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GOLDEN HOUR AND THE MANAGEMENT OF POLYTRAUMA. THE EXPERIENCE OF SALENTO'S UP-AND-COMING TRAUMA CENTER.

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ABSTRACT

The "Golden Hour" is the 60 minutes immediately post-trauma within which time the survival rate is much higher if patients are able to reach definitive care for treament of their injuires. The organization of a traumatological network for an up-and-coming trauma center is very complex, has a very long implementation curve, and very often the international flow charts must be changed and adapted to match the local reality. The aim of this paper is to analyze the types of trauma, the probability of death, and the outcomes and complications of polytrauma patients who received treatment at the Vito Fazzi Hospital in Lecce between 2017 and 2018. Selecting from a total of nearly 150,000 entries into our emergency department, 56 polytrauma patients were chosen for enrollment in this study. All fractures were treated according to the ATLS principles. The criteria used to evaluate this group of patients was: the number of injuries, the average Injury Severity Score upon admission and discharge from the emergency department (ED), the averange Glasgow Coma Scale upon admission and discharge from the ED, the duration of stay (in hours) in the ED, the index of death at admission to the ED and upon discharge from the shock room based on SAPS III scores, mortality within 1 month post-trauma, whether or not patients underwent surgery, patients needing damage control, patients not treated with urgency, the number of angioembolizations, and the average stay of patients in the resuscitation unit. Males were more than three times likely to be affected with respect to women. Most patients were employed primarily in the industrial sector, however, the top cause of trauma was traffic accidents. On average, the patient was in the emergency room about 4.64 hours. 291 were lesions associated with the patient's polytrauma condition. All patients' scores improved in three subgroups of four with $p<0.05$. The average hospitalization days in the intesive care unit for the patients was 15.3 days. The three most common complications at the time of discharge from the resuscitation unit were, in order: mental disorders, urinary tract infections, and chest complications. The presence of an organized polytrauma team and a well-defined standard operating procedure could be a better way of managing patients with polytrauma efficiently and effectively.

1. Introduction

The "Golden Hour" is the 60 minutes immediately post-trauma within which time the survival rate is much higher if patients are able to reach definitive care for treament of their injuires. The organization of a traumatological network for an up-and-coming trauma center is very complex, has a very long implementation curve, and very often the international flow charts must be changed and adapted to match the local reality [1-14]. The aim of this paper is to analyze the types of trauma, the probability of death, and the outcomes and complications of polytrauma patients who received treatment at the Vito Fazzi Hospital in Lecce between 2017 and 2018. Selecting from a total of nearly 150,000 entries into our emergency department, 56 polytrauma patients were chosen for enrollment in this study.

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2. Methods

Choosing from a total of nearly 150,000 entries into our emergency department, out of 210 polytrauma cases, we selected 56 patients utilizing the following inclusion criteria: their mean Injury Severity Score [15] value ranged from 4 to 75; injury to one body cavity (head/thorax/abdomen) plus two long bone and/or pelvic fractures or injury to two body cavities; injuries of at least two long bone fractures or one life-threatening injury and at least one additional injury, or severe head trauma and at least one additional injury; AIS [16] ≥ 3 in at least two body regions, one out of five physiologic parameters; and hypotension (systolic blood pressure ≤ 90 mmHg). The exclusion criteria were patients not meeting the inclusion criteria.

All fractures were treated according the ATLS principles [17]. Patients were treated according to the ethical standards of the Helsinki Declaration. The criteria used to evaluate this patient group were: the number of injuries; the average Injury Severity Score [15] upon admission and discharge from the emergency department; the averange Glasgow Coma Scale [18] upon admission and discharge from the emergency department; the duration of stay (in hours) in the emergency department; index of death upon admission to the emergency department and being discharged from the shock room based upon the SAPS III scores [19]; mortality within 1 month post-trauma; patients who underwent surgery, damage control, and/or patients who were not treated with urgency; the number of angioembolizations; and the average stay of patients in the resuscitation unit. Descriptive statistics were used to summarize the characteristics of the study group and subgroups, including means and standard deviations of all continuous variables. The t-test was used to compare continuous outcomes. The Chi-square test or Fisher's exact test (in subgroups smaller than 10 patients) were used to compare categorical variables. The statistical significance was defined as $P < 0.05$.

3. Results

The average age of patients was 42.6 years (±13.67; range 16-92). Males were three times more likely to be affected than women. Patients were mainly employed in the industrial sector, but the principle cause of trauma was traffic accidents (Table 1). On average, patients were in the emergency room about 4.64 hours (±1.34, range 2-8) to complete all primary investigations before receiving surgical treatment or being admitted to the intensive care unit.

