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Original Article

The emergency department length of stay: Is the time running out?

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ABSTRACT

Purpose: To examine the relationships between emergency department length of stay (EDLOS) with hospital length of stay (HLOS) and clinical outcome in hemodynamically stable trauma patients.
Methods: Prospective data collected for 2 years from consecutive trauma patients admitted to the trauma resuscitation bay. Only stable blunt trauma patients with appropriate trauma triage criteria requiring trauma team activation were included in the study. EDLOS was determined short if patient spent less than 2 h in the emergency department (ER) and long for more than 2 h.
Results: A total of 248 patients were enrolled in the study. The mean total EDLOS was 125 min (range 78–180). Injury severity score (ISS) were significantly higher in the long EDLOS group (17 ± 13 versus 11 ± 9, $p < 0.001$). However, when leveled according to ISS, there were no differences in mean in diagnostic workup, admission rate to intensive care unit (ICU) or HLOS between the short and long EDLOS groups.
Conclusion: EDLOS is not a significant parameter for HLOS in stable trauma patients.

Introduction

There is general acceptance that early identification of injury with rapid resuscitation and management may improve outcome in trauma patients. As such, there is a notion that shorter length of stay in the emergency department may decrease the hospital length of stay (HLOS) as well as the morbidity and mortality rates in patients with severe trauma. However, there is lack of data to support this notion in trauma patients, especially in hemodynamically stable patients. In fact, studies examining the relationship between the emergency department length of stay (EDLOS) in critically ill patients with sepsis or cardiovascular diseases and clinical outcomes have produced conflicting results.[1,2] The objective of this study was to prospectively examine the relationships between EDLOS with HLOS and clinical outcomes in hemodynamically stable trauma patients.

Methods

Study design and setting

A prospective observational study performed at a level 2 trauma center in northern Israel (1600 annual trauma admissions and 220–250 trauma team activations). The study was approved by the Institutional Review Board of the medical center. Data was collected prospectively from consecutive trauma patients admitted to the trauma resuscitation area from January 2012 to January 2014. Only stable blunt trauma patients (systolic blood pressure >100 mmHg, heart rate <110 beats/min) requiring trauma team activation in accordance with the trauma triage criteria were included in the study. Patients that died in the emergency department or those taken emergently to the operating room on arrival were excluded from the study. Unstable patients and patients transferred to other hospitals also were excluded from the study.

Definitions and outcome measures

EDLOS is the time from entrance until decision on final hospital disposition is made. EDLOS was categorized as “short” if duration was less than two hours and “long” if it was more than two hours, consistent with the hospital's average EDLOS for all trauma patients. EDLOS and HLOS were examined in association with injury severity score (ISS), and patients with “short” EDLOS were compared with patients with “long” EDLOS. The primary outcome measure examined in this study was the impact of EDLOS on HLOS.

Statistical analysis

Categorical variables were presented using frequencies and percent and continuous variables were presented using mean ± SD,

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range. The association between EDLOS and HLOS was estimated by spearman correlation. For each ISS category (1–8, 9–15, 16–24, 25+), the association between the study groups and categorical variables was examined using Chi-square (or Fisher's exact test). For continuous variables the *t*-test (or Wilcoxon two sample tests) was used. The statistical analyses were performed using SAS 9.4 software. Significance was determined at $p < 0.05$.

Results

Four hundred ninety seven patients met the criteria for trauma team activation. Two patients died in the emergency room and 17 (3.5%) patients required emergent surgery. The distribution of emergency surgeries was 5 patients (1%) underwent splenectomy for hemodynamically unstable grade 4–5 laceration of spleen; 6 patients (1%) had explorative laparotomy for hollow viscus injury (3 small bowel injuries, 2 sigmoid colon injuries, and 1 case of duodenum and pancreas transection). Four hemodynamically unstable patients (0.8%) with pelvic fracture underwent external fixation and angio-embolization. Two patients (0.4%) underwent an urgent external fixation and vascular repair for open fracture with associated vascular injury. Two in-extremis patients with multiple torso injuries had an emergency department recitative thoracotomy, and both of them died in the emergency room.

After excluding patient transferred to other facilities, unstable patients, and patients with incomplete data, the records of 248 patients were included for analysis.

One hundred and eighty patients (72.5%) were men and mean age of patients was 46 (SD = 19) years. Overall mean EDLOS of all patients was 125 min (SD = 32). Mean short EDLOS was 78 min (range 45–115), accounting for 156 patients (63%) compared to 180 min (range 120–215) in the long EDLOS group. Significantly higher ISS scores were noted in the long EDLOS arm (17 ± 13 versus 11 ± 9, $p < 0.001$). Thus, low acuity trauma score was more common (78.8%) in the shorter EDLOS group ($n = 123$), whereas in the long EDLOS group 64.1% ($n = 59$) of patients had high ISS (Table 1).

