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The Factors Related to Death of Trauma Preventable Death Patients in Rajavithi Hospital

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Authors' contributions

This work was carried out in collaboration among all authors. Author TN designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors UT and CS managed the analyses of the study. Authors DJ and KN managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To study the factors related to death of traumatic preventable death patients with probability of survival score more than 0.75
Methodology: A 1:4 case-control study was conducted on traumatic preventable death patients with probability of survival score more than 0.75 who received treatment at the Emergency Department and was admitted in Rajavithi Hospital between 2015 and 2018. Data were retrieved from Rajavithi trauma registry. Statistical analysis using Chi-square test, student t-test, and Multiple logistic regression was employed for factors associated with death of trauma.
Results: There were 36 cases (death) and 150 controls (survivors). In cases group,

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21 (61.1%) were male with mean age of 61.36±20.23 years. 26 (72.2%) had underlying diseases. 22 (61.10%) of these injuries occurred at home. The cause of accidents are categorized to fall injury occurring 21 (58.3%), and blunt mechanism of injury 35 (97.20%). The mean Injury Severity Score was 17.81±9.66. Factors significantly associated with increased death are age (Adjust OR: 1.05 (1.01-1.08), *P* = .02), pulse rate (Adjusted OR): 1.05 (1.01-1.08), *P* = .01), underlying disease (Adjusted OR): 12.0 (2.29-62.88), and Injury Severity Score (Adjusted OR): 1.29 (1.16-1.43), *P* < .001)

Conclusion: The factors related to death of traumatic preventable death patients with probability of survival score more than 0.75 were age, pulse rate, underlying disease, and Injury Severity Score.

Keywords: Trauma registry; probability of survival score; geriatric trauma; Traumatic Preventable Death (TPD); Injury Severity Score (*ISS*).

1. INTRODUCTION

Trauma injury is the main cause of patients death worldwide. In 2011, the World Health Organization (WHO) reported that trauma injuries were the second most common cause of death in Thailand. On yearly average 40,000 people die a year due to trauma injuries, a mortality rate of 60 per 100,000 persons [1,2]. The causes of injury are acts of violence against others or oneself, traffic crashes, burns, drowning, falls, and poisonings [3]. Approximately 12,000 injured patients are admitted to Rajavithi Hospital per year. To enable evaluation of the quality of care supplied to trauma patients and to pinpoint areas which could be improved, preventable deaths of traumatic cases in hospitals need to be analyzed in a level-1 trauma center [4,5].

The increasing number of deaths of geriatric trauma patients in these institutes presents a challenging problem for trauma systems care and emergency departments in managing trauma prevention, trauma system care, and interventions which may improve the outcomes [5]. All admitted trauma patients were assessed possibility to survive (Ps) by Trauma registry injury severity score (TRISS) methodology which determines the probability of survival (PS) of a patient from the Injury Severity Score (ISS) and Revise Trauma Score (RTS). The ISS is calculated by abbreviated injury score (The ISS ranges from 1-75, and an ISS of 75 is assigned to anyone with AIS of 6) and RTS is calculated by Glasgow Coma Score (GCS), systolic blood pressure, respiratory rate, age. The Ps <0.75 mean potential preventable death and Ps ≥0.75 preventable death. However, in Rajavithi Hospital, we found some patients died. Trauma-related deaths are mostly preventable, and prevention can decrease the rate of deaths [6]. However, the factor related to death cases and increasing alive groups in trauma patients due to accidents is less studied in Thailand. This research aims to study the factors related to death in TPD patients who had probability of survival (Ps) >0.75.

2. MATERIAL AND METHODS

2.1 Study Design

A retrospective 1:4 case-control study was conducted to determine the factors related to death in traumatic preventable death (TPD) patients (Ps) >0.75. The study was conducted with complete injury assessment data and continuous treatment until the end of treatment at Rajavithi Hospital. To study populations in 2 groups 1. Cases group; trauma patients who had (Ps) >0.75 and death in hospital. 2. Control group; trauma patients had (Ps) >0.75 and survived at discharge. The sample size in each group was calculated by two independent means formula based on the study of Sim J, et al [7]. The ISS (score) factor had differentiated odd ratio was 1.042 (1.019-1.065), cases and control (29.6±9.4 vs 24.0±7.8) ratio 1: 4 cases 26, control 104. This study increases sample size in order to prevent some data loss. The samples size estimates in case and control groups were 36 and 150 cases, respectively.

