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Original Article

Effectiveness of Trauma Fast Track Protocol in Surat Thani Hospital

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Abstract

Background: The trauma audit showed that delayed operative surgery was the most important problem for the mortality rate in trauma patients. This study aims to compare timing from the emergency room (ER) to the operative room (OR) and the mortality rate of trauma patients with blunt or penetrated abdomen or active vascular injury with shock before and after trauma fast track (TFT) was established in Surat Thani Hospital.

Materials and Methods: Prospective comparative study with historical control aimed to analyze the ssociation between factors in fast-track trauma patients who visit the Emergency Department (ED) of our hospital between 1 September 2019 to 31 March 2022. We collected 190 trauma patients who met the criteria of TFT. The outcomes were analyzed, including comparing timing from ER to OR, mortality rate, and factors associated with mortality. Given a statistically significant difference of ***p***-value < 0.05.

Results: There were 87 patients in the pre-protocol group and 103 patients in the post-protocol group. The results showed average times from ER to OR time in the post-protocol group were less than the pre-protocol group (31 vs. 58-minute, ***p***-value < 0.001). The mortality cases of the pre- and post-protocol groups were 20 cases (24.10%) and 13 cases (12.15%); respectively, the ***p***-value was 0.031. However, we found that several factors correlated with mortality rate.

Conclusion: After implementing the TFT, injured patients underwent surgery earlier, and the mortality rate decreased. To improve survival, the assessment and referral system and quality of care should be improved and standardized.

Keywords: Trauma patients, Trauma Fast Track, ER to OR time

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Introduction

Injuries are defended as the result of road traffic crashes, falls, drowning, burns, poisoning, and acts of violence against oneself or others. More than 5 million people die each year as a result of injuries. This accounts for 9% of the world's deaths.[1] Injuries are also the leading cause of death for Americans aged 1 to 44 years and the third leading cause of death overall. Injury deaths have risen in the United States over the past 2 decades, from 52 per 100,000 in 2000 to 72 per 100,000 in 2016.[2] In Thailand, mortality rates by leading cause of death, road traffic accidents increased from 24.1 to 25.4 person per 100,000 population in 2017 and 2021 respectively.[3]

Abdominal trauma is also the leading cause of death in many trauma patients. Because the abdominal cavity contains vital organs such as the liver, spleen, kidneys, gastrointestinal tract, and vascular structure. When managing patients with general injuries, special attention should be given to abdominal injuries. The history taking and physical examination are the most important to diagnosing trauma patients, after the primary survey, adjunct to the primary survey, and secondary survey, considering the mechanism of the event in detail and the trajectory of the force acting on the body in blunt or penetrating injuries is the most significant to diagnosis and plan of investigation.

Schwartz's principles of surgery[4] indicated immediate surgical treatment in penetrating injured category, e.g., hemodynamic instability in gunshot wound or stab wound, peritonitis, and bowel evisceration. Moreover, in blunt abdominal mechanism categories such as FAST positive with hemodynamic instability and peritonitis, there should be no delay to operative management too. In patients with a positive FAST who required emergent laparotomy, delay in operation was associated with increased early and late in-hospital mortality. Delays in time to operation in trauma patients with a positive FAST should be minimized.[5]

The concept of a "Fast track," as defined by the Thai Ministry of Public Health,[6] refers to a healthcare service within the trauma system that aims to provide timely and critical care to patients within the "Golden hour" for definitive treatment (achieving the goal of 60 minutes from the door to the operating room). Each year, trauma audits have consistently shown that delayed surgical procedures are the most significant factor contributing to the mortality rate among trauma patients. To address this issue, a trauma fast track (TFT) has been implemented at Surat Thani Hospital to reduce the waiting time from the emergency room (ER) to the operating room (OR). This study aims to compare the timing from the ER to the OR and the mortality rate of trauma patients with blunt or penetrating abdominal injuries or active vascular injuries with shock who require immediate operative management before and after the establishment of the trauma fast track at Surat Thani Hospital.

