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Update on prehospital emergency care of severe trauma patients☆,☆☆

Les avancées en médecine d'urgence préhospitalière pour la prise en charge des traumatisés graves

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ABSTRACT

The prognosis of severe trauma patients is determined by the ability of a healthcare system to provide high intensity therapeutic treatment on the field and to transport patients as quickly as possible to the structure best suited to their condition. Direct admission to a specialized center ("trauma center") reduces the mortality of the most severe trauma at 30 days and one year. Triage in a non-specialized hospital is a major risk of loss of chance and should be avoided whenever possible. Medical dispatching plays a major role in determining patient care. The establishment of a hospital care network is an important issue that is not formalized enough in France. The initial triage of severe trauma patients must be improved to avoid taking patients to hospitals that are not equipped to take care of them. For this purpose, the MGAP score can predict severity and help decide where to transport the patient. However, it does not help predict the need for urgent resuscitation procedures. Hemodynamic management is central to the care of hemorrhagic shock and severe head trauma. Transport helicopter with a physician on board has an important role to allow direct admission to a specialized center in geographical areas that are difficult to access.

Mots clés :
Traumatismes graves
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Traumatisme crânien grave
Réseau

RÉSUMÉ

Le pronostic des traumatisés graves est déterminé par la capacité d'un système de soins à prodiguer une intensité de soins thérapeutiques élevée sur le terrain et à diriger le patient le plus rapidement possible vers la structure la mieux adaptée à son état. L'admission directe dans un centre spécialisé (*trauma center*) réduit la mortalité des traumatisés les plus graves à 30 jours et un an. Le relais par un hôpital non spécialisé est un risque majeur de perte de chance et doit être évité autant que possible. La régulation médicale joue un rôle majeur dans le parcours de soins du patient et la mise en place d'un réseau de soins hospitalier est un enjeu important, pas assez formalisé en France. Le triage initial des traumatisés graves doit être amélioré pour éviter d'adresser des patients dans des hôpitaux incapables de les prendre en charge. À cet effet, le score MGAP peut permettre de prédire la gravité et d'aider à orienter le patient. Toutefois, il ne permet pas de prédire la nécessité de réaliser des gestes de réanimation urgents. Le contrôle de l'hémodynamique est l'élément central de la prise en charge des chocs hémorragiques et des traumatismes crâniens graves. L'hélicoptère médicalisé a un rôle important pour permettre une admission directe en centre spécialisé dans des zones géographiques difficiles d'accès.

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1. Introduction

Severe trauma has historically been one of the causes of the creation of pre- and intra-hospital systems to reduce the risk of "avoidable deaths" [1]. The first studies in this area were related to Vietnam War injuries, where the nature of the injury, often penetrating and hemorrhagic, necessitated a quick and direct access to a surgical facility. This military experience has been, for a decade, challenged by the wars in Iraq and Afghanistan [2]. Between 2001 and 2011, the analysis by the US military of the death of 4596 injured military personnel showed that death occurred predominantly (87%) before the arrival in a medical–surgical structure, and that death was considered preventable in 25% of cases. Inadequate prehospital care of hemorrhagic shock and/or respiratory distress represented the two main situations leading to avoidable death in this study in which paramedics were involved. [2] In a civilian setting, regardless of the country, the majority of severe injuries is due to motor vehicle accidents (MVAs) or falls. These are blunt traumas, for which diagnostic and therapeutic management are complex and costly in technical and human resources [3]. Death due to blunt trauma, occurs more than half of the time immediately on the scene; in 25–30%, it occurs within 6 hours, and fewer than 20% of deaths are delayed beyond the seventh day following the trauma [3]. Immediate deaths are considered to be the responsibility of accident prevention, and the quality of the health care system will thus be judged on the outcome of the patients who survive immediately after the trauma. Preventable deaths following blunt trauma were estimated, in a civilian non-medicalized prehospital system, to account for 6% of recorded deaths [1]. In this study that analysed retrospectively over 2000 deaths, a judgment error in assessing the severity of the patient's condition, as well as a delay in the management of hemorrhagic shock and/or respiratory distress were the two main causes of avoidable death as well [1]. Inadequate hospital dispatch was a major risk factor of preventable death. The number of annual deaths due to severe trauma at the beginning of the twenty-first century was estimated to five million people under the age of 30, 90% of which lived in countries with a lower socio-economic level [4]. A reduction of the number of preventable deaths in the prehospital setting through better care and better dispatching could save 75,000 people per year worldwide. This has raised awareness to try to optimise the initial management of severe trauma.