2.2 Data Collection

Investigators collected retrospective data from Rajavithi trauma registry between October 2015 and September 2018. The data (which was) collected include patient demographics, locations of injury, causes, transportation (Private car, Ambulances) and patient deaths.

2.3 Statistical Analysis

Data analysis was performed using the IBM SPSS version 22.0. Categorical variables were

compared using Chi-square or Fisher exact test as appropriate. Continuous variables were compared between groups using Student's t-test. Multiple logistic regression was performed to determine the factors related to death of traumatic preventable death patients with probability of survival score more than 0.75. A p-value less than 0.05 was considered statistically significant.

3. RESULTS

The general characteristic of trauma patients admitted between 36 cases (death) and the 150 controls (survive) were analyzed. In cases group 61.1% of gender were male and the mean patient age was 61.36±20.23 years, 72.2% (26) of cases had underlying diseases. The top three underlying diseases were hypertension (58%) followed by liver disease (19.2%) and other (heart disease, renal disease, Soft tissue infection), which were less than 5%. The most common location of injury occurred at home 22 (61.1%), the main cause of accident was fall injury 21 (58.3%). Blunt accidents 35 (97.2%) were the most common mechanism of death; the mean Injury Severity Score (ISS) of cases was 17.81±9.66 which is higher than those in control of 8.39±5.08. The transportation in cases were transporting from location of injury to hospital by private cars (52.8%) more than ambulances (47.2%). In control group; males' finding were similar to these of cases group found which was similar to cases group. The different factors of control group were the location of injury occurred outdoor (street, industrial public, other). The main causes of accident were motorcycle accident, gunshot wound and assault stab wound, mostly having no underlying disease as shown in (Table 1).

Multivariate logistic regression analyses showed that age (Adjusted OR 1.05, 95%CI 1.01-1.08, *P* = .02), pulse rate (Adjusted OR 1.05, 95%CI 1.01-1.08, *P* = .01), underlying disease (Adjusted OR 12.0 95%CI 2.29-62.88, *P* = .01) and Injury Severity Score (Adjusted OR 1.29, 95%CI 1.16-1.43, *P* < .001) were significantly associated with death as shown in (Table 2). However, causes of accident and location of injury were not significantly associated with death.

4. DISCUSSION

This study focused on186 TPD patients (Ps) >0.75 who visited to Emergency Department (ED) and hospitalized. The mean age of cases was 61.36±20.23 years old, which was much higher than control. Fall was the most common cause of injury 58.3% which is similar to a previous study, the three most common causes of geriatric trauma were falls, motor vehicle collisions, and pedestrian-related vehicle accidents [8]. In the present study, the home is the most common place (61.1%), where accidents occur, followed by outdoor such as street, industrial public and others Rajavithi trauma registry data reported TPD (Ps) >0.75 death rate 4%-5% of trauma admission the same as other trauma centers [9]. This death rate was less than other lower-middle income countries worldwide. The traumatic preventable death rate had 23%- 56% in other lower-middle income countries [10,11]. The quality hospital needs to reach the highest quality of hospital services trauma in Rajavithi Hospital (trauma center level-1) highest quality of hospital service in order to limit death cases to be less than 2% of TPD patients (Ps) >0.75.

This study shows that the factors related to death were similar as previous studies. The increase age was one of the factors in TPD death > 60 years. A Center of Disease Control and Prevention (CDC) report showed continuous growth of senior population during (the 10-years of)1993-2003 with an attendant increase in road traffic injuries involving the elderly [12]. Similar to Knudson et al, an analysis of various factors using multiple logistic regression models to find factors related to death found statistically significant factors, one of which was that each additional year of age resulted in a 1.06 increase in the chance of death [13]. Van der Sluis CK and colleagues, study long-term survival is mainly determined by host factors a person's age [14]. As the Thai and world population continue to increase life expectancy, the number of at-risk geriatric trauma patients will also grow patients with higher pulse rate has higher death rate similar to Sina Jeloda et al's study, which identifies independent risk factors of death in trauma patients abnormal pulse rate [15]. The reported aging group who had underlying disease had mortality rate than younger. Patients with pulse rate were 1.05 times more likely to die of injury.