Materials and Methods

This study utilized a prospective comparative design with a historical control group. It focused on fast-track trauma patients who presented to the ER of Surat Thani Hospital from September 2019 to August 2020 in the pre-protocol group and between September 2020 and March 2022 in the post-protocol group.

Study population, the inclusion criteria encompassed injured patients who visited the ER department of Surat Thani Hospital and had a mechanism of trauma involving blunt abdominal injury, penetrating abdominal injury, or active vascular injury with shock, the age range for inclusion was 15 to 90 years old, and immediate operative treatment from the ER to the operating room was required. Exclusion criteria consisted of patients who underwent cardiopulmonary resuscitation (CPR) either in the prehospital setting or in the ER, patients receiving conservative treatment, pregnant patients, and those undergoing operative treatment for other conditions such as neurological, orthopedic, or cardiovascular surgery.

Data were collected from 25,820 cases of minor and major trauma that visited the ER during the study period; the activated trauma fast-track protocol encompassed 739 injured cases, including those requiring endotracheal intubation, as well as cases of penetrating or blunt abdominal, chest, or neck injuries, and vascular injuries with shock.

Finally, we enrolled 190 patients who required immediate operative treatment and fulfilled the mechanism in our study: blunt abdominal injury with FAST positive and unstable hemodynamic or peritonitis, penetrating abdominal injury, and vascular injury that had emergency conditions to operative treatment. In pre-protocol, we found 83 and 107 patients in post-protocol, as shown in Figure 1.

This study was approved by the institutional ethics committee. Demographic data, such as gender, age, mechanism of injury, visit type, initial Glasgow Coma

Scale (GCS), initial systolic blood pressure (SBP), initial pulse rate (PR), initial hemoglobin (Hb) levels, Revised Trauma Score (RTS), comorbidity, operative time, OR waiting time, and mortality rate, hospital stay were collected. Multiple logistic regression defines independent factors for mortality rate. The significance of difference was estimated using chi-square for qualitative variables, significantly attaining $p \leq 0.05$ on univariate analysis or multivariate analysis considered clinically relevant in final statistical analysis using Stata® version 13.

