

APPLICATION OF PREHOSPITAL TRAUMA LIFE SUPPORT PRINCIPLES

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ABSTRACT: The objective was to analyze the application of the Prehospital Trauma Life Support principles by the emergency medical teams. Observational study involving 100 care files of trauma victims during admission to an emergency medical service in April 2014. The prevalent cases of trauma victims were between 12 and 39 years of age (64%), with a predominance of male victims (69%). The teams applied the principles of Prehospital Trauma Life Support in most victims observed, but it was identified that 17% did not have their cervical and vertebral spine immobilized, the body remained immobilized using fixation belts in only 31% of the cases, injuries were unprotected in 15% of the victims and 63% were not undressed in search of injuries. It is highlighted that the emergency medical teams' application of the principles is fundamental to standardize actions through a logical sequence of universal care. Ongoing training is suggested for these teams, based on Prehospital Trauma Life Support.

DESCRIPTORS: Emergency Medical Services; Trauma; Emergencies; Inservice training; Nursing.

APLICAÇÃO DOS PRINCÍPIOS DO PREHOSPITAL TRAUMA LIFE SUPPORT

RESUMO: Objetivou-se analisar a aplicação dos princípios do *Prehospital Trauma Life Support* pelas equipes do serviço pré-hospitalar móvel. Estudo observacional com 100 processos de atendimento às vítimas de trauma durante a admissão em um pronto socorro, em abril de 2014. Houve prevalência de vítimas de trauma entre 12 a 39 anos (64%) e predomínio do sexo masculino (69%). As equipes aplicaram os princípios do *Prehospital Trauma Life Support* na maioria das vítimas observadas, no entanto, identificou-se que 17% não estavam com a coluna cervical e vertebral imobilizadas, o corpo permaneceu imobilizado com cintos de fixação em apenas 31% dos casos, lesões não estavam protegidas em 15% das vítimas e 63% não foram despidas à procura de lesões. Ressalta-se que a aplicação dos princípios pelas equipes do serviço pré-hospitalar é primordial para padronizar ações, por meio de uma sequência lógica de atendimento universal. Sugere-se a capacitação continuada para essas equipes com base no *Prehospital Trauma Life Support*.

DESCRIPTORIOS: Atendimento Pré-Hospitalar; Trauma; Emergências; Capacitação em serviço; Enfermagem.

APLICACIÓN DE LOS PRINCIPIOS DEL PREHOSPITAL TRAUMA LIFE SUPPORT

RESUMEN: Fue objetivo del estudio analizar la aplicación de los principios del *Prehospital Trauma Life Support* por los equipos de servicio pre hospitalar móvil. Estudio observacional con 100 procesos de atendimento a las víctimas de trauma durante la admisión en la emergencia, en abril de 2014. Fueron predominantes las víctimas de trauma entre 12 y 39 años (64%) del sexo masculino (69%). Los equipos aplicaron los principios del *Prehospital Trauma Life Support* en la mayoría de las víctimas observadas, sin embargo, se identificó que 17% no estaban con la columna cervical y vertebral inmovilizadas; el cuerpo permaneció inmovilizado con cintos de fijación en solamente 31% de los casos, lesiones no estaban protegidas en 15% de las víctimas y 63% no fueron desnudadas en la búsqueda de lesiones. Se destaca que la aplicación de los principios por los equipos del servicio pre hospitalar es primordial así como crear un patrón para las acciones, por medio de una secuencia lógica de atendimento universal. Se sugiere la capacitación continuada para esos equipos con base en el *Prehospital Trauma Life Support*.

DESCRIPTORIOS: Atendimento Pre Hospitalar; Trauma; Emergencias; Capacitación en servicio; Enfermería.

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● INTRODUCTION

Trauma represents a great public health problem in Brazil, with profound repercussions for the social, economic and political structures of society⁽¹⁾. It can be defined as a harmful event originating in the transmission of mechanical, chemical, thermal, electrical or irradiation energy⁽²⁾. This refers to homicides, suicides, falls, traffic accidents, drowning, poisoning and victims of stab wounds and fire arms⁽³⁾.

In recent decades, important advances have been achieved in health in Brazil through the development of new technologies. The industrial age, the increased speed of vehicles, the socioeconomic conditions and human nature itself are factors that contributed to the progressive growth of external causes, characterized as traumas, injuries or any other sudden health problems – whether intentional or not – as an immediate consequence of violence or other exogenous causes⁽⁴⁾.

Since 2000, external causes rank third among the causes of death in Brazil⁽⁵⁾. They are the primary cause of mortality in the age range from 1 to 39 years and most of the population affected is male⁽¹⁾.

