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The effect of a new in-hospital trauma care model on the outcomes of severely injured trauma patients in the emergency department: a retrospective observational study in China

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Abstract

Background The mortality and disability rates among severely injured trauma patients are very high. This study aimed to investigate whether a new in-hospital trauma care model can improve emergency care efficiency and enhance the prognosis of severely injured trauma patients.

Methods This retrospective observational study included 366 severely injured trauma patients (ISS ≥ 16) who were admitted to the emergency department of a tertiary hospital between 2023 and 2024. Based on the emergency care model used, patients were divided into the traditional model group ($n = 213$) from January to April 2023 and the new model group ($n = 153$) from January to April 2024. The general clinical data, prognosis information, as well as seven emergency quality control indicators for both groups were collected and analyzed.

Results The study included 270 male patients (73.8%) and 96 female patients (26.2%), with a mean age of 56 (44, 69) years. No significant differences were found between the two groups regarding gender, age, time since injury, mechanism of injury, and vital signs upon admission ($P > 0.05$). The new model group had significantly shorter times for establishing effective circulation access (15.66 ± 3.36 vs. 9.44 ± 3.18 min), establishing an artificial airway (36.90 ± 12.23 vs. 23.91 ± 9.07 min), preparing blood transfusion (48.84 ± 5.73 vs. 31.0 ± 64.67 min), completing whole-body CT scans (57.18 ± 8.26 vs. 42.17 ± 7.28 min), and developing a definitive treatment plan (77.45 ± 6.26 vs. 56.50 ± 6.35 min) compared to the traditional model group. Additionally, the new model group had a significantly higher rate of bedside FAST completion (92.8% vs. 53.1%) and a higher success rate of resuscitation within the first hour (70.9% vs. 85.0%) than the traditional model group. Regarding prognosis, the new model group had a lower overall in-hospital mortality rate (12.1% vs. 5.9%) and a lower incidence of complications such as DIC and ARDS (23.9% vs. 9.2%, all $P < 0.05$).

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Conclusion The new in-hospital trauma care model significantly enhanced the in-hospital emergency care efficiency, reduced in-hospital mortality, and decreased the incidence of complications for severely injured patients, which may serve as a useful reference for developing countries in similar settings.

Clinical trial number Not applicable.

Keywords Emergency care, Injury, Trauma, Resuscitation, In-hospital

Introduction

In China, approximately 60 million individuals suffer from trauma each year due to traffic accidents, falls, natural disasters, and other causes, with severe trauma accounting for up to 800,000 fatalities, which represents 10% of total annual deaths [1]. Trauma is also the leading cause of death among individuals under the age of 45, and the direct medical costs associated with trauma treatment amount to 65 billion RMB annually [2, 3]. The high rates of disability and mortality resulting from severe trauma not only significantly impact the quality of life of affected individuals and their families but also impose long-term negative effects on socio-economic development [4–6]. These factors make trauma care and treatment a critical challenge for healthcare systems in China.

Compared with developed countries, which began establishing trauma care systems in the 1970s, China initiated its trauma care system much later. The China Trauma Care Alliance and the first National Trauma Medical Center was established in 2016 and 2019, respectively, accompanied by a series of policies [7]. Unlike the independent trauma center model implemented in developed countries like the United States, China relies on existing hospitals to build a "China Regional Trauma Care System". This system is organized by administrative regions, with one large tertiary hospital serving as the trauma center and five to six secondary hospitals functioning as trauma care sites within each region [8]. Currently, this system has been implemented in approximately two-thirds of China's cities [9]. However, despite the fact that all of these hospitals can receive patients with severe multiple injuries, most of them still lack specialty construction and specialized treatment teams in terms of discipline configuration [10]. Furthermore, China's vast geographical area results in significant regional variation in trauma care models. During the pre-hospital phase, three primary modes exist: (1) the command mode: Emergency medical services (EMS) system oversees operations but does not perform the rescue; (2) the affiliation mode: EMS is integrated within a hospital department that manages both prehospital and in-hospital emergency care; (3) the collaborative mode: EMS handles prehospital care, while the hospital manages in-hospital care (This study was conducted in a region that uses a collaborative mode and therefore focuses on improving in-hospital trauma care). In the in-hospital phase, the most common mode in China is specialist consultation, where diagnosis and treatment are organized through ad hoc specialist consultations [11].

