Original Article

Prehospital versus Emergency Room Intubation of Trauma Patients in Qatar: A-2-year Observational Study

Hassan Al-Thani[1], Ayman El-Menyar[2,3], Rifat Latifi[1,3,4]

[1]Department of Surgery, [2]Clinical Research, Trauma Surgery Section, Hamad General Hospital, [3]Clinical Medicine, Weill Cornell Medical College, Doha, Qatar, [4]Department of Surgery, Arizona University, Tucson, Arizona, USA

Abstract

Background: The impact of prehospital intubation (PHI) in improving outcome of trauma patients has not been adequately evaluated in the developing countries. **Aims:** The present study analyzed the outcome of PHI versus emergency room intubation (ERI) among trauma patients in Qatar. **Materials and Methods:** Data were retrospectively reviewed for all intubated trauma patients between 2010 and 2011. Patients were classified according to location of intubation (PHI: Group-1 versus ERI: Group-2). Data were analyzed and compared. **Results:** Out of 570 intubated patients; 482 patients (239 in group-1 and 243 in group-2) met the inclusion criteria with a mean age of 32 ± 14.6 years Head injury ($P = 0.003$) and multiple trauma ($P = 0.004$) were more prevalent in group-1, whereas solid organ injury predominated in group-2 ($P = 0.02$). Group-1 had significantly higher mean injury severity scoring (ISS), lower Glasgow coma scale (GCS), greater head abbreviated injury score and longer activation, response, scene and total emergency medical services times. The mortality was higher in group-1 (53% vs. 18.5%; $P = 0.001$). Multivariate analysis showed that GCS [odds ratio (OR) 0.78, $P = 0.005$) and ISS (OR 1.12, $P = 0.001$) were independent predictors of mortality. **Conclusions:** PHI is associated with high mortality when compared with ERI. However, selection bias cannot be ruled out and therefore, PHI needs further critical assessment in Qatar.

Keywords: Emergency room, intubation, mode of transport, on-scene, prehospital, trauma

Address for correspondence: Dr. Hassan Al-Thani, Head, Trauma Surgery section, Hamad General Hospital, HMC, PO Box 3050, Doha, Qatar. E-mail: TraumaResearch@hmc.org.qa

Introduction

Prehospital intubation (PHI) is an essential component of advanced life support for the initial management of severely injured trauma patients.[1] The primary goal of PHI is to stabilize the patient and prevent physiological and hemodynamic deterioration.[2] Though, on-scene airway-management decisions are mostly controversial in marginal cases. Several studies have reported an increased failure rates and severe complications in trauma patients who underwent PHI.[3-6] Many factors are thought to explain in part the high risk of worse outcomes in PHI such as severe head injury, malpositioning of the endotracheal tube, direct blocking of the respiratory system, and aspiration of gastric contents.[7-11] In addition, Herff *et al*., observed suboptimal airway management training and inexperience of the prehospital emergency medical services (EMSs) team associated with high failure and complication rates in PHI.[12] On the contrary, Sise *et al*., advocated early intubation to be safe and effective in trauma patients.[13]

Access this article online	
Quick Response Code:	Website: www.najms.org
	DOI: 10.4103/1947-2714.125855

Worldwide, blunt trauma constitutes a significant cause of morbidity and mortality among young population.[14,15] Qatar, a rapidly developing Middle Eastern country, is also experiencing high incidence of blunt trauma due to road traffic crashes and work-related accidents. Despite great improvement in trauma care, Qatar still has one of the highest rates of road traffic- related death in the region with death rate of 19 per 100,000 populations.[16] In order to provide superior trauma services, a dedicated trauma system has been established in Qatar late in 2007 with advanced EMS department. A World Health Organization report in 2011 stated that according to quality indicators, the length of stay in the hospital for trauma patients has also got reduced from an average of 12 days in 2007 to 8 days in 2011. Trauma center has achieved a 50% reduction in the number of deaths of patients admitted to the hospital with serious traumatic injury in five years.[17] The impact of scene intubation in improving outcome of severely injured patients has not been adequately evaluated in the Arab Middle East. So, the present study aims to analyze the patterns and outcome of PHI compared with the emergency room intubation (ERI) over a 2-year period in Qatar.

