The relationship between scores and outcomes for polytrauma patients in the emergency department

A case study

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AIM: *Traumas are one of the most relevant pathological events in health care, because of clinical and prognostic relevance. Morbidity and mortality rates are strongly affected by the timely and correct approach to the patient (golden hour). The objective of this study was to investigate the possible influence of the diagnostic time and of the Injury Severity Score (ISS) on outcomes in trauma patients.*
MATERIAL OF STUDY: *Out of a total of 240,833 emergency patients, we observed, 447 polytrauma. All patients were assessed according to the Advanced Trauma Life Support (ATLS) guidelines, diagnosed by computed tomography (CT), and summarized using an adapted complex trauma card (italian version).*
RESULTS: *Overall, 2.5% (11/447) of patients died during the assessment, whereas the remaining 436 patients were diagnosed at the Emergency room and afterwards hospitalised. In 76 out of 436 patients (17.43%) the outcome was poor. Particularly, the most significant complications involved the central nervous system, chest and abdomen lesions respectively, with an ISS of 41.7 ± 15.9. The mean time for the diagnostic assessment in patients with poor outcome was 115.2 ± 0.4 minutes.*
DISCUSSION: *The immediate mortality percentage, as well as the delayed ones, was highest in patients involved in road accidents. The early management certainly plays a crucial role, reducing death rate and permanent disability.*
CONCLUSIONS: *The high percentage of patients affected by haemodynamic instability (24.3%) demonstrates the existence of a criticality identifiable in the approach to the patient during the pre-hospital phase: a phase that is dramatically characterised by the exclusion of intensivists from rescue teams.*

KEY WORDS: Complex Trauma Card, Mortality, Multiple injuries, Polytrauma, Scores

Introduction

Overall, trauma is the 5th cause of mortality and morbidity worldwide, being associated to a high incidence of disability [1-4]. It also represents one of the most relevant pathological events in health care, because of its clinical and prognostic relevance [2,5-7].
In Italy, about 10% of traumatic injuries cause a hospital admission [8-10]. Morbidity and mortality, often related to the cardiovascular instability and metabolic disorders which may trigger fatal illness such as Systemic Inflammatory Response Syndrome (SIRS), Acute Respiratory Distress Syndrome (ARDS) and Multiple Organ Failure (MOF), are heavily influenced by the correct approach to the patient (usually referred as 'golden hour') already from the trauma scene; indeed appropriate management can lead to a considerable reduction of avoidable deaths and permanent disabilities [10-14].
On the other hand, the prevention of complications depends on the prompt identification of early risk fac-

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tors [15,16]. Moreover, in the case of multiple traumas or polytrauma, the frequent presence of misdiagnosed or undetected abdominal injuries is associated with a negative outcome [17,18].

Anatomical evaluation systems such as the Abbreviated Injury Scale (AIS) and Injury Severity Score (ISS), physiological ones such as the Revised Trauma Score (RTS), as well as mixed ones such as the Trauma Injury Severity Score (TRISS) and Glasgow Coma Scale (GCS) do not allow to accurately assess the chances of survival or outcomes [19-23]. Similarly, virtuous models are poorly widespread in Italy. Such models attempt to mimic the American Trauma System (ATS) and have been able to reduce preventable deaths due to severe traumas [10,24-29]. However, nowadays, their diffusion is deeply influenced by problems involving the destination of funds to health systems [17,30].

In the last eight years, we observed and collected data on a broad number of patients that were all admitted for polytrauma in our Emergency Department (ED) in a large teaching Hospital serving a population of 300,000. Taking into consideration these data, the aim of this paper was to investigate the possible influence of the diagnostic time and of the ISS on the patient outcomes.

Material and Method

From January 2008 to December 2015, we collected data on patients who were treated at the ED in the University Hospital of Messina, Italy, for polytrauma.