Data from the Ministry of Health show that, in 2012, approximately 152 thousand deaths due to external causes took place. The Mortality Information System notified events related to land transportation, homicides, aggressions, suicides, intentionally self-inflicted injuries, falls, burns, drowning and events of undetermined intentions⁽⁶⁾.

This reality increases the demand for emergency medical care to the victims at the event site, with the professionals' speedy initial approach of victims to identify and stabilize injuries. In addition, there is the need for appropriate and equipped transportation to deliver efficient and safe care to the victims inside the emergency hospital. The objective of the emergency medical services is early intervention in order to reduce the morbidity and mortality indices, while intra-hospital care promotes therapeutic life support measures⁽¹⁾.

In that sense, a North American program internationally known as Prehospital Trauma Life Support - PHTLS stands out, created in 1981, which regulates the global standard in care delivery to trauma victims. It contains the knowledge needed to reduce the mortality. Consequently, based on the program, the emergency medical professional guarantees correct decisions in care delivery to the victims, based on solid and scientific knowledge⁽²⁾.

To execute this program, the ABCDE Protocol should be followed, considered as a mnemonic method for primary trauma care. It originates in the United States, was created by the American College of Surgeons⁽²⁾ and intends to improve care delivery to trauma victims through the early detection of the physiological changes that put him/her at risk of death and/or sequelae.

The primary approach (or primary ABCDE) is intended to stabilize the vital signs and identify injuries that compromise the victims' life through the following methods: rapid assessment and airway stabilization (Airway), respiration (Breathing), Circulation, assessment of neurological condition (Disability) and skin exposure in search of injuries with maintenance of normal body temperature (Exposure and Environmental control)⁽⁷⁾.

Emergency medical services need to adapt to the exponential increase in the number of trauma victims. Therefore, the application of standardized actions permits guaranteeing the quality of care delivery to reduce the mortality rates and minimize sequelae. Therefore, the professionals should be prepared and trained for decision making during emergency situations.

In the same perspective, Brazil approved a trauma care line through Decree 1.366 from July 8th 2013⁽⁸⁾, which recommends the reduction of morbidity and mortality rates through the universalization and standardization of a care model for trauma victims based on the Brazilian Society of Trauma Care⁽¹⁾.

In Nursing, the Law on Professional Practice 7.498/86⁽⁹⁾, the Ethics Code of Nursing Professionals⁽¹⁰⁾ and Federal Nursing Council⁽¹¹⁾ Resolution 375/2011 discuss the presence of emergency care nurses in the structuring of services, in the delivery of nursing care, in the oversight and coordination of the nursing team (consisting of Nursing Technicians and Auxiliary Nurses) and in the development and management of educative actions. Thus, it is the function of nurses to get to know the care delivered

in order to qualify the services offered.

In this context, the objective in this study was to analyze the application of the PHTLS principles by the emergency medical services.

● METHOD

Observational study focused on research without any intervention⁽¹²⁾. The data were collected between April 05th and 30th 2014 at alternative times, including weekends and holidays.

The research was developed at an Emergency Medical service of a public referral hospital in trauma in the city of Curitiba, state of Paraná (PR). The admission of trauma victims was observed at the Emergency care service with a view to analyzing the application of the PHTLS principles by the emergency medical service, besides registering sociodemographic data like age and sex, using an observation script elaborated by the researchers and based on the primary ABCDE trauma Protocol.

The option to develop an observation study of emergency medical files inside a hospital is justified by the logic that the management steps of emergency medical care delivery to trauma victims are completed upon arrival to the hospital. Hence, the most appropriate time to collect the data would be during the admission to the emergency service; in addition, the limitations to develop the observation study in the emergency medical services, due to the small physical space, limited to the emergency care professionals inside the ambulances and among the different bases spread across the city of Curitiba.

The following inclusion criteria were adopted: care delivery to trauma victims of any nature and age, delivered by specialized emergency medical services like the Integrated Emergency Trauma Care Service (SIATE), Mobile Emergency Medical Service (SAMU) and other rescue ambulances and helicopters when they enter the fixed emergency hospital.

Using data from the public domain, the study population consisted of 500 emergency medical care files for trauma victims at the institution, corresponding to the mean number of cases attended each month.

To select the sample, the sample plan was used, based on the Proportionate Sampling process, due to the large number of research variables according to the ABCDE trauma Protocol.