Materials and Methods

This study was approved by the Medical Research Center at Hamad medical corporation, Qatar (IRB# 12238). Medical records of all trauma patients who required intubation between January 2010 and December 2011cwere retrospectively reviewed. The study specifically analyzed and compared posttraumatic PHI to ERI at Hamad General Hospital; the only Level I trauma center in the State of Qatar. Patients were classified according to the site of intubation into two groups; group-1(PHI) and group-2 (ERI).

Inclusion criteria included any traumatic injury that required intubation [i.e. low Glasgow coma scale (GCS), and desaturation]. Intubation was carried on either at the location of injury on the scene (PHI) or on arrival to the ER. Exclusion criteria included patients who died at the scene before intubation, patients with incomplete data, and patients who were intubated during the hospital course (surgical wards, intensive care unit, or operating room). Data such as age, gender, mechanism of injury, mode of transportation, activation, response, and transportation intervals, total EMS and scene time, injury severity scoring (ISS), abbreviated injury score (AIS), type of injuries, hospital length of stay (LOS), intensive care unit (ICU) LOS, morbidity, and mortality were analyzed. Our EMS service is following up-to-date evidence-based standard treatment protocols and is staffed by critical care paramedics as well as Emergency Medical Technicians. Recently, helicopter EMS (HEMS) staffed by critical care paramedics has been launched in Qatar. It mainly serves the severely injured patients from remote locations. PHI is conducted exclusively by well-trained Critical Care Paramedics. The training program includes rapid sequence intubation (RSI) and the application of a comprehensive critical care medication formulary and the management of critical care patients during transfer. All the intubation procedures were performed using RSI and oral endotracheal tubes.

Dispatch records of the emergency room were utilized to calculate the EMS intervals, which were based on standard EMS definitions.

Definitions

It included *activation interval* (time of 999 call received at dispatch to alarm activation at EMS first response agency), *response interval* (time from alarm activation to arrival of first responding vehicle on scene), *on-scene interval* (time arrival of first EMS responding vehicle on scene until leaving the scene), and *transport interval* (time leaving the scene to vehicle arrival at the receiving hospital).[18] The total EMS interval is considered as time from call received to arrival at the receiving hospital. Further, categorical versions of total EMS time (≤60 versus > 60 min) and response interval (<4, 4-8, and >8 min) were also evaluated as described previously by Newgard *et al*.[18]

Statistical analysis

Data were presented as proportions, mean ± standard deviation (SD) or median as appropriate. Baseline demographic characteristics, clinical presentation, and outcomes were compared according to site of intubation, scene time, and EMS time using the Student-T test for continuous variables and Pearson's Chi-square (X^2) test was used for categorical variables. Univariate and multivariate regression analysis were performed to study the predictors for mortality. Results were summarized using odd ratio and 95% confidence interval. A significant difference was considered when the two-tailed P value was less than 0.05. Data analysis was carried out using the Statistical Package for Social Sciences version 18 (SPSS Inc. USA).

Results

Between January 2010 and December 2011, a total of 570 trauma patients were intubated; of them 239 and 243 patients were intubated at the scene (PHI) and in the ER, respectively. There were 88 patients excluded from the analysis (80 patients were intubated during hospital course and eight patients had missing relevant data. [Figure 1] shows the entire study design. The mean age was 32 ± 14.6 (median 29; range 1-92) years with 94% males. A total of 75% of patients were between 19and 50 years old.

Blunt trauma (96%) was the major cause of injury which included motor vehicle crash (42%), pedestrians hit by vehicle (21%), fall from height (20%), and fall of heavy objects (4%). The mean injury severity scoring was 22 ± 11.

