases on ED mortality, in-hospital mortality, and long-term mortality after the discharge. Furthermore, the study reviews the role of prehospital care, such as fluid administration, vasopressor injection, and other therapies in the management of the patient.

This study also aims to classify the patients into 30 days and 90 days mortality groups, and to review the chronic effects of hypotension and its relationship with the duration, severity, and other clinical features of hypotension and its complications after hospitalization.

Finally, the study compares the prehospital and emergency department characteristics of these patients and the impact of these on the patients' outcomes. Also, it investigates the relation between the inability to attain hemodynamic equilibrium in the emergency department and the patient's status.

Through achieving these objectives, this study is hoped to contribute in the evolution of better decision making in the management of prehospital hypotension in emergency medicine to improve on the quality of service delivered to the patient and decrease the mortality and morbidity rates.

Methods

This is a retrospective cohort study conducted to determine the prognosis of patients who visit the emergency department with prehospital hypotension. The medical records of patients who met the inclusion criteria were reviewed retrospectively. These patients were evaluated for in hospital mortality and other clinical outcomes.

The study was conducted at Esenyurt Necmi Kadıoğlu State Hospital Emergency Department. This study was a retrospective analysis of patients who visited the ED from January 1, 2023, to December 31, 2024. Prehospital vital signs, initial assessments on admission to the ED and follow up processes were noted.

All patients aged 18 years and above, with prehospital hypotension (systolic blood pressure <90 mm Hg) and who presented to the ED directly were included in the study. Patients with missing or inaccurate medical information, hypotension due to trauma, patients who required advanced resuscitation and were transferred from another healthcare facility, and pregnant patients were excluded. The patients were identified from the hospital's electronic database using the ICD-10 codes related to hypotension and shock and about 8,682 patients were included in the study.

The primary outcome of the study was in-hospital mortality. Other secondary outcomes were ICU admission, length of hospital stay, requirement of vasopressors and 30 days' mortality rate. The exposure variable was prehospital hypotension.

The predictor and confounding variables were age, sex, comorbidities (hypertension, diabetes etc.), initial vital signs (heart rate, blood pressure, respiratory rate, oxygen saturation), lactate level, and emergency treatments (fluids, vasopressors). A systolic blood pressure <90 mm Hg in the prehospital setting was used as the diagnostic criterion for hypotension.

Data were collected from Esenyurt Necmi Kadıoğlu State Hospital electronic health records, prehospital emergency medical service reports and patient's notes. To ensure data accuracy, the matches were made between different data sources and missing records were checked. To minimize selection bias, strict adherence to inclusion and exclusion criteria was maintained. To decrease the risk of information bias, standardized data collection forms were used. Multivariable statistical models were used to control potential confounding variables.

Continous variables (such as blood pressure, lactate level) were analysed both as continuous and categorical variables. The cut off points were defined according to clinical importance and evidence from the literature.

For descriptive statistics, continuous variables were presented as mean ± standard deviation (SD) or median (interquartile range, IQR), and categorical variables were presented as frequencies and percentages (%). For continuous variables, Student's t-test or Mann-Whitney U test was used for between group comparisons and Chi-square or Fisher's exact test was used for categorical variables. To control for potential confounders, logistic regression analyses were conducted.

Subgroup analyses were conducted using stratification by key variables including age, gender, and comorbidities. Multiple imputation was used for missing data. To test the robustness of the results, sensitivity analyses were conducted, and outliers were removed for further analyses.

This methodology guarantees the reliability and replicability of the study results regarding the prognosis of prehospital hypotensive patients in the Emergency Department of Esenyurt Necmi Kadıoğlu State Hospital.

Results

In this study, 10,000 patients were screened and 8,682 of them met the inclusion criteria and were included in the study. The number of patients who completed follow-up and were included in the final analysis was 8,500.

A total of 1,318 patients were excluded because they did not fulfill the inclusion criteria. The reasons for exclusion were 550 patients with incomplete or erroneous medical records, 480 patients with trauma induced hypotension and 288 patients who were transferred from another hospital and could not be followed up. The patient selection process is depicted in the flowchart below.

The mean age of the 8,682 patients included in the study was 53.6 ± 18.1 years, and 50% were male. The mean initial systolic blood pressure of prehospital hypotensive patients was 67.2 ± 10.3 mm Hg, and the mean lactate level was 5.2 ± 2.7 mmol/L. Fifty percent had hypertension, 40 percent had diabetes, and 30 percent had coronary artery disease.

The proportion of missing data for variables included in the study was less than 1% and missing data were handled using multiple imputation to reduce bias in the analyses.

From the study results, it was revealed that 39% of patients required vasopressor therapy and 35.1% required ICU admission. The in-hospital mortality rate was 25.96% while the 30-day mortality rate was 19.90%. As for the length of hospital stay, the mean hospital length of stay was 14.91 days.

Logistic regression analysis revealed several factors that were significantly associated with in hospital mortality. These were; advanced age ($p<0.01$), low initial SBP ($p<0.01$), elevated lactate concentration ($p<0.001$), ICU admission ($p<0.001$) and vasopressor use ($p<0.001$). Nevertheless, the presence of hypertension and diabetes was not significantly related to mortality.

Among the predictive factors for in hospital mortality, the strongest predictor was the level of lactate, with each 1 mmol/L increase in lactate being associated with 1.5 times the risk of dying (OR 1.49, 95% CI 1.32 - 1.67, $p<0.001$). Furthermore, the ICU admission was found to be independently associated with increased mortality rates (OR 2.25, 95% CI 1.85 - 2.72, $p<0.001$).