Study sample	56
Average Age (±SD)	42.6(±13.67)
Age range	16-92
Gender Ratio (M:F)	3.66:1(44:12)
Age classes	16-35: 11 (19.6%) 36-50: 15 (26.8%) 51-59: 12 (21.4%) 60-65: 10 (17.9%) 70-85: 6 (10.7%) >85: 2 (3.6%)
Working activity, n (%)	Agricultural Activity: 14 (25%) Industrial Sector: 18 (32.14%) Tertiary Industry: 12 (21.43%) Not Working: 10 (17.86%) Student: 10 (17.86%)
Type of Accident, n (%)	Fall From Height: 10 (17.86%) Traffic Accident: 18 (32.14%) Work Accident: 15 (26.8%) Hobby Accident: 7 (12.5%) Bid to Kill Theirselves: 4 (7.15%) Shooting: 2 (3.6%)
Average Injury Severity Score (ISS) in points, (±SD; range)	36.7 (±12.73;4-75)
Average Glasgow Coma Score (GCS) in points; (SD; range)	10.4 (±3.4; 3-15)
Average SAPS 3 in % at entrance in emergency department; (SD; range)	69.3% (±18.9; 10.1%-96.4%)

Table 1. Description of the study population

291 patients suffered lesions associated with their polytrauma condition. The most common lesion, in addition to fractures, was brain concussion and hemopneumothorax (Table 2). The ratio of patient lesions was 5.19 (Table 2). In 42 cases (75%), patients underwent damage control after a primary stabilization; in 12 cases (21.43%) patients reported emobilization; in 10 (17.86%) cases and finally in 4 cases (7.14%), patients had not been treated for their precarious clinical conditions.

Upon admission to the emergency department, the average ISS was 36.7 (±12.7; 4-75) and at discharge it was the same, p=1. Afterwards, for damage control it was 28.3 (±6.6; 0-55), $p<0.05$ for damage control; the embolization was 30.6 (±9.9; 2-60), $p<0.05$ for embolization. For definitive surgery, it was 14.2 (±1.3; 0-15), $p<0.05$ for definitive surgery.

The worst results were for non-operated patients because at discharge the average was 42.9 (±8.6; 12-75), p<0.05 for non-operated.
The average GCS was 10.4 (±3.45; 3-15) with no change at discharge or in the subgroups. Average SAPS 3 in % upon admission to the ED was 69.3% (±18.9; 10.11%-96.4%) and at discharge 65.6% (±16.3; 10.11%-82.14%), p>0.05. Afterwards, for damage control it was 42.3% (±8.6; 2-72), p<0.05 for damage control; the embolization was 56.2 (±9.9; 22-84), p<0.05 for embolization. The definitive surgery was 22.2% (±6.5;0-42), p<0.05 for definitive surgery. The worst results were for non-operated patients at discharge who were 84.3 (±14.6; 80 - 96.9), p<0.05 for non-operated.
The average hospitalization days in the intesive care unit for the patients was 15.3 days (±5.4; range 4-42).

Injuries associated with the floating knee, n (%)	**Cerebral Concussion:24 (19.6%) Fat Embolism:4 (3.6%) Important Vessel Broken: 10 (17.9%) Peripheral Nervous System: 14 (25%) Hemopneumothorax:15 (26.8%) Liver Injuries:6 (10.7%) Spleen Injuries:5 (8.9%) Bowel Injuries:2 (3.6%) Femur Injuries: 16 (12.5%) Tibia Injuries:18 (19.64%) Rib Fractures:30 (53.57%) Clavicle Fractures:19 (33.92%) Humerus Fractures:6 (10.71%) Forearm Fractures:10 (17.86%) Wrist: 7 (12.5%) Hand: 7 (12.5%) Ankle: 7 (12.5%) Foot: 16 (28.6%) Patella Fractures:23 (41.1%) Pelvic Injury: 12 (21.4%) Acetabulum Fractures: 16 (16.1%) Spine Fractures: 24 (42.8%)**
Total Associated Injuries	**291**
Injuries Patients ratio (I:P)	**5.19:1**
Type of Treatment after the ATLS	**Embolization: 12 (21.4%) Damage Control: 42 (75%) Definitive surgery:10 (17.9%) Not Surgery: 4 (7.1%)**

Table 2. Description of associated injures and treatment steps.

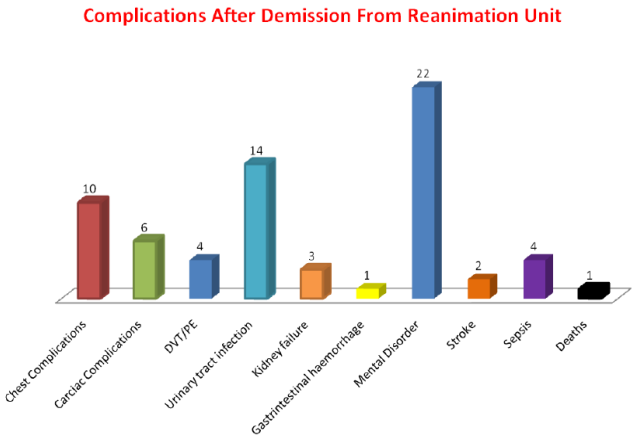

Figure 1. Reduction in SF2/ASF pattern score due to c.492+46 G>A variant.