2. Effectiveness of a prevention policy

Accident prevention is a major public health issue. The most obvious example is roadside safety. Wearing a seat belt or a helmet for motorcyclists and the adoption of speed limits have reduced the incidence of serious bodily injury in countries developed enough to have a public health policy. In the United States, the adoption in 29 states of measures to limit vehicle speed to 65 mph (104 km/h) is estimated to have saved 3000 lives per year and reduced the cost of care by at least $2 billion per year [5]. In that study, it is interesting to note that the overall cost of care for the treatment of trauma related to MVAs in the United States in 2000 was estimated at $231 billion. That estimate of direct costs did not include the cost of long-term potential disability or the number of years of life "productive to society" that were lost. A meta-analysis published in 2006 by the Cochrane group analyzed the effects of the introduction of a speed limit in 36 studies and confirmed a reduction of between 14 and 72% of the number of accidents, between 8 and 46% of the number of injuries and 45% of severe injury and death [6]. Prevention also involves the advice given by primary care physicians. In a cohort study in the United States, the advice given by a physician to his patient to no longer drive due to impaired health was shown to reduce by 45% the number of bodily injuries [7]. However, although patients had heeded the advice, a third of them also decided to change physicians, and they were more often depressed than those who did not "benefit" from that advice. Prevention has its limits when it comes to reducing access of potentially exposed populations to a given risk.

3. The "golden hour"

A study of more than 3000 blunt trauma patients in the United States suggested that mortality was not related to whether patients arrived at the hospital in over or under one hour [8]. In that study, however, the majority of patients arrived in less than 60 minutes. In a study by McDermott et al. [9] devoted to preventable deaths, direct admission to a specialized hospital reduced the risk of avoidable death by 25%, while 55% of patients arrived in specialized centers beyond 60 minutes after the trauma. The FIRST study analyzed the 30-day outcome of 2513 trauma patients cared for by mobile medical teams in France ("SMUR"). The mortality of patients admitted to the hospital within an hour and beyond one hour was 15% and 17%, respectively (no significant) [10]. In this study, the intensity of prehospital care was high: venous access was obtained in all patients, and general anesthesia with mechanical ventilation was used in more than half of the patients included. In the FIRST study, the comparison between 2513 severe trauma patients taken care of by medical teams (SMUR) and 190 serious trauma patients transported to the hospital by first-aid workers showed a significant reduction in mortality for patients attended to by a medical team on the scene (OR: 0.55, 95% CI: 0.32 to 0.94), despite the fact that the time for transport to the hospital was shorter with first-aid workers (58 min [IQR 38–92] vs 100 minutes [IQR 65–147] with SMUR; $P < 0.001$) [10]. Conversely, patients with penetrating and hemorrhagic trauma need to be transported as fast as possible to a suitable surgical center. In a North American study involving 180 patients over 5 years (2000–2005) who experienced one or more penetrating trauma injuries of the thorax and/or abdomen, the overall mortality was 85%, and rose to 95% if the time spent on the scene exceeded 20 minutes. In this study, survival was correlated with the ability to get the patient within 20 minutes of the injury to a specialized center capable of performing immediate salvage surgery [11]. If it is reasonable to assume that a patient requiring surgical hemostasis needs to be admitted to a hospital as soon as possible, severe traumatic brain injury (TBI) patients often need not so much a surgeon as a team capable of quickly initiating appropriate resuscitation. Studies on the management of TBI showed that the time of arrival at the hospital was less important than the quality of prehospital resuscitation. [12] Thus, the "golden hour" can be interpreted according to the type of trauma: arrival at the hospital as soon as possible for severe hemorrhagic lesions necessitating a full technical platform, or arrival on the scene as soon as possible of a prehospital resuscitation team able to initiate resuscitative measures. Dispatch to a hospital should be based on the type of hospital needed to treat the patient, even in cases where the specialized hospital is more distant than a local hospital.

4. Triage and direct admission to a trauma center

It has been shown that admission to a level 1 trauma center reduces mortality for the most severe trauma patients [13]. In a study by McKenzie et al. [13] that included 5587 trauma patients treated in 18 level 1 trauma centers, and 51 non-specialized hospitals in 14 states in the United States, mortality at 30 days was 7.5% vs 9.5% for non-specialized hospitals (RR 0.80, 95% CI: 0.66 to 0.98) and 10.4% vs 13.8% (RR 0.75, 95% CI: 0.60 to 0.95) at 1 year,