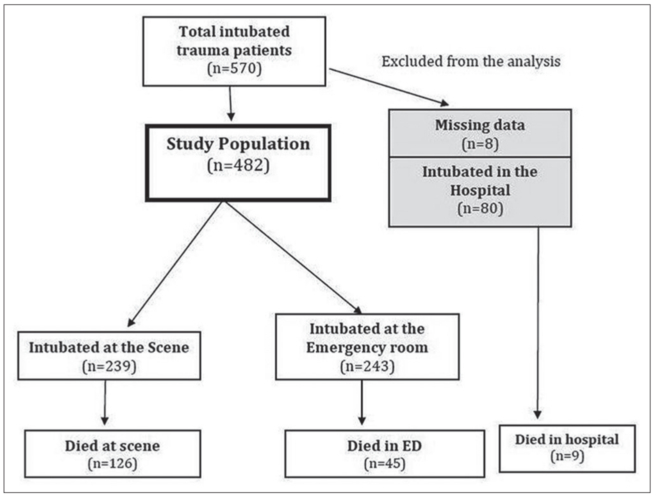

Figure 1: Study design and outcome

[Table 1] shows the demographic characteristics, presentation, and outcomes of trauma patients according to the site of intubation i.e. PHI (group-1) *Vs* ERI (group-2). The majority of patients (80%) were transported by ground EMS in group 1 and 2. HEMS use was more frequent in group 1, whereas private transportation was observed only in group 2. Higher number of patients in group-1 were shifted to the hospital by HEMS (20% *Vs* 11%; $P = 0.001$). Number of patients shifted to the operating room (25% vs. 13%) and ICU (70% vs. 54%; $P = 0.001$) were significantly higher in group-2. The rates of head injury (74% vs. 61%; 0.003) and multiple trauma (81% *Vs* 69.5%; $P = 0.004$) were significantly greater in group-1 whereas, solid organ injuries (33% *Vs* 23%; $P = 0.02$) occurred more often in group-2.

[Table 2] shows the clinical profile and outcome based on the mode of transportation. Patients who were transported by HEMS comprised only 14% of the study population and had greater rate of head injury and multiple trauma in comparison to other mode of transportation.

[Table 3] shows the prehospital intervals and outcome for trauma patients according to the location of intubation. Patients in group-1 had significantly longer activation, response, scene, and total EMS times in comparison to group 2 patients. Moreover, response time (>8 min) was also higher in group-1 patients (75% vs. 59%; $P = 0.01$). Greater mean injury severity scoring and head AIS and lower GCS were observed in group-1 whereas; patients in group-2 had higher chest AIS. Ventilator days and hospital length of stay were comparable among the two groups.

Mortality

There were 180 (out of 570) deaths (31.6%) during the study period. This mortality rate increased to 35.5% (171 out of 482) after excluding those who were intubated during hospitalization and who had incomplete data. The mortality was higher in group-1 in comparison to group-2 (53% vs. 18.5%, $P = 0.001$) [Figure 1]. Moreover, mortality rate (24% vs. 9%, $P = 0.02$) was significantly higher in patients who experienced prolonged scene time (≥20 min) [Table 4].

Table 1: Demographics, presentation, and injury type according to site of intubation for all the patients

	Group-1	Group-2	*P* value
Age (median and range)	29 (1-69)	27 (2-80)	0.42
≤18 years %	11	16	0.23
>18-50 years %	78	71	
>50 yrs %	11	13	
Male (%)	95	94	0.55
Blunt injury (%)	98.3	97	0.27
Mechanism of injury			0.06 for all
MVC (%)	47	37	
Pedestrians (%)	24	21	
Fall (%)	14	25.5	
Fall of heavy object (%)	32.1	2.9	
Assault (%)	1.3	3.3	
Mode of transportation			0.001 for all
Ground (%)	80	79	
Air-life flight (%)	20	11	
Private car (%)	0.0	10	
Disposition			0.001 for all
OR (%)	13	25	
ICU (%)	54	70	
Injured region			
Head (%)	74	61	0.003
Face (%)	28.5	31	0.56
Chest (%)	51	46	0.32
Solid organ injury (%)	23	33	0.02
Spine (%)	20	25	0.18
Neck (%)	1.7	2.1	0.76
Extremities (%)	44	35	0.06
Pelvic (%)	14	18.5	0.16
Polytrauma (%)	81	69.5	0.004
Hemothorax (%)	7	9	0.52
Pneumothorax (%)	10.5	12	0.61