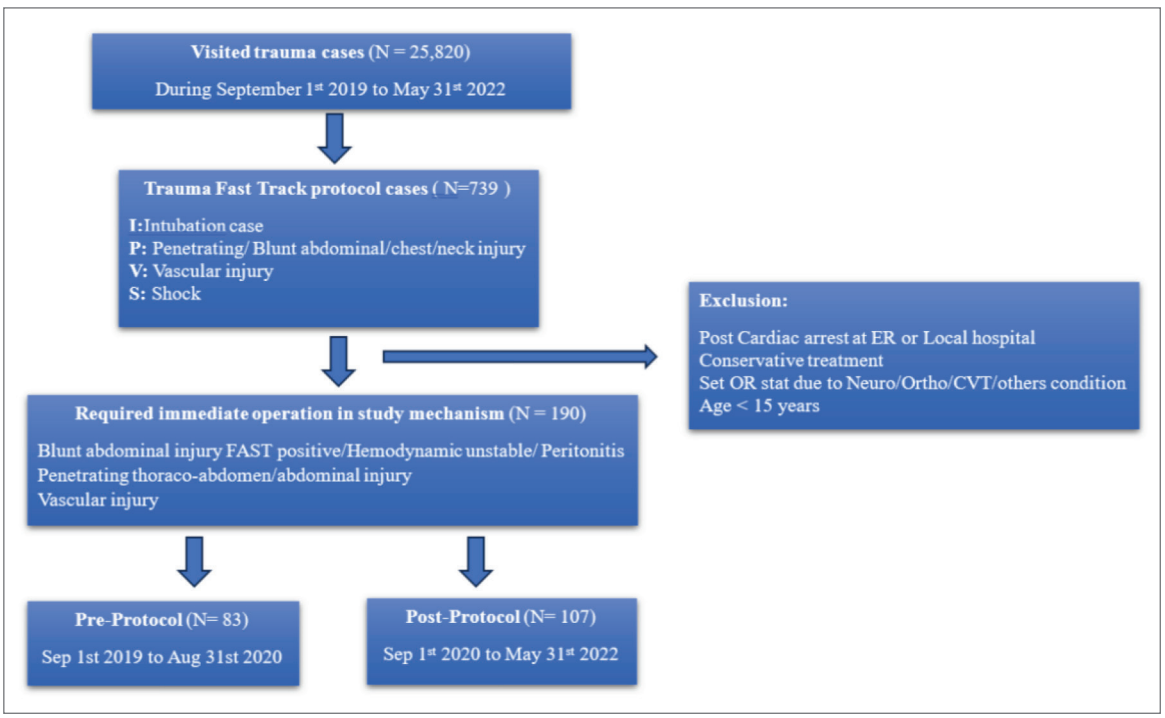

Figure 1

Results

Our study included 190 patients who underwent emergency operative treatment; 83 cases (45.79%) were in the pre-protocol group, while 107 cases (54.21%) were in the post-protocol group. The majority of the patients were males (79%) and aged under 60 (88%). Half of the patients were injured from blunt abdominal mechanisms (51.58%), a third from penetrating mechanisms (32.63%), and 15.79% from active vascular injuries. Most of the patients were transferred from the rural hospitals (82%). We found that three-quarters of the cohort had SBP ≥ 90 mmHg (73%), over half exhibited a pulse rate ≥ 100 beats per minute (55%), and initial hemoglobin levels were ≥ 10 mg/dl for 62%. In addition, we found 92% scored ≥ 4 in RTS. The majority, approximately 85% of the injured patients, had no comorbidities, and 65% took operative duration ≤ 60 minutes. However, the clinical epidemiological characteristics and laboratory data of this study are shown in Table 1.

Table 1 Demographic data

Demographic data	Number (Percent)		*p*-value
	Pre protocol (N = 83)	Post protocol (N = 107)	
Gender, n (%)			
Male	63 (75.90)	88 (82.24)	0.283
Age (years)			
< 60	72 (86.75)	97 (90.65)	0.394
Mechanism, n (%)			
Blunt abdominal	48 (57.83)	50 (46.73)	0.258
Penetrating	25 (30.12)	37 (34.58)	
Vascular injury	10 (12.05)	20 (18.69)	
Visit type, n (%)			
Referral	70 (84.34)	85 (79.44)	0.682
EMS	11 (13.25)	19 (17.76)	
Direct	2 (2.41)	3 (2.80)	
GCS (Glasgow Coma Score)			
< 8	18 (21.69)	11 (10.28)	0.095
8 - 12	9 (10.84)	13 (12.15)	
13 - 15	56 (67.47)	83 (77.57)	
SBP (mmHg)			
< 90	22 (26.51)	24 (22.43)	0.515
Pulse rate (bpm)			
< 100	33 (39.76)	51 (47.66)	0.277
Hemoglobin (mg/dl)			
< 10	38 (45.78)	33 (30.84)	0.035
Revised Trauma Score			
< 4	8 (9.64)	7 (6.54)	0.432
Comorbidity			
Yes	13 (15.66)	14 (13.08)	0.614
Operative duration time			
< 60 (min)	33 (39.76)	33 (30.84)	0.200

After implementing the trauma fast-track protocol, we found that the average time from the emergency room to the operating room was 32 minutes in the post-protocol group, while the average time was 59 minutes in the pre-protocol group. Furthermore, the two groups were significantly statistically different (p-value < 0.001) (Table 2). The mortality rates decreased in the post-protocol group, and survival rates also increased. In addition, there was a statistically significant difference between the two groups, as shown in Table 3.

Table 2 Primary outcome

Time to OR	Time to OR (min)		*p*-value
	Pre protocol (N = 83)	Post protocol (N = 107)	
Time average	58.73	31.83	< 0.001

Table 3 Secondary outcome – Mortality rate

	Number (Percent)		*p*-value
	Pre protocol (N = 83)	Post protocol (N = 107)	
Dead	16 (19.28)	13 (12.15)	0.031

Additionally, we identified factors independently associated with mortality rate through logistic regression analysis. Following univariate and multivariate analysis, we observed significant correlations between mortality rate and the following variables: GCS ≤ 8 (p = 0.02) and initial Hb < 10 mg/dl (p = 0.005), as shown in Table 4.