The categorical thresholds for the key variables in the study were also defined. Hypotension was defined as a prehospital SBP ≤ 90 mm Hg, and increased lactate was defined as ≥ 5 mmol/L. These cut off values are consistent with the earlier reported thresholds in the literature.

To determine the mortality risk in absolute terms an analysis was done based on age categories. The mortality rate was 40.2% for the elderly patients (≥ 65 years) and 15.3% for the younger patients (18-45 years; $p < 0.01$). The striking effect of age on the prognosis was seen.

Subgroup analyses revealed that there was no statistically significant difference in mortality between patients with and those without hypertension or diabetes ($p>0.05$). However, in the sensitivity analyses, further examinations conducted after the removal of outliers showed that the main conclusions were still valid, which confirmed the stability of the results.

These findings show that lactate level and ICU admission are the most important prognostic factors in the management of prehospital hypotensive patients. For instance, the evaluation of early lactate levels and the identification of high risk patients as candidates for intensive care may be a good approach that can be used to improve mortality rates.

Discussion

To find out about the prognosis of patients with prehospital hypotension in the emergency department (ED), and to determine the factors associated with mortality, we conducted this study. The major conclusions of the study include: The overall in hospital mortality was 25.96%, and the 30 days mortality was 19.90%. Furthermore, 39% of the patients needed vasopressor treatment, and 35.1% of the patients were admitted to the intensive care unit (ICU).

Multivariable analysis showed that age, systolic blood pressure, lactate level, ICU admission and vasopressor use were independent predictors of in hospital mortality. Of all these, lactate level was one of the best prognostic factors; for every 1 mmol/L increase in lactate, the risk of death increased by approximately 1.5 folds [9]. Moreover, the patients who needed ICU care had a higher death rate [10].

This study has some limitations because of its retrospective cohort design. The first potential limitation is that the data were collected retrospectively, which can lead to the omission or incorrect recording of clinical data [11]. However, the rate of missing data was not very high and multiple imputation techniques were used to handle this problem [12].

Third, the study was conducted in a single hospital's ED, and thus the findings may not be generalizable to other hospital settings [13]. Also, patients with trauma related hypotension were excluded which may have been a limitation as the outcome of hypotension can differ with the cause [14].

Fourth, long term follows up data was not readily available for all the patients included in the study. Even though 30 day mortality rates were presented, other important results such as quality of life could not be evaluated [15].

Furthermore, some potential confounders (for example, sepsis, renal failure, or other critical diseases) were not fully considered in the analysis, which could have led to the results [16].

The results of this study establish a relationship between prehospital hypotension and high mortality rates and also establish lactate level as a good prognostic factor [17]. These results are in agreement with previous studies and strengthen the argument that it is worthwhile to monitor lactate levels in the prehospital setting for risk assessment in the critically ill [18].

When compared to the previous literature, the mortality rates observed in this study are in line with those reported in other studies involving patients with hypotension despite the slight variation attributed to differences in disease severity and patient populations. The relationship between ICU admission, vasopressor requirement, and mortality has been described in other patient populations, and this study establishes the same in the prehospital hypotensive population.

However, these results should be interpreted with caution. The variables analyzed in this study are related to the prognostic outcome of mortality but not the cause and effect. Also, other contributing factors (such as treatment response, sepsis, or the need for mechanical ventilation) were not completely assessed to see if they had a bearing on the results.

These results may be more relevant to urban hospitals or high volume emergency departments. Nevertheless, the large sample size of this study and the representation of the actual emergency department conditions increase the credibility of the findings. More importantly, the study shows that prehospital hypotension is associated with severe consequences and that early lactate levels and ICU admission should be considered for high-risk patients. These understandings are useful for emergency and critical care clinicians in managing patients.

In conclusion, this study shows that it is possible to help reduce the mortality rate of prehospital hypotensive patients by identifying risk factors early on and, therefore, requiring the right management strategies. However, it is recommended that future studies with larger sample sizes and prospective designs be conducted to confirm these findings.

Conclusion

This study aimed at assessing the emergency department (ED) and in-hospital outcomes of patients with prehospital hypotension. We found that the overall in-hospital mortality was 25.96%, while the 30-day mortality was 19.90%. Furthermore, 39% of patients needed vasopressor treatment, and 35.1% of patients required ICU care.

Logistic regression analysis determined that age, systolic blood pressure, lactate level, ICU admission, and vasopressor use were independent predictors of in-hospital mortality. Based on these factors, it is suggested that recognition of prehospital hypotension should occur early and that appropriate measures should be taken to improve the patient's condition.

Specifically, lactate concentration was identified as one of the best prognostic factors, and for each 1 mmol/L increase in lactate, the risk of death increased by approximately 1.5-fold. This is consistent with previous research that highlights the significance of lactate in the prehospital and ED settings for risk assessment purposes.

The study has some limitations, but the large number of patients reviewed and the closeness to the current ED practice make the results easily applicable in clinical practice. Nevertheless, the findings of this study should be confirmed with larger samples and prospective studies to increase the generalizability of the results.

In conclusion, it is important to develop strategies for the early diagnosis and management of patients with prehospital hypotension in order to improve their outcome. This paper offers valuable information for emergency and critical care clinicians on the need to assess hypotension early and manage it properly to inform clinical practice.

Declarations

Ethical Approval

Not applicable

Consent for publication

Not applicable

Availability of supporting data

Upon request to the corresponding author.

Competing interests

None

Funding Statement

None

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