ER: Emergency Room; ICU: Intensive care unit; MVC: Motor vehicle crash; OR: Operation room

Table 2: Clinical profile and mortality based on the mode of transportation

	Ground EMS	HEMS	Private car	*P* value
Number	457 (80%)	82 (14%)	31 (6%)	
Age	32±14	31±13	24±17	0.006
ISS	23±11	24±11	19±10	0.11
Head injury	64%	77%	57%	0.04
Multiple trauma	74%	85%	50%	0.001
Mortality (n)	34% (155)	24% (20)	23% (7)	0.13

EMS: Emergency medical services; HEMS: Helicopter emergency medical services; ISS: Injury severity scoring

Table 3: Prehospital time intervals and outcome based on the location of intubation

	Group-1	Group-2	*P* value
Activation Interval†	2 (1-39)	1 (1-34)	0.001*
Response Interval†	14.6±8.7	11.4±6.9	0.001*
Scene time†	26.5±12.1	15.8±8.6	0.001*
Transportation Interval†	22.7±12.7	24.8±13.9	0.497
Total EMS Interval†	64.3±20.9	51.7±21.9	0.002*
EMS time (≤60)† (%)	100	98	1.000
Response time†			
<4 (%)	04.3	05.5	0.014
4-8 (%)	21.0	35.4	
>8 min (%)	74.6	59.1	
Scene GCS	6.9±4.4	12.1±3.8	0.001
Scene saturation	92.1±10.7	95.6±6.9	0.001
Scene SBP	127.9±27.4	129.4±28.7	0.635
Scene DBP	80.4±20.1	82.5±21.6	0.400
Scene pulse	100.5±29.4	96.7±26.8	0.232
ISS (mean±SD)	25.3±10.5	21.3±10.6	0.001
Head AIS (mean±SD)	3.9±0.9	3.7±0.8	0.032
Chest AIS (mean±SD)	2.9±0.6	3.1±0.7	0.031
Abdominal AIS (mean±SD)	2.5±0.7	2.7±0.9	0.426
Ventilatory days (median; range)	4 (1-163)	3 (1-96)	0.280
HLOS (median; range)	19 (1-447)	17 (1-272)	0.510
TICU LOS (median; range)	8.5 (1-165)	5 (1-150)	0.058
Mortality (%)	53	18.5	0.001

AIS: Abbreviated injury score; DBP: Diastolic blood pressure; EMS: Emergency medical services; GCS: Glasgow coma scale; HLOS : Hospital length of stay; ISS: Injury severity scoring; LOS: Length of stay; SBP: Systolic blood pressure; SD: Standard deviation; †Time in minutes

Table 4: Mechanism of injury and outcome according to scene time

	Scene time (<20*)	Scene time (≥20*)	*P* value
Frequency (%)	49	51	
MVC (%)	36.2	53.5	0.29 for all
Pedestrians (%)	24.6	15.5	
Fall (%)	24.6	21.1	
ISS (mean±SD)	21.4±11.3	23.3±11.8	0.33
Deaths (%)	8.7	23.9	0.02

SD: Standard deviation; MVC: motor vehicle crash; ISS: Injury severity score; SD: standard deviation; * Time in minutes

Univariate and multivariate analysis

Univariate analysis demonstrated that PHI, head injury; higher ISS, lower initial GCS and prolonged scene time were associated with high mortality. However, in multivariate logistic regression analysis, only initial GCS [odds ratio (OR) 0.78, $P = 0.005$] and ISS (OR 1.12, $P = 0.001$) were independent predictors of mortality [Table 5].