The three most common complications (Figure 1) were at discharge from the resuscitation unit, in order: mental disorder, urinary tract infection, and chest complications.

4. Discussion

According to data from the WHO and the Center for Disease Control and Prevention, more than nine people die every minute following a traumatic event and every year 5,800,000 individuals of all ages and social classes die from intentional or non-intentional lesions. Traumatic injuries represent 12% of all diseases worldwide [20].
Road accidents cause more than one million deaths worldwide each year, between 20 and 50 million significant injuries, and are the leading cause of trauma death. The development of prevention systems for traumatic events is having a positive impact in more developed countries, even if trauma continues to be the leading cause of death in all age groups between 1 and 44 years old [20].
In our study, the polytrauma caused by traffic accidents represent the most frequent source of trama (32.14% type of accident). Global trauma-related costs exceed 500 billion dollars per year, and they are even higher considering lost earnings, medical expenses, insurance costs, property damage, costs to the employer, and indirect losses due to work-related injuries. To understand the actual economic impact, it is necessary to consider that trauma affects the younger and potentially more productive subjects of society. In line with this data, the age range of polytraumatized patients in our study is from 16 to 50 years of age, represents 46.43% of the population, and 78.6% of them are workers [21].
First described in 1982, the trimodal distribution of trauma mortality predicts that deaths should be concentrated in three periods of time or peaks. The first peak occurs within a few minutes of the traumatic event. At this early stage, death can be caused by apnea due to severe brain or spinal cord injury at the level of the first cervical vertebrae or a rupture of the heart, aorta or other large vessels. The extreme severity of these injuries makes it possible to save only a very few patients. Only prevention can reduce this peak mortality. The second peak occurs within a few minutes to a few hours after the trauma. The deaths that occur in this period are mainly due to subdural or epidural hematoma, haemopneumothorax, rupture of the spleen or liver, fractures of the pelvis or other multiple lesions, associated with significant blood loss [22].
The golden hour following a traumatic event is characterized by the need for rapid assessment and immediate resuscitation treatment, which represent the fundamental principles of ATLS. According to our experience, the treatments implemented after the ATLS were: embolization in 21,43% of cases; damage control in 75% of cases; definitive surgery in 17.86% of cases; and no surgery in 7.14% of cases..
The third peak, which manifests itself starting from a few days up until a few weeks after the initial injury, is mainly determined by sepsis and multi-organ failure [22].
The temporal distribution of mortality reflects the resources used and the processes implemented by the various Trauma Centers. Interpretation of the data suggest that the time spent in the emergency room to perform all investigazionis too long. Treatment of polytrauma involves different specialists.
Culture can also influence the success or failure of organizational outcomes.

Staff development include team training, team management, interprofessional and interdepartmental team work, conflict resolution, communication strategies, and leadership development. Researchers have found formal Emergency Department teamwork training to be an effective method to improve team behaviors and communication, reduce errors, and improve staff attitudes which results in improved patient safety and outcomes [2]. Our study is limited by the fact that there is no pediatric population to evaluate. The adolescent-young adult group is significantly represented. To reduce the effect of trauma in this age group, it is essential to determine optimal treatment strategies.

Since adolescents straddle the gap between pediatric and adult medicine, identifying differences in care among Pediatric Trauma Centers, Adult Trauma Centers, and Mixed Trauma Centers will help determine the most appropriate triage strategies or identify practice strategies that can optimize the outcome for patients in this age group [23,24]. Another limitation is the lack of out-of-hospital mortality rates and data. Cities that were less geographically isolated with more concentrated trauma centers in their surrounding region have lower total and out-of-hospital mortality rates [25].

Appropriate and timely treatment can significantly improve the prognosis of traumatized patients [26 - 34].

5. Conclusions

In conclusion, most of the patients with polytrauma admitted to the ED during the study period were in the younger age group in this study.

Males were significantly more affected than females, and road traffic accidents were the predominating etiological factor followed by falls. The Emergency department needs many specialists on-site, and need to build an operative Trauma Team. Most of the patients had serious problems and were delayed in receiving their needed definitive treatment. Damage control is the better surgical treatment for life rescue. Most patients with polytrauma, at any stage, probably need a lot of specialists whose coordination requires leadership. Problems were faced at various steps at an up-and-coming Trauma Center. The majority of problems were faced when patients needed a rapid treatment by an emergency medical doctor or a diagnostic test from the Radiography Depart. One way to improve upon this problem would be to have a dedicated Radiographic Unit exclusively for the Emergency Department.

An organized polytrauma team and a well-defined standard operating procedure could be a better way to manage patients with polytrauma efficiently and effectively.

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