The population was established as $N = 500$ and the confidence level of the sample was set at 95%, with a maximum error of 7%. In addition, the sample size was calculated for the total number of care files, including an additional of 20% in view of possible difficulties during the data collection; hence, $N = 100$ care files of trauma victims.

The assessment of the care process, considering the immobilization and emergency medical procedures, followed the actions recommended by the PHTLS program and the ABCDE trauma Protocol. The data were analyzed using descriptive statistics, in an electronic worksheet (Microsoft Office Excel®) and the results are presented as simple and absolute frequencies. The study was developed with institutional approval, obtained on 04/02/2014, and approval from the Research Ethics Committee (CAAE 25686313.2.0000.0095).

● RESULTS

Among the 100 victims admitted, individuals between 12 and 39 years of age were predominant, corresponding to 64% (64), with a predominance of male victims, totaling 69% (69) of men attended.

The results of the primary ABCDE survey result from the care provided when the trauma victims were admitted to the Emergency service, with the confidence interval (CI=95%). As illustrated in Table 1, the management of step A – airways and neck control, 99% (99) of the care observed guaranteed the airway permeability; nevertheless, this information corresponds to the larger number of conscious victims admitted to the emergency service during the study period and reflects in the percentage

of 99% (99) of non-application of oropharyngeal intubation. There was no indication of an advanced airway approach in 97% (97) of the victims; for 3% (03), despite the indication, the permeability was not guaranteed through a definitive airway.

As for the neck control in step A: 83% (83) of the victims were admitted on a long board. This high percentage should not be a synonym of accommodation though, in view of the absence of neck control in 17% (17) of the victims. Another goal of the cervical collar is protection. Eighty percent (80) of the trauma cases entered using the device, but 20% (20) were not. In the same context, the head was not fully immobilized using a lateral head immobilizer in 66% (66) of the cases. The body remained immobilized using fixation belts in only 31% (31) of the cases.

Table 1 – Distribution of care process observed regarding maintenance of step A – airways and neck control. N = 100. Curitiba, PR, Brazil, 2014

Management of step A	n (%)	CI= 95%
Was airway permeability guaranteed?		
Yes	99 (99)	(97; 100)
No	1 (1)	(0; 2.95)
Does not apply	0 (0)	(0; 0)
Did the victim receive an oropharyngeal tube?		
Yes	1(1)	(0; 2.95)
No	0 (0)	(0; 0)
Does not apply	99 (99)	(97; 100)
Was the advanced airway management technique indicated?		
Yes	3 (3)	(0; 6.3)
No	97 (97)	(93.6; 100.3)
Does not apply	0 (0)	(0; 0)
Admitted on a dorsal immobilization board?		
Yes	83 (83)	(75.6; 90.3)
No	17 (17)	(9.6; 24.3)
Does not apply	0 (0)	(0; 0)
Used a cervical collar?		
Yes	80 (80)	(72.1; 87.8)
No	20 (20)	(12.1; 27.8)
Does not apply	0 (0)	(0; 0)
Was the head immobilized so as not to permit any movement?		
Yes	34 (34)	(24.1; 43.2)
No	66 (66)	(56.7; 75.2)
Does not apply	0 (0)	(0; 0)
Was the body immobilized so as not to permit any movement?		
Yes	31 (31)	(24.7; 43.2)
No	69 (69)	(56.7; 75.2)
Does not apply	0 (0)	(0; 0)

The management of step B – Breathing, showed 92% (92) of victims with oxygen saturation over 95% (95). One victim with oxygen saturation under 95% (95) was admitted to the emergency service without supplemental oxygen though.

As regards the results identified in step – Circulation, 87% (87) of the victims observed did not need hemorrhage control. The victims with injuries corresponded to 47% (47), which were not protected in 15% (15) of the victims. The maintenance of two venous accesses of large diameter was not observed in 82% (82) of the traumas. Regarding the volume replacement, Ringer Lactate was the volume used in

16% (16) of the cases. Probable fractures were immobilized in 19% (19) of the cases.

During the care related to step D – Disability (neurological assessment), the Glasgow Coma Scale (GCS) was used in 100% (100), while pupil alterations were assessed in 89% (89). This information was obtained by observing the completion of the care forms by the emergency medical service or the transmission of this information to the fixed emergency service.

The management of step E – Exposure/Environment appointed that 63% (63) of the victims were not undressed in search of injuries and that 67% (67) of the patients were not kept warm using a thermal blanket.

● DISCUSSION

The analysis of this research was based on the perspective of the PHTLS protocol, which has qualified care for trauma victims in more than 60 countries since long. In addition, in Brazil, the Brazilian Trauma Care Society guides emergency medical care using the ABCDE trauma survey.