Table 5: Univariate and multivariate analysis for predictors for mortality

	Univariate analysis	*P* value	Multivariate analysis	
	OR (95% CI)		OR (95% CI)	*P* value
Head injury	1.6 (1.06-2.29)	0.02	0.63 (0.16-2.49)	0.51
Location of intubation	4.7 (3.14-7.16)	0.001	2.4 (0.61-9.44)	0.21
Initial GCS	0.80 (0.76-0.84)	0.001	0.78 (0.66-0.93)	0.005
ISS	1.13 (1.10-1.16)	0.001	1.12 (1.05-1.19)	0.001
Scene time	1.04 (1.01-1.07)	0.002	1.0 (0.96-1.05)	0.89
EMS time	1.002 (0.99-1.01)	0.70	0.98 (0.96-1.01)	0.23

OR: Odd ratio; CI: Confidanc interval; GCS: Glasgow coma scale; ISS: Injury severity scoring; EMS: Emergency medical services

Discussion

To the best of our knowledge, there is no similar study from the Arab Middle East that analyzes prehospital intervals, mode of transportation, and outcomes among patients sustained trauma based on the location of intubation (PHI vs. ERI). Our study shows that PHI is associated with high mortality when compared with ERI.

Several investigators have highlighted the association of adverse outcomes with PHI.[19-21] Our data found that apart from mortality, total hospital and intensive care unit length of stay and ventilator days were nonsignificantly higher in PHI group. The mortality in PHI group was triple that in ERI group.

Mort and Schwartz *et al.*,[9,10] also demonstrated increased procedure related complication rates in PHI. Besides complications, PHI affects other resuscitation efforts and eventually delayed definitive care at the same time is life saving.[22-23] The present study also shows increased scene time and total EMS time in patients intubated at the scene. Although, ground EMS was the main mean of transportation in both groups, HEMS frequently served group-1 patients. Ringburg *et al.*,[24] demonstrated increased prehospital time with higher frequency use of HEMS. An earlier study showed greater ISS in patients with PHI compared to the patients with ERI.[25] In our study, compared to ERI, the mortality rate was significantly higher in PHI group. The current findings corroborate with earlier studies showing increased risk of mortality for PHI in head injury patients.[7,26-27] Further, Sen and Nichani[7] showed that PHI was associated with adverse neurological outcome and a fourfold increased risk of mortality.

Mortality rate did not differ significantly with either mode of EMS transportation in our study. Talving *et al.*,[28] observed more number of patients transported by

HEMS had severe injuries and need on-scene intubation. Moreover, the overall adjusted survival benefit post trauma remains unaffected in patients transported by HEMS. The possible explanation for increased mortality in PHI group is that these patients had significantly higher incidence of head injuries, polytrauma, and greater ISS. However, in order to analyze the safety of PHI in comparison to ERI, prospective studies are needed.

In general, improvement in the transportation methods in addition to advanced training for EMS personnel would lead to significant reduction of the interval between the point in time of injury to the time of receiving the appropriate management. However, it is noteworthy that the initial 60 min posttraumatic injury (golden hour) is the most effective time period for reducing complications and severity of injuries.[19] In order to analyze the exact duration in various events involved in prehospital care, investigators have classified "golden hour" into different time intervals.[18,29-31] These time intervals are useful in assessing the performance of EMS for the delivery of best possible care for critically ill patients.[30] The overall prehospital time intervals in the current study are consistent with the earlier published reports [Table 6]. We reported prolonged out-of-hospital time in patients with PHI compared with patients with ERI. This finding is consistent with earlier studies that have reported increased overall prehospital time for definitive care due to prehospital interventions involving advanced life support in severely injured patients.[32-34] In our analysis, the majority of patients in group-1 were located in rural areas, whereas group-2 patients were mainly transported from urban areas. This observation may explain in part the shorter activation and response intervals in group 2.

