


Evaluation of the primary medical treatments based on the advanced trauma life support principles in trauma patients

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Abstract

Objective: In Iran, road traffic accidents were responsible for 14716 deaths in 2015. This study aimed to compare the initial resuscitation of traumatically injured patients to the internationally recognized ATLS standards.

Materials and methods: As a cross-sectional study, 506 traumatically injured patients who were referred to the tertiary referral major trauma center in Poursina Hospital during the study period, were evaluated. All therapeutic interventions were compared to the ATLS standards. Data on mortality by demographic was compared to those in whom the ATLS standards were met and in those whom it was not met

Results: Mean age of the patients was 37.37 ± 19.72 and motorcycle was the most common cause of accidents (40.9%). ATLS guideline interventions were completely performed in 18.2% of the patients in their primary hospital, and in rest of 414 cases (81.8%), ATLS algorithms were not fully carried out. The mortality rate was significantly higher in the second group: 10.86% vs 32.36%, respectively.

Conclusion: Application of ATLS principles in multiple trauma patients can reduce the mortality rate.

Keywords

Trauma, emergency, ATLS

Introduction

Trauma is always a social, economic, and medical problem which is not only a major cause of death but also leads to high societal costs because of long-term medical care. Trauma is the most common cause of death in the first four decades of life and motor vehicle accidents play the most common role and account for about 26% of deaths from accidents.¹ In Iran, injuries are the main causes of death among 15 – 49-year-olds in both sexes² and almost 15,000 deaths occurred in Iran because of road accidents in 2015.³

This situation is getting worse and, according to forecasts by the World Health Organization (WHO) in 2020, trauma caused by motor vehicle accidents will be the second leading cause of years loss of life around the world, including Iran.^{4,5} The nature of the problem and its enormous costs for the country's economic systems on the one hand and its recognition as the leader of disability and handicap in the society, on the other hand, end up in great strategies by policymakers and health

practitioners in different countries. Based on these strategies, trauma systems were developed and focused based on their activities on the prevention of trauma and comprehensive care for trauma patients.⁶

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The trauma system provides a wide range of prevention facilities, access to pre-hospital care, rehabilitation, and research activities for the optimal and cost-effective care of victims, regardless of the severity of the damage, anytime and anywhere. Trauma systems have proved their advantages in different countries by reducing avoidable deaths and improving the outcome of patients with severe injuries and reducing the socio-economic burden of trauma.

Scene mortality due to injury is prevalent (50%) and is usually due to spinal cord injury, aortic rupture, and bleeding into the abdominal cavity, for which immediate treatment is not possible. So, to save these lives, trauma prevention assumes greater importance. Trauma centers and trauma systems are the second step, which affects 30% of trauma deaths caused by reasons such as severe brain damage and uncontrollable bleeding. It has been shown that using trauma systems and trauma centers reduces the mortality rate from 30% to 9%.⁷ Evidence suggests that using a structured approach to trauma management like Advanced Trauma Life Support (ATLS) significantly improves the knowledge of participants managing multiple trauma patients, their clinical skills, and their organization and priority approaches.⁸

In level 1 trauma centers, a 24-hour access to specialist medical and nursing care is available which may include different specialties such as emergency medicine, trauma surgery, neurosurgery, orthopedic surgery, critical care and anesthesiology, and radiology, and a wide range of specialized and advanced diagnostic and surgical equipment is present. Lower levels of trauma centers can only provide initial evaluation, stabilization, and diagnostic capabilities of traumatic patients and prepare them for transfer to higher levels of trauma care. Implementing ATLS protocols is one of the key elements of lower Levels of trauma centers⁹

Due to the high frequency of the damage caused by trauma in the Guilan province, it is important to evaluate how the principles of ATLS for initial stabilization and safe inter-hospital transfer are performed for these patients. Therefore, in this study, which was conducted for the first time in the country, we decided to check how trauma patients are referred from health centers with lower levels to the Level 1 trauma center. This study aims to identify factors increasing the mortality rate in these patients and to understand whether the application of complete or incomplete ATLS principles can save lives in these patients.

Material and methods

This cross-sectional study consisted of patients with multiple traumas due to accidents or other incidents referred to the emergency department of Poursina

hospital from other primary hospitals after performing primary lifesaving interventions according to ATLS algorithms. Poursina Hospital is the referral level I trauma center in Guilan province in the north of Iran; Guilan is about 14,000 km² in area with a population of approximately 2.5 million.¹⁰ There are six levels II to V trauma centers that transfer their trauma patients to the Poursina hospital over a range of distance of about 5–70 km.