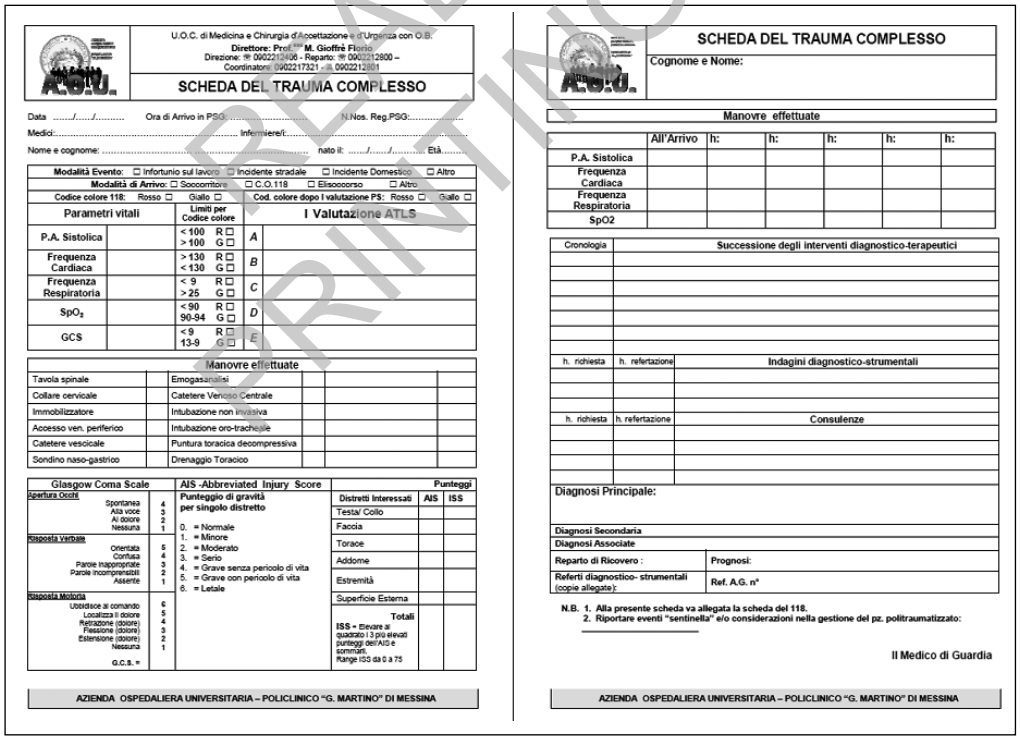
All patients were accepted in Shock Rooms, and were assessed according to our adapted Complex Trauma Card (Italian version) (Fig. 1). The Card is currently in use at the ED, and assesses traumas by combining the ISS, GCS and AIS. Whereas the ISS allows to qualitatively 'measure' traumas by relating the severity of the injury to the lesion of the organ and the affected area, the GCS is useful for brain injuries, and the AIS allows describing the threat to life in accordance to the trauma.

After arrival at the ED all patients were monitored with multi-graphic ECG and their condition re-assessed every 20 minutes. The focused assessment with sonography for trauma (FAST) was performed, followed by whole-body CT (for haemodynamically stable patients). Moreover, when necessary, targeted X-rays for bone segments were equally performed. Organ lesions were diagnosed and classified according to the American Association for the Surgery of Trauma (AAST) score. The approach followed the guidelines of the Advanced Trauma Life Support (ATLS), and we calculated the average time-lag between patient intake and his/her discharge to the appropriate hospital ward.

We also monitored the rate of mortality in the emergency room, as well as the outcomes in the different wards.

Furthermore, outcomes of admitted patients were studied in relation to time lag between intake and admission to relevant wards, and the ISS.

The guidelines for the management of polytrauma allowed us to intake and admit all patients under observation in a time that ranged from 20 minutes to 2 hours.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SCHEDA DEL TRAUMA COMPLESSO

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Fig. 1: Complex Trauma Card.

Results

From January 2008 to December 2015, among 240,833 accesses were observed in the ED, we prospectively studied the data collected on the 447 (0.19%) patients affected by polytrauma.

Males more commonly presented than females (295M/152F, 66%M/34%F). Average age was 57 ± 19 (range: 13-99 years). The causes of polytrauma were: road traffic accidents in 76.5% of cases (342 patients), other causes (i.e. falls, physical violence, etc.): 17% (76 patients), and workplace injuries: 6.5% (29 patients) (Fig. 2).

Moreover, 16% of all patients (72/447) was affected by abdominal injuries (i.e. spleen, liver, kidney traumas). In 45 cases these injuries were associated in 52 cases with chest trauma, while in 68 cases with fractures of long bones and/or pelvis (all of them in multiple contusions).

Among patients, 2.5% (11/447) died during the assessment - just few minutes after arriving at the emergency room, because of the serious conditions of their multiple injuries (2 cervical lesions; 2 breakthroughs of pelvis; 5 cranium, thoracic and abdominal traumas; 1 abdominal trauma; 1 cardiac tamponade).

In addition, among the 436 patients that were treated in the ED, 25% (109/436) suffered from SIRS, 24.3% (106/436) suffered haemodynamic instability (heart frequency >100 bpm, systolic blood pressure <90 mm Hg), and 9,4% (41/436) had a GCS <9.

The ISS average of all treated patients was 20 ± 12.5, the RTS was 7.3 ± 1.0, and the TRISS was 99.4 ± 15.8.