Table 2 represents patients' ISS, clinical variables such as blood pressure (BP), heart rate (HR) and Glasgow coma scale (GCS). There were no differences in BP, HR and GSC in short and long EDLOS groups. In terms of diagnostic work up and care that patients received in the resuscitation room, there were no differences between short and long EDLOS group in ISS leveled patients.

ISS leveled in both groups patients did not differ significantly in term of their clinical variables.

Of 248 stable blunt trauma patients included into the study, 17 (6.9%) underwent urgent surgery. Seven of 156 (4.5%) patients (short EDLOS) and 10 of 92 patients (6.1%) in long EDLOS group underwent surgery in the first 24 h after admission. Fourteen patients underwent orthopedic surgery for the open fractures, 2 patients had external fixation of pelvis and angio-embolization. Two patients underwent laparotomy for the missed small bowel injuries and one patient had a splenectomy for the failed conservative treatment. Five patients had splenic artery embolization, 2 patients underwent angio-embolization for the liver injuries.

Of the 92 patients in the long EDLOS group, 36 (39.1%) patients were admitted to ICU, while only 18 (19.6%) of patients in the short group had ICU admission. However, leveled patients didn't differ significantly by destinations including ICU (Table 3). Patients with high acuity injury had EDLOS longer than patients with low ISS ($p = 0.0012$). Patients with long EDLOS had higher percent of ICU admission in leveled groups, but it was not statistically significant ($p = 0.06$). Patients with high grade ISS had high ICU admission rate ($p < 0.05$).

EDLOS and its implication on HLOS according to ISS was examined as outcome measure. There was no difference in HLOS in ISS-leveled trauma patients between the short and long EDLOS groups (Table 4). The mean HLOS for the two groups was 11.5 (SD = 3.5) days for short EDLOS versus 12.8 (SD = 4.6) days in the long group ($p = 0.65$, correlation coefficient = 0.095). No relationship between EDLOS and hospital length of stay was found in all groups examined. EDLOS had no impact on hospital length of stay ($p = 0.65$).

Discussion

Assessing the outcome of critically ill patients is a difficult and complex process. Early recognition of severe illness, timely appropriate intervention and early optimal medical care may have a strong effect on the outcome. Therefore, a search for factors that may predict outcome or quality of care is important. Numerous measures were suggested including EDLOS. Recently, the National Quality Forum with goal to improve the quality of American healthcare has suggested that this EDLOS may be an important indicator quality of care.[3] Similarly, HLOS is widely used as an indicator of efficiency of patient care delivery. Prolonged HLOS is not only associated with increased morbidity and mortality, but also with greater risk of adverse events such as thromboembolism, nosocomial infections, and medical errors.

Nevertheless, studies on the impact of EDLOS on the outcome in non-trauma population have given contradictory results. Chalfin et al.[4] in a cross-sectional study using a multicenter U.S. database of intensive care unit patients, found HLOS was significantly longer in patients with long EDLOS, as were the mortality rates. Similar findings were reported in another retrospective cohort study of non-trauma patients, using 2-h marker for short EDLOS. The mortality rates increased from 2.5% in patients boarded less than 2 h to 4.5%.[5] In contrast, Parkhe et al.[6] analyzed 122 emergency department medical patients admitted to the ICU either directly from the emergency department (direct group) or within 24 h of ward admission (delayed group) and found no difference in HLOS but increase 30 day mortality in delayed group. Other studies have also

Table 1
Demographic and emergency department length of stay.

Characteristics	Patients	Age (year)	Gender		OR[a]
			Male	Female	
Short EDLOS (<2 h)	156 (62.9)	48.8 ± 20, 15–88	112 (71.8)	44 (28.2)	7 (4.5)
Long EDLOS (>2 h)	92 (37.1)	46.8 ± 19, 16–84	68 (73.9)	24 (26.1)	10 (10.9)
Total	248	46 ± 19, 15–88	180 (72.6)	68 (27.4)	17 (6.9)
p value		0.08	0.09	0.09	0.08

Values are given as number (percent) or mean ± SD, range.
EDLOS: emergency department length of stay.
[a] Present as patients had surgery within 24 h of admission.

Table 2
ISS leveled patients in short and long EDLOS group and their clinical variables.

Characteristics	Patients	Age (year)	BP (mmHg)	HR (beats/min)	GCS
ISS = 1–8					
<2 h	21 (13.5)	48.6 ± 20.7, 21–84	121.6 ± 15.0, 100–160	105 ± 10.6, 85–120	14.6 ± 0.7, 13–15
>2 h	3 (3.3)	41.7 ± 25.5, 16–67	122.7 ± 12.1, 110–134	109 ± 12.5, 96–121	14.3 ± 1.2, 13–15
ISS = 9–15					
<2 h	102 (65.4)	44.8 ± 20.1, 15–88	112.7 ± 12.5, 88–150	109 ± 8.5, 76–140	14.4 ± 1.3, 4–15
>2 h	42 (45.7)	40.6 ± 17.3,18–82	112.3 ± 13.2, 88–170	110.1 ± 7.8, 90–125	14.4 ± 0.9, 11–15
ISS = 16–24					
<2 h	28 (17.9)	43.6 ± 18, 18–72	108.5 ± 8.1, 90–125	111.3 ± 8.7, 80–128	14 ± 0.8, 13–15
>2 h	30 (32.6)	43.4 ± 17.5, 14–84	110.8 ± 11.2, 84–150	115.9 ± 7.9, 89–135	13.9 ± 0.9, 12–15
ISS = 25+					
<2 h	5 (3.2)	50.8 ± 23.7, 17–72	117 ± 13.7, 106–140	120 ± 6.5, 112–130	13 ± 1.9, 11–15
>2 h	17 (18.5)	40.2 ± 15.6, 16–67	107.9 ± 12.1, 86–123	117.4 ± 7.5, 100–130	12 ± 1.9, 8–14