The underlying disease factor was related to increase death in TPD (Ps) >0.75. However, previous reports of aging groups found that elderly accident patients had double the mortality rate of their younger counterparts and had significantly more underlying diseases, as per the Perdue PW [16] and Chang WH [17] studies. Linda J study [18] the relationship of age, injury severity, injury types, comorbid conditions, levels of care,

and survivals found the underlying diseases (cardiovascular, liver, renal disease and other diseases) in trauma cases increase mortality which is similar as previous studies Grossman et al., and this study [19]. The physiology of elderly people deteriorates as they age, with the result that they have little reserve power, tend to have underlying disease. Moreover, geriatric patients with increasing underlying diseases were at higher risk of home accident and more severe injuries. Higher Injury Severity Score (ISS) correlated with higher risk of death. The Severity of injury patients as Injury Severity Score (ISS) were 1.29 times, with every one-point rise in Injury Severity Score (ISS), the chance of death increased 1.29 times, and this is in keeping with the Kuhl DA study [20]. ISS has been found to be the variable that most significantly correlated with mortality.

Preventable deaths in trauma patients (Ps) >0.75 require better decision-making and improved trauma care systems in Emergency Department. Geriatric patients who had high pulse rate, underlying disease and high Injury Severity Score (ISS) had early warning risks in deaths trauma cases.

The limitation of this study is unmatched age of case and control group. The injury pattern of case group tends to be fall which is mostly found in elderly. Further research should be matched in age of subjects in order to prove the factors and explore in a more specific group. In the future, as geriatric patients are growing. More study triage measures in traumatic ageing group can increase survival rate in TPD.

Table 1. Characteristics of traumatic patients between case and control group (n = 186)

Factors	Case (n=36)	Control (n= 150)	*P*
Gender			.06
Male	22(61.1)	115(76.7)	
Female	14(38.9)	35(23.3)	
Age (years)	61.36±20.23	38.28±18.80	< .001*
Pulse rate (times/minutes)	98.03±20.48	89.92±19.79	.03*
underlying diseases #			< .001*
No	10 (27.8)	122 (81.3)	
Yes	26(72.2)	28(18.7)	
Location of injury			.01*
Outdoor (Street, Industrial public other)	14 (38.9)	107 (71.3)	
Indoor (Home)	22 (61.1)	43 (28.7)	
Cause of accident			< .001*
Other (Gunshot wound, Assault stab wound, Motorcycle accident)	15(41.7)	113(75.3)	
Fall	21(58.3)	37(24.7)	
Mechanism of injury			.03*
Blunt	35(97.2)	125(83.3)	
Penetrating	1(2.8)	25(16.7)	
Personnel Protective Equipment			.31
No	35 (97.2)	136 (90.7)	
Yes (Helmet, Safety belt)	1 (2.8)	14 (9.3)	
Glasgow Coma Scale	13.19±3.41	14.65±1.32	.02*
Probability of survival (Ps)	0.93±0.06	0.99±0.02	< .001*
Injury Severity Score (ISS)	17.81±9.66	8.39±5.08	< .001*
Revised Trauma Score (RTS)	7.45±0.75	7.68±0.66	.09
Length of stay care at ED (hour)	3.68±1.25	3.41±1.55	.34
Length of hospital stay (days)	26.89±34.20	11.67±13.60	.01*
Shock index	0.80±0.27	0.73±0.24	.12
Surgery operation			.75
No	19 (52.8)	83 (55.7)	
Yes	17 (47.2)	66 (44.3)	

*Value are represented as number (percent, and Mean±SD, * significant at P = .05 from Chi-square test and Student t-test, # =Hypertension, Diabetic Mellitus, Liver disease, Renal disease, Heart disease, other*

Table 2. Multivariable logistic regression models identifying the factors predicting the early mortality of trauma patients

Factors	Crude OR (95% CI)	*P*	Adjusted OR (95% CI)	*P*
Age	1.05 (1.03-1.07)	< .001*	1.05(1.01-1.08)	.02*
Pulse rate	1.02(1.01-1.04)	.04*	1.05 (1.01-1.08)	.01*
underlying diseases #	11.33(4.91-26.16)	< .001*	12.0 (2.29-62.88)	.01*
Injury Severity Score	1.19 (1.12-1.26)	< .001*	1.29 (1.16-1.43)	< .001*
Cause of accident				
Other (Gunshot wound, Assault stab wound, Motorcycle accident)	1		1	
Fall	4.28(2.00-9.14)	< .001*	1.65(0.32-8.57)	.55
Location of Injury				
Outdoor (Street, Industrial public)	1		1	
Indoor (Home)	3.91(1.83-8.34)	.01*	2.03(0.39-10.61)	.40

*Value are represented as number (percent), and Mean±SD, * significant at P = .05 from Multiple logistic regression, # =Hypertension, Diabetic Mellitus, Liver disease, Renal disease, Heart disease, other*

5. CONCLUSION

The four factors related to death in TPD patients who had probability of survival score (Ps) >0.75 in super tertiary Hospital (trauma center level -1) were advancing age, increased pulse rate, underlying diseases and high Injury Severity Score (ISS).