Table 4 Univariate and multivariate analysis of the factors that correlated with the mortality rate

Variables	Univariate Analysis			Multivariate Analysis		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Age ≥ 60 yrs.	0.67	0.27 - 1.63	0.39	0.70	0.28 - 1.73	0.43
GCS ≤ 8	0.40	0.18 - 0.89	0.01	0.41	0.19 - 0.92	0.02
SBP < 90 mmHg	0.76	0.39 - 1.49	0.42	0.77	0.39 - 1.50	0.44
Pulse ≥ 100 bpm	0.73	0.41 - 1.31	0.29	0.71	0.40 - 1.27	0.24
Hb < 10	0.41	0.22 - 0.77	0.003	0.43	0.23 - 0.78	0.005
Co-morbidity; present	0.81	0.36 - 1.84	0.61	0.86	0.38 - 1.97	0.73
Operative time ≥ 60 min	1.48	0.80 - 2.71	0.20	1.44	0.79 - 2.63	0.23

Discussion

This kind of TFT research has been conducted in multi-hospitals that establish the protocol, such as in the USA,[7] Khon Kaen Hospital,[8,9] Prachinburi Hospital,[10] and Buddhachinaraj Hospital[11] Phitsanulok. Our research focuses on general surgery mechanisms such as blunt, penetrating abdomen, and vascular injury that require emergency operative treatment, excluding neurosurgery, orthopedics, and cardiothoracic conditions.

Our study in demographic data showed mechanism mostly half of the patients were injured from blunt abdominal mechanism (51.58%), while T Impool[8,9] (Khon Kaen Hospital) mostly mechanism is from penetrating injury with shock (74.29%), our study in Revised Trauma Score (RTS) shown no difference between pre and post protocol group while Kraysubun C[10] (Prachinburi Hospital) shown more severity in post protocol group. However, there were no significant differences between

pre- and post-protocol groups in terms of gender, age, mechanism, type of visit, GSS, initial SBP, initial pulse rate, RTS, Comorbidity, or Operative time. Meanwhile, initial hemoglobin levels were shown to be ≥ 10, mostly in the post-protocol group (62%).

The aim of this study was to examine the impact of implementing a trauma care system outcome, specifically focusing on the mortality rate and the ER to OR time. The findings of this study revealed a decrease in both mortality rates among injured individuals and waiting time. These results, similar to previous research reports such as in Khon Kaen Hospital,[8,9] Prachinburi Hospital,[10] and Buddhachinaraj Hospital,[11] revealed that patients who underwent surgery experienced reduced waiting times, leading to a decrease in the mortality rate.

Recently, studies reported[12-15] that decreased GSC, and high Injury Severity Score (ISS) scores were associated with mortality rates. similar to this study that reported GCS < 8 and initial hemoglobin < 10 mg/dl correlated with mortality risk based on univariate and multivariate analysis. Both factors were statistically different between the pre- and post-protocol groups, which supports that the TFT protocol had an effect on the mortality rate.

Based on these findings, it is advisable to minimize unnecessary procedures or interventions at the ER. Ensuring adequate fluid resuscitation and the availability of blood components were crucial aspects of the resuscitation process. Implementing the protocol at local hospitals enables the proper activation of TFT and facilitates effective resuscitation. It is important to practice routinely and review the protocol within the local hospital, emergency department, trauma team, and multidisciplinary team. Regular case discussions and feedback sessions are essential for continuous learning and improving patient outcomes.

Conclusion

Following the implementation of the TFT protocol, there was a significant reduction in the ER-to-OR time for patients requiring immediate operation, and the mortality rates also showed a significant decrease. Among the factors contributing to mortality cases, having GCS ≤ 8 and initial hemoglobin < 10 mg/dl were found to be significant.

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