Arriving at Poursina hospital, all the patients were admitted to an emergency department and fully evaluated by emergency medicine specialists or residents based on the severity of the initial injury, level of consciousness, and hemodynamic status. After initial assessments, checklists of gender, age, cause of the trauma, patient's vital signs, and Glasgow Coma Scale (GCS) were filled. Using a standard checklist, all aspects of ATLS protocol that could have done before the patient transfer, were evaluated. All necessary therapeutic interventions including peripheral IV line and adequate hydration, cervical collar fixation, tracheal intubation, and mechanical ventilation, and splinting the extremities were assessed and enacted if found deficient.

At the end of the treatment, additional information such as duration of hospital admission and outcome at discharge (survived/deceased) was also recorded. The data was analyzed by statistical software SPSS Version 19 using student T-test and chi-square test; $p < 0.05$ was considered significant.

Results

The study population was 506 traumatic patients referred to the Poursina hospital emergency department from August 2013 for one year. The majority of patients were male (424, 83.8%) with an overall mean age of 37.4 ± 19.7 years (range: 1-95 years). The most frequent cause of trauma was motorcycle accident in 207 patients (40.9%) and the least common was a fight in 16 patients (3.2%) (Table 1).

According to observations, the average hospital length of stay was 7.9 ± 7.5 with the range of 1-50 days; the severity of the brain injury determined by the level of consciousness using GCS scale was categorized into low GCS (<8) medium level (9-12) and high level (>13) which was reported in 166 patients (32.8%), 132 patients (26.1%) and 206 patients (40.7%), respectively. Observed GCS in Poursina hospital was reported as low in 182 patients (35.96%), medium in 144 patients (28.45%), and high in 178 patients (35.17%). Vital sign changes before and after the referral are shown in Table 2.

ATLS interventions consisting of endotracheal intubation, mechanical ventilation, cervical fixation with

collar, two large-bore IV lines, control of active bleeding, and splinting were evaluated and it was recorded that any or all of the measures were done before admission (Table 3).

Table 1. Demographic data of referred trauma patients (n = 506).

Age	N	%
<10	29	5.7
11–20	82	16.2
21–30	121	23.9
31–40	67	13.2
41–50	81	16.0
51–60	52	10.3
61–70	35	6.9
>70 y	39	7.7
Cause of trauma		
Car accident	131	25.9
Motorcycle	207	40.9
Passenger	82	16.2
Drop	70	13.8
Fight	16	3.2
Gender		
Female	82	16.2
Male	424	83.8

Table 2. Vital sign changes before and after referral.

Vital signs	After referral				Before referral			
	DBP	SBP	HR	RR	DBP	SBP	HR	RR
N	454	488	504	463	415	422	411	393
Mean	71.5	113.5	95.8	21.9	72.7	116.9	92.2	20.7
Std. deviation	16.6	29.7	22.8	5.5	10.5	20.4	15.3	4.7
Minimum	10.0	40.0	8.0	8.0	40.0	60.0	30.0	8.0
Maximum	120.0	240.0	180.0	80.0	120.0	240.0	160.0	60.0

DBP: diastolic blood pressure; SBP: systolic blood pressure; HR: heart rate; RR: respiratory rate.

Of all the patients, the ATLS process was completed in 92 patients (18.2%) and incomplete in 414 patients (81.8%). The mortality rate was 10.86% in patients with complete ATLS procedures and 32.36% among patients with incomplete procedures. The commonest required interventions were two large bore IV cannulas (100%) and collar fixation (477 cases; 94.3% of total patients) (Table 3), while only 95 patients (18.8%) needed mechanical ventilation.

According to statistical results, the student t-test showed that the proportion of patients, who received completed ATLS, was greater in patients who survived (22.7%) in comparison to those who died (6.9%). This difference is statistically significant ($P < 0.001$). Mean length of stay in completed ATLS patients was 8 ± 6.45 days versus 7.92 ± 7.73 in incomplete ones. Differences in the number of admission days, level of consciousness, and also the relation of age and sex with admission duration, were not statistically significant ($p > 0.05$). As indicated in Table 4, the more incomplete was the performance of ATLS interventions, the higher was the mortality rate ($P < 0.05$).

Discussion

ATLS principles were correctly applied in only a small number of patients but the difference in mortality was statistically significant. Annually, large numbers of mainly young people suffer traumatic injuries in various incidents. In this cross-sectional study, we evaluated referral trauma patients from level 2 or 3 trauma hospitals to Poursina hospital and tried to identify some of the factors affecting their mortality. As noted in this study, there is a poor adherence to ATLS guidelines while transferring adult trauma patients, even in terms of control of active bleeding and cervical collar fixation. This is similar to McCrum's report that key aspects of ATLS resuscitation guidelines are frequently missed during the transfer of trauma patients.¹¹ However, Hussmann reported that the pre-hospital

Table 3. Procedures performed compared to those that should have been performed for patients before referral (n = 506).