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

This study was approved by the Research Ethics Committee Rajavithi Hospital, Thailand (REC) (certificate of approval no.60095).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. World Health Organization. Injury: A leading cause of the global burden of disease, 2000. Geneva, WHO. 2011;4-15.
2. Health BoHPaSMoP. Death Rates by Leading Cause of Death per 100,000 populations, Thailand. 2006 and 2010. Health information. 2010;78-81.
3. World Health Organization. Injury and violence: the facts. Geneva, WHO. 2014;2.
4. Moore EE, Feliciano DV, Mattox KL. Trauma. 5th ed: McGraw Hill 2004; 57-84.
5. Champion HR, Copes WS, Sacco WJ. A new characterization of injury severity. J Trauma. 1990;30:539.
6. Gholipour C, Rad BS, Vahdati SS. Evaluation of preventable trauma death in emergency department of Imam Reza hospital**.** World J Emerg Med. 2016;7:135-7.
7. Sim J, Lee J, Lee JC, Heo Y, Wang H, Jung K. Risk factors for mortality of severe trauma based on 3 years' data at a single Korean institution. Annals of Surgical Treatment and Research. 2015;89:215.
8. Pudelek B. Geriatric trauma: special needs for a special population. AACN Clin Issues. 2002; 13:61-72.
9. Teixeira PGR, et al. Preventable or potentially preventable mortality at a mature trauma center. Journal of Trauma and Acute Care Surgery, 2007;63.6:1338-1347.
10. Yeboah D, Mock C, Karikari P, Agyei-Baffour P, Donkor P, Ebel B. Minimizing preventable trauma deaths in a limited-resource setting: a test-case of a multidisciplinary panel review approach at the KomfoAnokye Teaching Hospital in Ghana. World Journal of Surgery. 2014;38: 1707-12.

11. Roy N, Veetil DK, Khajanchi MU, Kumar V, Solomon H, Kamble J, Basak D, Tomson G, von Schreeb J. Learning from 2523 trauma deaths in India-opportunities to prevent in-hospital deaths. BMC Health Services Research. 2017;17: 1-8.
12. Stevens A, Ryan G, Kresnow M. Fatalities and injuries from falls among older adults United States, 1993-2003 and 2001-2005. Morb Mortal WklyRep. 2006;55:1221-4.
13. Knudson MM, Lieberman J, Morris JA. Mortality factors in geriatric blunt trauma patients. Arch Surg. 1994;129:448-53.
14. Vander Sluis CK, Timmer HW, Eisma WH. Outcome in elderly injured patients: injury severity versus host factors. Injury 1997;28:588-92.
15. Jelodar S, Jafari P, Yadollahi M, Jahromi GS, Khalili H. Potential Risk Factors of Death in Multiple Trauma Patients. Emergency 2014;2:170-173.
16. Perdue PW, Watts DD, Kaufmann CR, Trask AL. Differences in mortality between elderly and younger adult trauma patients: geriatric status increases risk of delayed death. J Trauma.1998; 45:805-10.
17. Chang WH, Tsai SH, Su YJ. Trauma mortality factors in the elderly population. Int J Gerontology 2008;2:11-7.
18. Scheetz LJ. Relationship of age, injury severity, injury type, comorbid conditions, level of care, and survival among older motor vehicle trauma patients. Research Fife in nursing & health. 2005;28:198-209.
19. Grossman MD, Miller D, Scaff DW, Arcona S. When is an elder old? Effect of preexisting conditions on mortality in geriatric trauma. Journal of Trauma and Acute Care Surgery. 2002; 52:242-6.
20. Kuhls DA, Malone DL, McCarter RJ, Napolitano LM. Predictors of mortality in adult trauma patients: the physiologic trauma score is equivalent to the Trauma and Injury Severity Score. J Am Coll Surg. 2002;194:695-704.

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