It remains unclear whether there is a correlation between the on-scene time and outcomes in trauma patients. The observed increased mortality rate was analyzed and has been found to be significantly higher in patients who experienced increased scene time (≥20 min). A recent study from Netherlands analyzed relationship between mobile medical team (MMT) involvement with on-scene time and mortality.[35] They have reported that an increased mortality observed in trauma patients managed by MMT, but after adjustment of major confounders the mortality was not independently associated with MMT involvement. Similarly, Newgard *et al*.,[18] showed no correlation between on-scene time and mortality. Earlier reports have demonstrated that on-scene time is influenced by injury severity and EMS interventions.[36-38] Over a 17-year period, Wyen *et al*.,[39] reported 16 variables that had significant impact on the on-scene-treatment time. Of these variables; intubation, car occupant, HEMS, volume administration, sedation, open fracture and establishing chest tubes were important determinants of on-scene-treatment time. However, the authors could not rule out selection bias in that study.

The present study attempted to analyze the association between total EMS time and outcome in adult trauma patients. Our findings are consistent with earlier reports which have observed lack of association between total prehospital time and outcome in traumatic injury patients.[18,30,40,41]

The main limitation of this study is the retrospective nature and availability of a preexisting dataset. As the data were studied retrospectively, missing data points or erroneous data entry may have skewed the present data mainly for the prehospital time intervals. The skewed prehospital time intervals may be attributed to the airfield restrictions or natural and structural barriers for HEMS, whereas ground EMS also suffers traffic congestion at peak hours. Number of attempts and duration of intubation were not given in the datasets.

Conclusion

The study finding shows that PHI and prolonged scene time is associated with high mortality in Qatar. However, ISS and GCS remain important predictors for worse outcome. As selection bias cannot be ruled out in this study, PHI needs critical assessment and evaluation before on-site management decision.

Table 6: Comparison of emergency medical services intervals among trauma patients from different countries

Study	Median (IQR)				
	Activation interval	Response interval	Scene time	Transport interval	Total EMS interval
United States[29]	0.82 (0.08-1.32)	4.00 (3.00-5.87)	18.2 (13.0-25.5)	10.2 (6.66-15.2)	35.7 (27.8-45.7)
Canada[29]	1.28 (0.67-2.15)	5.00 (3.53-8.00)	20.2 (14.9-27.0)	9.75 (5.85-15.4)	38.1 (30.5-49.9)
Canada[30]	0.8 (0.5-1.6)	6.5 (4.5-8.8)	16.8 (12.6-22.6)	7.2 (4.4-10.8)	34.2 (26.5-43.9)
Iran[28]0	1.0 (1.0-2.0)	4.0 (3.0-7.0)	5.0 (4.0-7.0)	5.0 (4.0-8.0)	28 (22.0-34.0)
United States[32]	-	-	15 (10-20)	38 (34-48)	55 (47.5-67)
Present study*	1.0 (1.0-3.0)	10.0 (7.0-18.00)	19 (11.0-26.0)	22 (14-22)	58 (45.0-77.0)

EMS: Emergency medical services; IQR: Interquartile range. *After exclusion of the patients died at the scene

Acknowledgment

We thank the entire registry database team in the section of trauma surgery and EMS department for their contribution. The authors have no conflict of interest and no financial issues to disclose. All authors read and approved the manuscript.

