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Editorial

Prehospital care for multiple trauma patients in Germany

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A B S T R A C T

For the German speaking countries, Tscherne's definition of "polytrauma" which represents an injury of at least two body regions with one or a combination being life-threatening is still valid. The timely and adequate management including quick referral of the trauma patient into a designated trauma center may limit secondary injury and may thus improve outcomes already during the prehospital phase of care. The professional treatment of multiple injured trauma patients begins at the scene in the context of a well structured prehospital emergency medical system. The "Primary Survey" is performed by the emergency physician at the scene according to the Prehospital Trauma Life Support (PHTLS)-concept. The overall aim is to rapidly assess and treat life-threatening conditions even in the absence of patient history and diagnosis ("treat-first-what-kills-first"). If no immediate treatment is necessary, a "Secondary Survey" follows with careful and structured body examination and detailed assessment of the trauma mechanism. Massive and life-threatening states of hemorrhage should be addressed immediately even disregarding the ABCDE-scheme. Critical trauma patients should be referred without any delay ("work and go") to TR-DGU® certified trauma centers of the local trauma networks. Due to the difficult prehospital environment the number of quality studies in the field is low and, as consequence, the level of evidence for most recommendations is also low. Much information has been obtained from different care systems and the interchangeability of results is limited. The present article provides a synopsis of recommendations for early prehospital care for the severely injured based upon the 2011 updated multidisciplinary S3-Guideline "Polytrauma/Schwerstverletzten Behandlung", the most recently updated European Trauma guideline and the current PHTLS-algorithms including grades of recommendation whenever possible.

1. Introduction

The definition of "polytrauma" is still not uniform and a validation is lacking.[1] For the German speaking countries, Tscherne's definition of "polytrauma" which represents an injury of at least two body regions with one or a combination being life-threatening is still generally accepted. According to recent European consensus opinion both anatomical and physiological parameters should be included into such a definition and preliminary data suggest two injured body regions with an Abbreviated Injury Scale (AIS) >2 as opposed to the conventional definition according to the Injury Severity Score (ISS) with a cut-off ≥16, since such an injury may also reflect a monotrauma. In the search for appropriate physiological parameters descriptors of hypoxia and coagulopathy may represent potential candidates.

The major causes for polytrauma in Germany are traffic/vehicle accidents (56%) followed by accidents at work or freetime. According to data retrieved from the German Trauma Registry database (TraumaRegister DGU®), the vast majority of the victims are male (71%) with an average age of 46 years.[2] The mechanism of injury is commonly blunt (95%) and in 61% the primary injury is to the brain, in 60% to the thorax, in 53% to the extremities, in 34% to the spine, and in 20% to the pelvis (AIS ≥2 for the corresponding body region). Combined injuries involving both traumatic injuries to the periphery and to the brain are common with up to 50% of all cases.[3] The typical distribution of injuries in relation to the individual form of mobility are depicted in Fig. 1. The typical triggers that are highly suggestive for the presence of a polytrauma at the scene are summarized in Table 1.

Within the German Emergency Medical System (EMS), each polytrauma patient is seen and treated by a specialized trained emergency physician who is called to the scene by the dispatch center. The most important tasks and actions to be performed by the emergency physician at the scene are depicted in Table 2. In summary, all actions and apparently symptomatic measures apart from stabilizing the patient aim to control and

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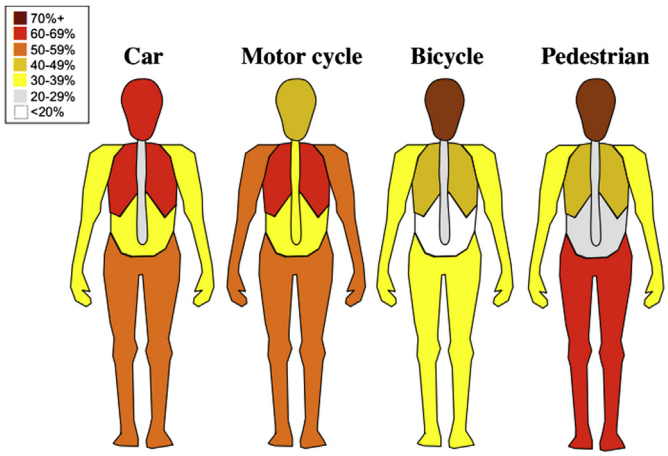

Fig. 1. Distribution of injuries (AIS $\geq$ 2) sustained as a function of mobility and the mode of transport used based upon data derived from the TR-DGU®. Patients with ISS $\geq$ 9.