This study revealed that, in the care process, the trauma victims admitted to the Emergency service were predominantly male. This profile is similar to other studies that indicate male persons as the most frequent trauma victims^(1,13), a probable consequence of greater male exposure in traffic and of certain socioculturally determined behaviors, in which men take on situations of greater risk⁽¹³⁾. Concerning the age profile, the highest incidence was found in the age range from 12 to 39 years, partially opposed to other studies, which appoint a greater incidence of trauma victims between 20 and 39 years^(1,4,13). Based on this victim profile, the emergency care service can develop strategies aimed at standardized high-quality care.

The findings in this research show peculiarities in the victim care process, appointing the need for intervention. The assessment and initial care for trauma victims demand a systematic approach, through the five steps of the primary survey, characterized as the trauma ABCDE.

The first step (A) in the method is intended to guarantee the airway permeability through manual opening maneuvers, such as jaw thrust or chin lift, or using mechanical means: oropharyngeal tube, in unconscious patients due to the drop of the tongue, nasopharyngeal tube or endotracheal intubation. Patients with reduced consciousness level, or with a Glasgow Coma Scale (GCS) score of eight or less require a definitive airway⁽²⁾. In this step, neck control is indicated.

The investigation reveals that airway permeability was not guaranteed in one percent of the victims. In this reality, the emergency professionals should be capable of identifying the need for advanced intervention at the event site and promote basic life support means until support arrives, with a view to avoiding irreparable sequelae due to the hypoxia. After all, the loss of an airway kills faster than the loss of breathing capacity, which kills faster than the reduction of the circulating blood volume⁽¹⁴⁾.

And regarding the neck control, the emergency medical professionals need to recognize the risks related to the non-immobilization of the spine. Unstable neck injuries without neurological lesion, mainly in multiple trauma patients, entail a great potential of additional damage to the nervous structures during the patient rescue and transportation. Therefore, the victims should be immobilized in an aligned and neutral position, in order to prevent any spinal movement from resulting in bone marrow injury⁽¹⁵⁾.

In this context, the use of neck and thoracolumbar immobilization devices needs to be maintained, through a cervical collar, head immobilizers, fixation belts and a rigid board^(2,16). Some authors emphasize that diagnosing this type of injury is not a priority, but that protection is essential⁽¹⁶⁾.

Consequently, these devices should be maintained until fractures or spinal ligament lesions have been excluded⁽¹⁻²⁾. Transportation on a hard board is fundamental until clinical tests and x-rays have been done, if necessary. In the hospital context, the cervical collar of conscious and oriented victims without neck trauma, without pain upon palpation and passive mobilization, can be removed by the physician at the emergency room, without the need for additional x-rays⁽¹⁾.

In this research, the data observed are highlighted as a factor of concern in spinal control, as trauma victims admitted without a dorsal immobilization board totaled 17%, and without a cervical collar 20%; and, finally, the head and body were not fixed to avoid any movement in 66% and 69% of the cases, respectively.

As regards the maintenance of breathing, step B in the mnemonic method, one percent of the victims were admitted with saturation inferior to 95% without supplemental oxygen, in line with the recurring risks of hypoxia. Supplying oxygen to the tissues is one of the objectives of initial care, as any trauma patient should receive supplemental oxygen at 10L/minute using a mask with reservoir, in order to maintain the pulse oximetry superior to 95%⁽¹⁻²⁾.

The hypoxia results from the inappropriate ventilation of the lungs and lack of tissue oxygenation, causing carbon dioxide to accumulate in the organism, leading to acidosis and eventually death if appropriate treatment is not provided⁽²⁾. Therefore, the emergency medical professional should assess the breathing function and the victim's capacity to effectively maintain oxygenation.

Concerning step C in the mnemonic method, the data about hemorrhage control are satisfactory. Nevertheless, the aspects about the protection of lesions demonstrated that, in 15% of the cases observed, the lesions were unprotected. In addition, absence of two large-caliber venous access routes was found in 82% of the victims, the non-use of Ringer Lactate in 84% of volume replacements and 2% of non-immobilized probable fractures.

In the emergency medical context, reducing infections due to pathogenic microorganisms through the protection of injuries is fundamental. The main cause of late mortality in trauma victims inside hospitals is infection⁽¹⁷⁾.

In that perspective, the literature describes hemorrhage as the main cause of avoidable post-traumatic deaths, whose worsening causes varying degrees of coagulopathy, hypothermia, metabolic acidosis, as well as hypovolemia and consequently hypotension if the necessary blood pressure is not maintained⁽¹⁸⁾. Controlling external hemorrhage is a priority, through the use of direct compression or the direct use of tourniquets⁽²⁾.