Values are given as mean ± SD, range or number (percent). ISS: injury severity score, BP: blood pressure, HR: heart rate, GCS: Glasgow coma scale.

Table 3
Patients admitted to ICU in relation to ISS.

Characteristics	Patients, *n*	Admitted to ICU, n (%)
ISS = 1–8	24	0
<2 h	21	0
>2 h	3	0
ISS = 9–15	144	6 (4.2)
<2 h	102	4 (3.9)
>2 h	42	4 (9.5)
ISS = 16–24	58	34 (58.6)
<2 h	28	15 (53.6)
>2 h	30	19 (63.3)
ISS = 25+	22	20 (90.9)
<2 h	5	3 (60.0)
>2 h	17	17 (100.0)

ISS: injury severity score, ICU: intensive care unit.

failed to show a clear association between delayed admission and poor outcome.[7–10]

The trauma-specific data studied the effect of EDLOS on the HLOS are also very limited. While some studies revealed strong relationship between EDLOS, HLOS and mortality others did not confirm this correlation.[11–14]

For example, Mowery et al.[12] published a retrospective analysis specifically examining the relationship between EDLOS and trauma patients' outcomes. They found that patients in the shorter EDLOS (<2 h) had a significantly decreased HLOS (7.5 versus 11.1) and decreased hospital mortality (4.3% versus 7.8%).

In contrast, Kinney et al.[13] reviewed the database of 1139 injured patient admitted to a level-1 trauma center and found no association between EDLOS and mortality in leveled trauma patients. The authors used a benchmark less than 4 h as the cut off between the short and long EDLOS.

Table 4
Relationship between EDLOS and hospital stay of length.

Characteristics	Patients (*n*)	Hospital length of stay (day)[a]
ISS = 1–8		
<2 h	21	6.5 ± 1.6, 4–11
>2 h	3	4.7 ± 2.1, 3–7
ISS = 9–15		
<2 h	102	10.7 ± 3.3, 4–21
>2 h	42	10.1 ± 3.3, 4–16
ISS = 16–24		
<2 h	28	15.5 ± 2.5,15.5–12,2
>2 h	30	14 ± 1 2, 9–17
ISS = 25+		
<2 h	5	16.6 ± 2.5, 1–21
>2 h	17	16.5 ± 2.9, 1–21

[a] Values are given as mean ± SD, range or number. EDLOS: emergency department length of stay.

The study also revealed that patients in the longer and shorter EDLOS groups had similar HLOS.[13] In the present prospective study, we were unable to support the contention that EDLOS is associated with HLOS among leveled stable trauma patients. We also failed to find statistically significant differences in terms of diagnostic procedures and care delivering for patients in between the groups.

Significantly higher ISS scores were noted in the long EDLOS group (17 ± 13 versus 11 ± 9, $p < 0.001$). Thus, low acuity trauma score was more common (78.8%) in the shorter EDLOS group (123 of 156 patients), whereas in the long EDLOS group 64.1% (59 of 92) of patients had high ISS. Patients in both groups underwent similar diagnostic work-up and procedures. On the other hand, there was a trend to outnumber of the diagnostic procedures (e.g. radiological examination) in long EDLOS group. Patients with high ISS very often as a result of multiple pattern injuries had several consulting services involved in their management. Therefore patients with high acuity trauma stayed longer in the emergency department. However, there was no difference in HLOS in ISS- leveled trauma patients between the short and long EDLOS groups.

Wide differences in trauma systems throughout the world exist; therefore caution should be used when examining data of studies on EDLOS and its implications on outcome of trauma patients. There is no doubt that prolonged EDLOS interferes with the main goal of emergency physicians to rapidly stabilize patients and transfer them to specialty services where they will receive definitive care, so that emergency department staff can redirect their attention to the next emergency. However, as it was shown here, EDLOS should not be used independently as a benchmark in stable trauma patients. We think that critical care cannot be limited by location. Expeditious progression of trauma patients through the initial evaluation process, as well as timely implementation of trauma resuscitation protocols is essential for better outcome.

EDLOS is not a significant parameter for HLOS in stable trauma patients.

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None at present.

Ethical statement

The study was approved by the institutional review board of the medical center.

Conflicts of interest

The authors declare no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cjtee.2019.01.008.

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