In addition to the late initiation of trauma center development, trauma training in China has also progressed slowly. The earliest Advanced Trauma Life Support (ATLS) training course, was introduced in 1997 by the American College of Surgeons (ACS) Hong Kong China Chapter in collaboration with the University of Hong Kong. Although ATLS is the most widely recognized trauma care training program globally, its accessibility to trainees in mainland China was very limited due to its English-language delivery and high cost [12]. It was not until 2016 that the first Mandarin version of the ATLS course was launched in China, achieving positive training outcomes. In the same year, the Chinese Trauma Surgeon Association officially initiated the China Trauma Care Training (CTCT) program, encompassing prehospital first aid, trauma scoring, and standardized trauma care protocols [10]. Currently, CTCT serves as the primary training initiative for first responders across China.

Overall, China's trauma care system and education have made some progress but continue to face significant challenges in the treatment of patients with severe multiple injuries. A study that included data on 3 million patients found that, compared to developed countries, the mortality rates during in-hospital emergency care for patients with severe trauma in China was significantly higher. However, the difference of mortality rate after hospitalization for specialized care was not significant [13]. Previous research has identified several issues within the current in-hospital emergency care system in China. For instance, the lack of information exchange between pre-hospital and in-hospital emergencies can easily lead to prolonged emergency department (ED) stays or secondary referrals [11]. Moreover, The traditional specialist consultation model is less time-sensitive and inadequate for addressing the immediate treatment needs of severe trauma cases [14]. Therefore, Therefore, a more efficient in-hospital emergency care management model is urgently required.

Research has shown that the trauma-related mortality is negatively correlated with the reduction in time to emergency intervention, especially for severely injured trauma patients who require surgical intervention, where the timing of early surgical intervention is crucial to the patient's prognosis [15, 16]. Adhering to the principle of "time is life", we have developed a new model of in-hospital trauma care by improving the traditional methods used in our institution in terms of manpower, methods, materials and management (4 M). The core concept of this model is to maximize the efficiency of emergency care during the first "golden hour" of admission through refined process management and effective multidisciplinary teamwork.

Notably, unlike previous studies that focused on the impact of multidisciplinary collaboration or trauma team activation on clinical outcomes [17–19], this study aimed to evaluate the effects of a comprehensive in-hospital emergency care improvement protocol centered on multidisciplinary teamwork. To achieve this, time-dependent emergency care quality control indicators were included as part of the outcome variables. Furthermore, given the differences in trauma care systems across regions, this study may offer a complementary strategy for optimizing trauma care under varying healthcare resource allocations and provide a scientific basis for improving in-hospital trauma care management, particularly in developing countries. We hypothesized that this newly implemented model significantly enhances the efficiency of in-hospital emergency care for severely injured patients, ultimately improving their prognosis.

Methods

Study design and setting

This retrospective observational study utilized data from the First Affiliated Hospital of Wenzhou Medical University, a provincial-level tertiary teaching hospital located in the eastern coastal region of China. The hospital receives over 1,000 trauma patients annually.

Participants

This study included the severely injured trauma patients admitted to the ED of the First Affiliated Hospital of Wenzhou Medical University, with all patients having an Injury Severity Score (ISS) of ≥ 16 [20]. Patients under 18 years of age and those with injuries occurring more than 24 h prior to admission were excluded from the study.

The hospital started to implement the new in-hospital trauma care model since May 2023, and it was basically perfected in October. Therefore, severely injured trauma patients admitted to the ED from January to April 2023 were selected as the traditional model group; while patients from January to April 2024 were included in the new model group. Figure 1 provides a flowchart of the participant enrollment process.

Intervention

Traditional model group

Manpower: There is no fixed team. Emergency care tasks are led by rotating doctors assigned by the Department of Surgery. Specialists from trauma surgery, neurosurgery, or other departments are consulted as needed. The trauma resuscitation team follows a "one doctor and multiple nurses" model, with no clear division of responsibilities among the nurses. Doctors and nurses undergo monthly assessments of theoretical knowledge and skills; however, no team collaboration training is conducted. The qualification requirements for medical staff are relatively non-strict, and only a few had received ACLS training.

Methods: (1) Trauma alert: Upon arriving at the scene, EMS assesses the patient's condition and issues a phone alert to the hospital. After the patient arrives at the hospital, the ED nurse evaluated the patient using the Modified Early Warning Score (MEWS) and notifies the on-duty physician. (2) Initial assessment and management: The on-duty doctor conducts a routine specialist examination and arranges for an expert consultation. (3) Subsequent examination and treatment: The ED prioritizes the examination and treatment of severely injured patients, but these kind of fast-track services are limited to within ED.

Materials and management: No trauma resuscitation unit (TRU) is available in the resuscitation room. Medical staff must retrieve necessary emergency items and equipment from a designated room. Additionally, there is no dedicated digital trauma care management system for time control, item reconciliation, or other functions.

The traditional trauma emergency care process: After arriving by ambulance or self-presenting, the patient is triaged and sent to the resuscitation room. The nurse then notifies the on-call emergency surgeon to initiate immediate care, while also informing the patient's family to complete registration. Once registered, the doctor orders routine tests and laboratory work. Based on the results, specialty consultations are arranged, and decisions are made regarding surgery or further treatment in specialized departments or the ICU.