Table 1
Tiggers suspicious for the presence of a polytrauma at the scene.

Items	Contents
Mechanism of injury	Pedestrian of motorcyclist hit by another vehicle
	High velocity motorcycle or motor vehicle accident
	Ejection out of vehicle
	Death of other vehicle occupant
	High fall
	Explosion injury
	Entrapment/Burying
Pattern of injury	Traumatic brain injury with loss of consciousness
	Instable and/or open thoracic injury
	Instable pelvic injury/fracture
	Proximal amputation injury
Vital signs	Glasgow Coma Score (GCS) <11
	Unconsciousness >5 min
	Cardiocirculatory instability
	Respiratory insufficiency

to reduce the degree and magnitude of secondary injury developing within the acute posttraumatic sequalae. The overall damage and the outcome after polytrauma is composed of the following:

1. the physical/mechanical and therefore irreversible primary injury;
2. the secondary injury which develops in the further sequalae and which is accesible to treatment;
3. the individual and biological host response to injury including immunocompetance (Fig. 2).

Timely and targeted management of the multiple injured trauma patient at the scene followed by an undisturbed and quick transport to an appropriate trauma center secured by the emergency physician and his EMS team may substantially limit the degree and magnitude of secondary injury and improve the outcome already during the prehospital phase of care. For example, single drops in blood pressure or brief episodes of hypoxia (also called the "lethal duo"), even when occurring with short duration, after the primary impact or within the later sequalae of treatment may substantially impair the outcome after traumatic brain injury.[5]

2. "Primary Survey" according to the Prehospital Trauma Life Support (PHTLS)-concept (ABCDE-Scheme) and life-saving measures

The professional treatment of severely injured patients is initiated in the context of a structured prehospital EMS at the scene. The primary assessment or the so-called "Primary Survey" is conducted by the emergency physician called to the scene according to the PHTLS[6]-concept. PHTLS is the prehospital equivalent to the Advanced Trauma Life Support (ATLS)-concept developed by the American College of Surgeons (ACS) back in 1980. Both concepts are characterized by clear and standardized algorithms on how to approach, prioritize and treat multiple injured patients. Deviations from treatment algorithms may be associated with preventable complications in 4%–5% of cases, and with preventable deaths in 2% of cases; not to mention the substantial time delay if not treated according to the algorithm! The most important challenge is related to the rapid and structured assessment of the patient and the detection and control of (potentially) life-threatening conditions according to the ABCDE-Scheme (Table 2). This is also performed in the absence of any knowledge about the patient's individual history and diagnosis according to the principle "Treat-first-what-kills-first"!

3. Extended assessment ("Secondary Survey")

In cases of less critical injury a second assessment in the sense of an extended basic "Secondary Survey" including careful physical examination and assessment of the injury mechanism is followed. The critical steps of this approach are summarized in Table 3. The examination should be performed from head-to-toe and should not take longer than 5 min. In many cases, the theoretical reconstruction of the accident mechanism may provide important information and clues in respect to the potential forces that may have been involved and injuries including the degree of potential contamination in cases of open injuries and may prevent from underestimating the trauma sustained. For example, the ACS has defined a fall from 6 m and more of height as being critical to be associated with major injuries. A major aspect in the context of the "Secondary Survey" is the assessment of the spine including associated functions (GoR A[7]). In comatous patients an injury to the spine should always be anticipated unless the contrary has been proven (GoR A[7]). In the absence of the following five criteria it may be assumed that no instable injury to the spine is present (GoR A[7]; sensitivity 95% and negative prediction 99.5%):

1. impaired consciousness;
2. neurological deficit;
3. spine pain or muscle spasm;
4. intoxication;
5. trauma to the extremities.

4. Time is important!

Time management is essential for successful trauma care! Already in the 1970's, Cowley observed a direct relationship between the time span from injury until care and treatment in the operation theatre and survival in severely injured trauma patients and termed the so-called "golden hour of shock".[8] Therefore, the time elapsed between the traumatic impact and referral of the patient to the operation theatre in cases of severe surgical hemorrhage should be minimized (R1: GRADE 1A[9]). Based upon data retrieved from the TraumaRegister DGU® the prehospital rescue