Patients were hospitalised in various ward: 25% (109/436) in Orthopaedics, 18% (79/436) in the Intensive Care Unit (ICU), 17% (74/436) in Surgery, 16% (70/436) in Thoracic Surgery, 12% (52/436) in Neurosurgery, 5% (22/436) in Vascular Surgery, 4% (17/436) in Maxillofacial Surgery, and 3% (13/436) in Plastic Surgery (Fig. 3).

We also observed 3 amputations of limbs and an impalement of the neck.

In 76 of the 436 cases (17.43%) the outcome was unfavourable (death) within 5 to 21 days. Amongst these deaths 3 occurred at Thoracic Surgery, 4 at Neurosurgery, 4 at Surgery, 4 at Vascular Surgery and 61 at ICU. The main cause of adverse outcomes in ICU was the complications occurred in complex traumas. Particularly, this occurred when the complications involved three body regions (central nervous system lesions and/or spinal cord, chest and abdomen: ISS 41.66 ± 15.89).

Furthermore, the average time-lag from arrival at the emergency room to hospitalisation was 120.31 ± 0.37 min. The average time time-lag form diagnostic assessments to death was 115.20 ± 0.40 min. Observing immediate deaths, as well as remote ones, the highest percentage was, recorded amongst patients that were involved in road traffic accidents.

The time spent to reach diagnosis was not significantly associated with outcome, this was the average length of time from patient intake in the emergency room to their admission in the appropriate ward. Conversely, the ISS score was associated with poor outcome (p<005).

Finally, more males had adverse outcomes compares to females (66%M *vs* 34%F)

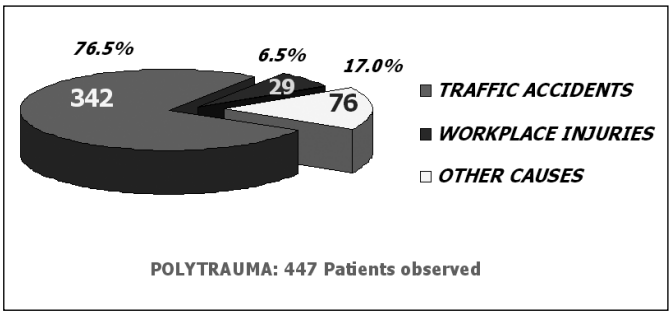

Fig. 2: Causes of multiple traumas.

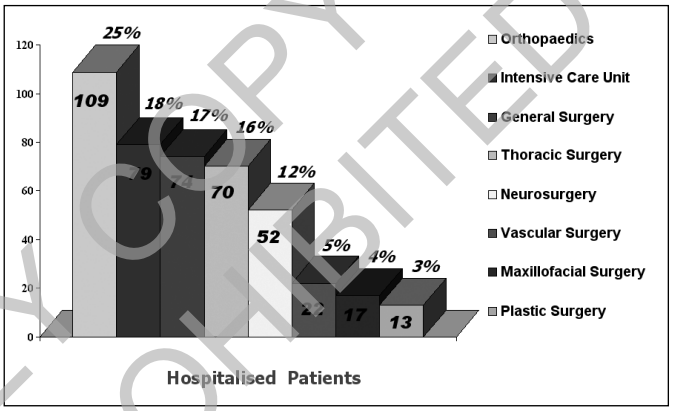

Fig. 3: Hospitalised patients.

Discussion and Comments

Since the publication of ATLS guidelines, enormous efforts have been made to progress the quality of care in case of polytrauma. Such developments involve the assistance to patients, aiming to broadly improve outcomes, and, more in detail, to reduce mortality and morbidity. Currently, the University Hospital of Messina provides a 2nd level ED, where most of the traumatic pathologies occurring in the province of Messina are centralised. In fact, in the Northeast of Sicily, the ED at University Hospital of Messina is the hub for traumatic injuries and major traumas, serving a population of 300,000.

In the ED a 'Trauma Team' is currently running. The emergency physician and consultants, who come from other university departments (i.e. Neurosurgery, Vascular Surgery, Maxillofacial Surgery, etc.), are part of this team. Such a collective structure guarantees to provide the skills