New model group

Manpower: A trauma multidisciplinary team (MDT) consisting of emergency medicine, trauma surgery, orthopedics, general surgery, neurosurgery, cardiothoracic surgery, and urology was established. The trauma resuscitation team follows a "two doctors and three nurses" model, which includes one emergency surgeon, one trauma surgeon, one trauma nurse, one airway nurse, and one intravenous access nurse. Doctors and nurses underwent monthly theoretical knowledge and skills assessments. Monthly in-situ simulation drills and

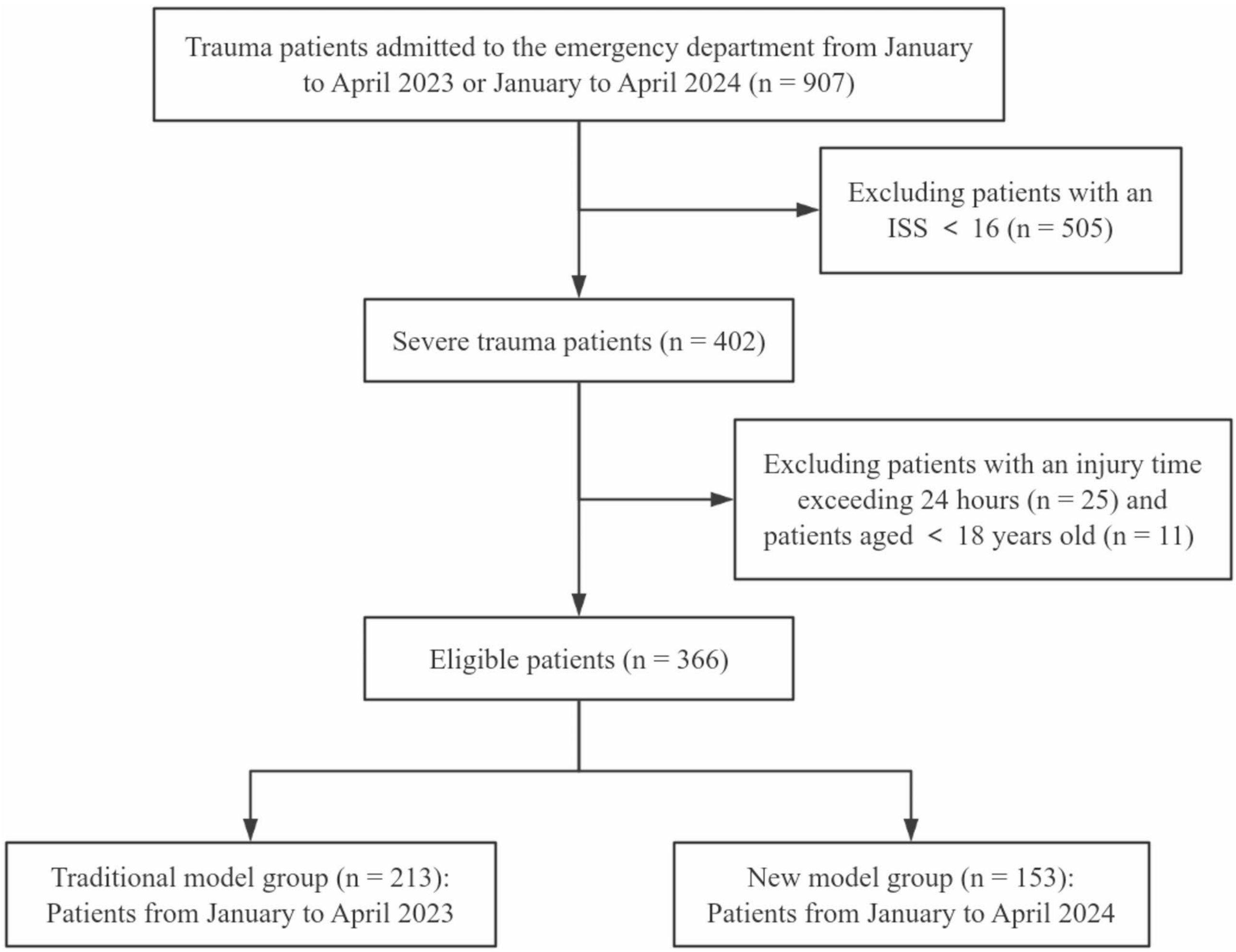

Fig. 1 Patient enrollment flowchart

emergency drills were conducted to enhance teamwork between the medical staff. Additionally, medical staff were sent in batches to participate in advanced training programs, such as CTCT and Advanced Cardiovascular Life Support (ACLS) [21]. Besides, caregivers received specialized training in patient transportation to minimize unnecessary secondary injuries.