References

1. Sollid SJ, Lossius HM, Søreide E. Pre-hospital intubation by anesthesiologists in patients with severe trauma: An audit of a Norwegian helicopter emergency medical service. Scand J Trauma Resusc Emerg Med 2010;18:30.
2. Liberman M, Mulder D, Lavoie A, Denis R, Sampalis JS. Multicenter Canadian study of prehospital trauma care. Ann Surg 2003;237:153-60.
3. Timmermann A, Russo SG, Eich C, Roessler M, Braun U, Rosenblatt WH, *et al.* The out-of-hospital esophageal and endobronchial intubations performed by emergency physicians. Anesth Analg 2007;104:619-23.
4. Mort TC. Complications of emergency tracheal intubation: Hemodynamic alterations, part I. J Intensive Care Med 2007;22:157-65.
5. Wang HE, Cook LJ, Chang CC, Yealy DM, Lave JR. Outcomes after out-of hospital endotracheal intubation errors. Resuscitation 2009;80:50-5.
6. Wirtz DD, Ortiz C, Newman DH, Zhitomirsky I. Unrecognized misplacement of endotracheal tubes by ground prehospital providers. Prehosp Emerg Care 2007;11:213-8.
7. Sen A, Nichani R. Best evidence topic report. Prehospital endotracheal intubation in adult major trauma patients with head injury. Emerg Med J 2005;22:887-9.
8. Bochichhio GV, Ilahi O, Joshi M, Bochicchio K, Scalea TM. Endotracheal Intubation in the field does not improve outcome in trauma patients who present without an acutely lethal traumatic brain injury. J Trauma 2003;54:307-11.
9. Mort TC. Complications of emergency tracheal intubation: Immediate airway-related consequences: Part II. J Intensive Care Med 2007;22:208-15.
10. Schwartz DE, Matthay MA, Cohen NH. Death and other complications of emergency airway management in critically ill adults: A prospective investigation of 297 tracheal intubations. Anaesthesiology 1995;82:367-76.
11. Ufberg JW, Bushra JS, Karras DJ, Satz WA, Kueppers F. Aspiration of gastric contents: Association with prehospital intubation. Am J Emerg Med 2005;23:379-82.
12. Herff H, Wenzel V, Lockey D. Prehospital intubation: The right tools in the right hands at the right time. Anesth Analg 2009;109:303-5.
13. Sise MJ, Shackford SR, Sise CB, Sack DI, Paci GM, Yale RS, *et al*. Early intubation in the management of trauma patients: Indications and outcomes in 1,000 consecutive patients. J Trauma 2009;66:32-9.
14. Hofman K, Primack A, Keusch G Hrynkow S. Addressing the growing burden of trauma and injury in low- and middle-income countries. Am J Public Health 2005;95:13-7.
15. El-Menyar A, Latifi R, AbdulRahman H, Zarour A, Tuma M, Parchani A, et al. Age and traumatic chest injury: a 3-year observational study . Eur J Trauma Emerg Surg 2013;39:397–403
16. Mock C, Julliard C, Joshipura M, Goosen J, editors. Strengthening care for the injured: Success stories and lessons learned from around the world., Geneva: World Health Organization; 2010. p. 28-32
17. The Peninsula. (Accessed October 28, 2013, at http://www.thepeninsulaqatar.com/qatar/153216-who-recognition-for-hgh-trauma-service-unit).
18. Newgard CD, Schmicker RH, Hedges JR, Trickett JP, Davis DP, Bulger EM, *et al*., Resuscitation Outcomes Consortium Investigators. Emergency medical services intervals and survival in trauma: Assessment of the "golden hour" in a North American prospective cohort. Ann Emerg Med 2010;55:235-46.
19. Davis DP, Hoyt DB, Ochs M, Fortlage D, Holbrook T, Marshall LK, *et al*. The effect of paramedic rapid sequence intubation on outcome in patients with severe traumatic brain injury. J Trauma 2003;54:444-53.
20. Wang HE, Peitzman AB, Cassidy LD, Adelson PD, Yealy DM. Out-of-hospital endotracheal intubation and outcome after traumatic brain injury. Ann Emerg Med 2004;44:439-50.
21. Wang HE, Yealy DM. Out-of-hospital endotracheal intubation: Where are we? Ann Emerg Med 2006;47:532-41.
22. Aufderheide TP, Lurie KG. Death by hyperventilation: A common and life-threatening problem during cardiopulmonary resuscitation. Crit Care Med 2004;32:S345-51.
23. Abo BN, Hostler D, Wang HE. Does the type of out-of-hospital airway interfere with other cardiopulmonary resuscitation tasks? Resuscitation 2007;72:234-9.
24. Ringburg AN, Spanjersberg WR, Frankema SP, Steyerberg EW, Patka P, Schipper IB. Helicopter emergency medical services (HEMS): Impact on on-scene times. J Trauma 2007;63:258-62.
25. Vandromme MJ, Melton SM, Griffin R, McGwin G, Weinberg JA, Minor M, *et al*. Intubation patterns and outcomes in patients with computed tomography-verified traumatic brain injury. J Trauma 2011;71:1615-9.
26. Bukur M, Kurtovic S, Berry C, Tanios M, Margulies DR, Ley EJ, *et al*. Pre-hospital intubation is associated with increased mortality after traumatic brain injury. J Surg Res 2011;170:e117-21.
27. Dunford JV, Davis DP, Ochs M, Doney M, Hoyt DB. Incidence of transient hypoxia and pulse rate reactivity during paramedic rapid sequence intubation. Ann Emerg Med 2003;42:721-8.
28. Talving P, Teixeira PG, Barmparas G, DuBose J, Inaba K, Lam L, *et al*. Helicopter evacuation of trauma victims in Los Angeles: Does it improve survival? World J Surg 2009;33:2469-76.
29. Carr BG, Caplan JM, Pryor JP, Branas CC. A meta-analysis of prehospital care times for trauma. Prehosp Emerg Care 2006;10:198-206.
30. Stiell IG, Nesbitt LP, Pickett W, Munkley D, Spaite DW, Banek J, *et al*., OPALS Study Group. The OPALS Major Trauma Study: Impact of advanced life-support on survival and morbidity. CMAJ 2008;178:1141-52.
31. Bigdeli M, Khorasani-Zavareh D, Mohammadi R. Pre-hospital care time intervals among victims of road traffic injuries in Iran. A cross-sectional study. BMC Public Health 2010;10:406.
32. Hoyer CC, Christensen EF, Andersen NT. On-scene time in advanced trauma life support by anaesthesiologists. Eur J Emerg Med 2006;13:156-9.