that are necessary for the specific emergency. In the team, the emergency physician is responsible of hospital admissions, even though the final decision follows a process that is shared amongst the whole specialists.
To begin with the earliest stages of the event, the appropriate approach plays a crucial role, reducing cases of death and permanent disability [3,31-33]. However, the care and the fast management of the patient have a relevant impact too. In fact, according to specific protocols, such treatment allows to manage cases where vital functions are compromised – particularly in the case of polytraumas, which are managed in a short time and following appropriate methodologies.
For these reasons, we decided to attribute more relevance to scores – which are applied for ATLS evaluation – relating these to the Complex Trauma Card (Italian version). In addition, we established some procedures for the management of patients. These procedures aim to allow faster stabilisations and diagnostics. Following this line of intervention, the concept of 'Golden Hour' is applied beyond the strict management of the patient, broadening it to involve the stabilisation, diagnosis and recovery in the appropriate ward.
Conventionally, the diagnostic-therapeutic approach in the shock room is marked by specific procedures. Amongst these, there are, for instance, the possibility to perform CT and angiography in the same place, the application of surgical protocols of Damage Control, as well as the early use of modulators and pro-coagulants. However, even though this approach can guarantee more virtuous immediate results, we suggest it is key to deepen the understanding of the post-traumatic, physiopathological aspects.
These aspects are, in fact, characterised by an altered metabolic state as well as by the activation of the immune system. According to Taylor, such conditions have a positive role in the first phase of the traumatic event, although they can induce to undesirable effects in a second time [24,34-36].
Therefore, in the various phases of the management of polytrauma, it is crucial to intervene by following appropriate therapeutic strategies: an intervention that is useful to control the evolution of the whole post-traumatic period. Moreover, together with the control of oxygenation and shock state, such intervention permits the metabolic monitoring (already from early stages), observing the progression of metabolism in the post-traumatic period – a period that is well known for late deaths. According to the collected data, the model we pursue can be defined as being a virtuous one. This is demonstrated by the rate of mortality in the period of observation. In our ED, deaths were 2.5%, mostly involving males, aged < 40 years, who suffered from road traffic accidents and were haemodynamically unstable.
Orthopaedics was the most frequent ward for admissions (25%), and it was followed by ICU (18%), where the highest number of deaths was observed (61/76). Undoubtedly, these percentages are due to the survival of patients from the acute-phase. In fact, these are very often the patients with particularly serious injuries, whose condition worsens during stays in the Intensive Care Unit.
Amongst the patients who suffered from abdominal trauma, 15 were treated conservatively. They were affected by: Grade-I Lesions (8), Grade-II (5) and Grade-III (2). Because of improved outcomes following these conservative treatments, we increased the application of the method at ED.

Conclusions

In conclusion, the high percentage of patients affected by haemodynamic instability (24.3%, 106 cases on 436 patients) demonstrates the existence of a critical point. This critical point needs to be identified in the approach to the patient during the pre-hospital phase: a phase that is dramatically characterised by the exclusion of intensivists from rescue teams.

Riassunto

Obiettivo: Il Trauma rappresenta uno dei più importanti eventi patologici in sanità, in termini di rilevanza clinica e prognostica. I tassi di morbilità e mortalità sono fortemente influenzati dal pronto e corretto approccio al paziente (golden hour). Obiettivo di questo lavoro è stato analizzare la possibile influenza del tempo impiegato per la diagnosi e dell'ISS (Injury Severity Score) sull'outcome di questi pazienti.
Materiali e Metodi: Abbiamo osservato, su un totale di 240.833 pazienti in emergenza, 447 (0,19%) politraumi. Tutti i pazienti sono stati valutati secondo le linee guida dell'Advanced Trauma Life Support (ATLS), diagnosticati mediante la tomografia computerizzata (TC), ed i dati riassunti usando la versione italiana di una Scheda del Trauma Complesso. In totale, il 2,5% (11/447) dei pazienti è morto durante tale valutazione, mentre i 436 pazienti restanti sono stati diagnosticati presso l'unità di emergenza e successivamente ospedalizzati.
Risultati: In 76 su 436 pazienti (17,43%) l'esito è stato sfavorevole. In particolare, le complicazioni più significative hanno coinvolto il sistema nervoso centrale (SNC), il torace e l'addome, rispettivamente, con un ISS di 41.66 ± 15.89. Il tempo medio utilizzato per la valutazioni diagnostiche nei pazienti con outcome sfavorevole è stato 115.20 ± 0,40 min.
Discussione: La percentuale di mortalità immediate, cosi come di quella a distanza, è stata registrata più alta tra i pazienti coinvolti in incidenti stradali. Una gestione precoce gioca certamente un ruolo cruciale nella riduzione del tasso di mortalità e di disabilità permanente.

CONCLUSIONI: L'alta percentuale di pazienti affetti da instabilità emodinamica (24,3%), dimostra l'esistenza di una criticità identificabile nell'approccio al paziente durante la fase pre-ospedaliera: una fase che è drammaticamente caratterizza dall'esclusione quasi totale dei rianimatori dalle squadre di soccorso.

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