	Need the procedure		Performed	
	N	%	N	%
Endotracheal intubation	230	45.5	149	29.4
Cervical collar	477	94.3	259	51.2
Mechanical ventilation	95	18.8	58	11.5
Control of active bleeding	300	59.3	265	52.4
Two large-bore IV lines (>18 G)	506	100	110	21.7
Splinting of fractures	207	40.9	157	31.0

Table 4. Relation between number of ATLS domains performed and mortality. The six main domains were endotracheal intubation, mechanical ventilation, cervical fixation with collar, two large-bore IV lines, control of active bleeding, and splinting.

Number of incomplete domains	alive		dead		Total
	N	%	N	%	
0	82	89.1	10	10.9	92
1	97	67.4	47	32.6	144
2	138	76.7	42	23.3	180
3	36	59.0	25	41.0	61
4	7	36.8	12	63.2	19
5	2	25.0	6	75.0	8
6	0	.0	2	100.0	2
Total	362	71.5	144	28.5	506

and early in-hospital management of trauma patients has improved and programs such as ATLS have increased the quality of treatment of trauma patients.¹² Although there is no evidence from controlled trials that ATLS or similar programs impact the outcome for victims of injury, there is some evidence that educational initiatives can improve knowledge of hospital staff of available emergency interventions.¹³⁻¹⁵

In this study 363 patients (71.5%) survived and 144 patients died (28.5%) after severe trauma. The results showed that patients who had performed complete procedures according to ATLS protocols survived significantly more often (32.7% vs 6.9%). These results confirm the effectiveness and necessity of the treatments, which can play a role in reducing mortality in patients with multiple trauma. Ali et al. reported that

trauma mortality decreased after ATLS training (134/400 vs. 279/413) throughout the hospital and that the ATLS program was a significant factor in determining the observed decrease in mortality.¹⁶ In another study that examined the causes and time of death in patients hospitalized in a level 1 trauma center, from 1985-1995, a total of 900 patients (7.3%) died due to trauma; the greatest cause of death in the first hour after trauma was thoracic, vascular and central nervous system injuries.¹⁷ These results are evidence of the risk of trauma patients in the early hours after the incident and undeniable role of therapeutic interventions in reducing morbidity and mortality. Navarro's study of 898 trauma patients reported that as the number of ATLS-trained professionals increased, the rates of potentially preventable or preventable deaths fell.¹⁸

Despite these studies, strong evidence showing that ATLS training reduces morbidity and mortality in trauma patients is lacking.⁸

Due to the mountainous nature of the Guilan area, helicopters cannot be used frequently for patient transport and most of the time patients are transported by land, and despite being accompanied by a registered nurse, this prolongs the time to reach the trauma center which may in turn lead to higher mortality and morbidity. Transferred patients showed a decreased level of consciousness when entering Poursina hospital, raising the risk of brain damage in the patients. This was potentially due to a delay in starting the appropriate therapy. If the patient transfers safer and faster to a trauma level 1 hospital, the possibility of serious damage and loss of consciousness in the brain is reduced.

Mean admission days in completed ATLS patients were 8 ± 6.45 days and 7.92 ± 7.73 in incomplete ones. Although this difference was not significant, it can be attributed to more death among those whom ATLS was not fully implemented and they die earlier than other groups, so they will be less time in the hospital.

Limitations

Because of the critical condition of the patients that finally led to their death, some of the data were missed and not collected. Another limitation of this study was that we were unaware of the training status of the personnel who were responsible for patients' transfer in the first hospital. It is important that if they have not received enough training to implement ATLS skills, familiarity with the importance of using these guidelines would prevent further shortcomings.

Conclusion

In general, according to the results of this study, performing ATLS interventions reduces mortality in patients with multiple trauma but does not shorten the length of hospital stay. The study also highlights the importance of staff training and the provision of understanding and knowing how to use and manage equipment and trained personnel in level 2 or 3 trauma hospitals. Correct transfer of patients between the hospitals is important and experienced personnel and adequate facilities are necessary. Finally, it is recommended that with staff training and providing necessary and appropriate supervision to perform ATLS recommendations, it is possible to prevent or reduce complications of major traumas.

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Ethical approval

This study was mentioned in local ethics committee and was approved with ethic number of 1920452607.

Informed consent

Informed consent was not sought for the present study because this cross sectional study did not affect the kind of treatment for the patients and all the patients received the medical services that they needed without any intervention from the study. These data were collected by filling the check lists not interfering with the medical services.

Guarantor

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Contributorship

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