Ringer Lactate is the preferred fluid to start volume replacement; immediately after its administration, the crystalloid fills the vascular territory depleted by the blood loss, improving the cardiac preload and output. Although Saline Solution is an acceptable alternative, hyponatremia may occur⁽¹⁻²⁾.

Nevertheless, this classical conduct is volume resuscitation, including the infusion of large fluid volumes, has been a source of controversy, in view of evidence that the conventional strategies may exacerbate the coagulopathy, bleeding, morbidity and mortality⁽¹⁸⁾.

Experimental studies show that the aggressive administration of crystalloids in case of uncontrolled hemorrhage promotes continuous bleeding and increased mortality. On the other hand, reducing the amount of fluids can lead to tissue hypoperfusion, organ failure and death, more than hemorrhage control. Maintaining a mean blood pressure between 60 and 80 mmHg is both advisable and appropriate in accordance to the literature⁽¹⁹⁾.

Concerning the large percentage of victims admitted to the Emergency service observed in this research without peripheral venous access, this can be related to the large number of cases executed by professionals (such as military firemen), who deliver basic life support, applying non-invasive actions in accordance with their legal responsibilities, in accordance with Ministry of Health Decree 2048 from 2002⁽²⁰⁾, which sets legal rules for mobile emergency medical services.

Trauma lesions result in temporary or permanent deficiencies and disabilities, which can compromise the capacity to perform daily activities and the quality of life. In those situations, frequent lesions include fractures, bruises and dislocations, demanding long periods of recovery with important economic and social costs⁽¹⁷⁾. Therefore, the emergency medical professionals are responsible for mobilizing probable fractures to avoid problems.

Concerning step D of the mnemonic method, neurological assessment was done in 100% of the cases through the application of the Glasgow Coma Scale and in 89% through assessment of the pupils. Both are fast and practical methods that can be used different times, favoring their application

and justifying the results. After all, characterizing the neurological response during care is essential to establish the victim's level of consciousness, through the application of the Glasgow Coma Scale and the pupil size, symmetry and reaction.

A decreased level of consciousness can represent the reduction of oxygenation or brain perfusion or result from direct cerebral trauma. There is an immediate need to reassess the ventilation, oxygenation and perfusion. In general, any change in the consciousness level should be considered a causal factor of a traumatic brain injury, except for alcohol and drugs use⁽²¹⁾.

As regards pupil alterations, these can be related not only to pathological conditions, but also to the use of alcohol and drugs and to altered psychological conditions⁽²¹⁾.

After the neurological assessment, step E in the mnemonic method should be assessed through the victim's exposure in an internal environment for the purpose of a physical examination. In this phase, hypothermia should also be controlled through the use of thermal blankets to minimize heat loss⁽¹⁹⁾.

Hypothermia interferes in different physiological functions, such as the baseline metabolism, oxygen and carbon dioxide transportation, concentrations of hydrogen ions in the blood, nervous, cardiovascular, respiratory, urinary and digestive systems and in the hematological, hydric, electrolyte and hormonal alterations⁽¹⁷⁾.

Finally, the risks need to be detected and controlled early to avoid irreparable damage as a consequence of the bone marrow lesions, hypoxia, hypovolemia, hypothermia and other problems deriving from inappropriate care, with a view to improving the trauma victims' prognosis.

Finally, the research limitations include the sample size, as the heterogeneity of the population (not foreseen before the results) causes a bias through sampling errors of more than 5%. Although limited, the research produced knowledge on a public health problem that is frequent in the care process for trauma victims. That is sufficient motivation for further research to contribute to improve emergency medical services.

● FINAL CONSIDERATIONS

The emergency medical professionals' constant handling of victims does not justify the exclusion of care in terms of correct attendance – on the opposite, the quality should be enhanced through daily practice. Therefore, the emergency medical services should be prepared for a wide range of emergency situations, and their practice should be based on theoretical knowledge.

The emergency trauma care services in this research should unify the care through the use of a universal language. The care should be executed based on a logical care sequence, focused on the victims' priorities.

This research also recommends the supply to inservice education and training to all stakeholders in the process, with a view to standardized conducts for correct actions, in line with the recommendations in the literature, programs and protocols.

Therefore, the use of the PHTLS principles and constant training provide support for the standardization of care in emergency medical services, so as to directly reflect on the quality of care delivery to the victim, through individualized, effective and safe care, minimizing sequelae and problems.

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