33. Gausche M, Lewis RJ, Stratton SJ, Haynes BE, Gunter CS, Goodrich SM, *et al*. Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome: A controlled clinical trial. JAMA 2000;283:783-90.
34. Davis DP, Stern J, Sise MJ, Hoyt DB. A follow-up analysis of factors associated with head-injury mortality after paramedic rapid sequence intubation. J Trauma 2005;59:486-90.
35. Aydin S, Overwater E, Saltzherr TP, Jin PH, van Exter P, Ponsen KJ, *et al*. The association of mobile medical team involvement on on-scene times and mortality in trauma patients. J Trauma 2010;69:589-94.
36. Spaite DW, Tse DJ, Valenzuela TD, Criss EA, Meislin HW, Mahoney M, *et al*. The impact of injury severity and prehospital procedures on scene time in victims of major trauma. Ann Emerg Med 1991;20:1299-305.
37. Birk HO, Henriksen LO. Prehospital interventions: On-scene time and ambulance technicians' experience. Prehosp Disaster Med 2002;17:167-9.
38. Cudnik M, Newgard CD, Wang H, Bangs C, Herrington R 4th. Endotracheal intubation increases out of hospital time in trauma patients. Prehosp Emerg Care 2007;11:224-9.
39. Wyen H, Lefering R, Maegele M, Brockamp T, Wafaisade A, Wutzler S, *et al*., TraumaRegister DGU. The golden hour of shock-how time is running out: Prehospital time intervals in Germany-a multivariate analysis of 15, 103 patients from the TraumaRegister DGU (R). Emerg Med J 2013;30:1048-55.
40. Lerner EB, Billittier AJ, Dorn JM, Wu YW. Is total out-of-hospital time a significant predictor of trauma patient mortality? Acad Emerg Med 2003;10:949-54.
41. Petri RW, Dyer A, Lumpkin J. The effect of prehospital transport time on the mortality from traumatic injury. Prehosp Disaster Med 1995;10:24-9.

How to cite this article: Al-Thani H, El-Menyar A, Latifi R. Prehospital versus Emergency Room Intubation of Trauma Patients in Qatar: A-2-year Observational Study. North Am J Med Sci 2014;6:12-8.

Source of Support: Nil. **Conflict of Interest:** None declared.