Methods: (1) Trauma alert and activation: EMS notifies the hospital and traffic police after assessing the patient's condition on-site. Trauma early warning and triage are rapidly performed based on the ATMIST alert form (as shown in Table S1), MEWS, and trauma classification, which in turn triggers the activation of trauma MDT prior to the patient's arrival. (2) Initial assessment and management: The ABCDE assessment is systematically performed, followed by the corresponding first aid measures. (3) Subsequent examination and treatment: A hospital-wide fast-track service system is established for severely injured patients, ensuring that all departments prioritize these patients. In cases requiring emergency blood transfusion, the on call emergency surgeon or nurse notifies the blood bank by phone, and a blood transfusion certificate is issued after the resuscitation is completed. For computed tomography (CT) scans, the trauma surgeon accompanies the patient to the CT room to prioritize the examination and minimize waiting times. A dedicated emergency surgery operating room is set up, with elective surgeries not allowed to occupy it. Life-threatening patients have priority for surgery, and the on call physician arranges for the procedure to be carried out as quickly as possible. Additionally, if there is a delay in securing medical payment, the principle of "emergency care first, payment later" is applied to avoid delaying life-saving treatment.

Materials: A one-stop TRU is established. Within the TRU, there are designated areas for trauma emergency care and trauma equipment preparation. The trauma emergency care area is equipped with trauma resuscitation-specific beds, and bedside units are permanently placed with blood and fluid warmers, warming blankets, FAST ultrasound machines, defibrillators, and other necessary equipment. The trauma preparation area is equipped with trauma cabinets, wound cleaning carts, intubation carts, and preparation tables for procedures. All instruments and items are clearly labeled and arranged according to their frequency of use.

Management: A digital trauma care management platform is established. The alert system is enhanced to include electronic handover forms of patients' information, enabling pre-hospital online trauma alerts. Personal digital assistant (PDA) devices are used to document emergency care timepoints and manage inventory of medical supplies. An emergency trauma resuscitation checklist is designed for on-site verification. Additionally, the TRU is equipped with high-definition cameras to facilitate review and analysis of resuscitation experiences. A digital trauma case database is also created, serving as a template repository for training and simulations.

The trauma emergency care process for the new model: (A) Five minutes prior to admission: EMS arrived at the scene and quickly assessed the situation, issued an early warning message based on ATMIST and notified the traffic police and the hospital. The hospital initially activates the MDT and supplies preparation after receiving the electronic 120 handover form and early warning message 5 min prior to the patient's admission. (B) Admission 0 min: Upon admission, the patient is immediately assessed using MEWS and trauma classification. Based on the triage results, the patient is then transferred to the trauma resuscitation unit (TRU), and the MDT is rapidly activated. (C) Admission 5 min: Within the TRU, the trauma care team conducts an initial assessment (ABCDE assessment) and initial treatment (including immobilization, hemostasis, oxygen therapy, IV access, blood transfusion, etc.). Once the patient's vital signs are stable, a second comprehensive assessment (ABCDE, ISS, FAST, AMPLE) is performed. (D) Admission 20–30 min: Based on the assessment results, the MDT specialists work together to develop an appropriate treatment plan. The next steps in diagnostics (CT, DR, etc.) and treatment (urinary catheterization, chest drainage, medication, etc.) are determined. (E) Admission 30–60 min: The patient is transferred to the operating room for emergency surgery or trauma intensive care unit (TICU)/trauma ward for further treatment. The specific flow chart is shown in Fig. 2. And the differences between traditional and new models are summarized in Table 1.

Data collection

Clinical data were collected from the hospital's electronic medical record system, including age, gender, ISS, time since injury, mechanism of injury, and vital signs upon admission (heart rate, respiratory rate, oxygen saturation, and systolic blood pressure). The primary outcome variables included in-hospital mortality. The secondary outcome variables included disposition of emergency patients, complications (disseminated intravascular coagulation, DIC; multiple organ dysfunction syndrome, MODS; acute respiratory distress syndrome, ARDS), length of stay, and the following seven quality control indicators:

(1) Time to establishment of artificial airway: The time from the patient's first medical contact to the establishment of an artificial airway.
(2) Time to establishment of effective circulatory access: The time from the patient's first medical contact to the establishment of effective circulatory access.
(3) Emergency transfusion preparation time: The time from the physician's order for blood transfusion to the initiation of the first unit of blood transfusion.
(4) Time to complete whole-body CT scan: The time from the patient's departure from the resuscitation room to the completion of the CT scan.
(5) Time to definitive treatment plan: The time from the patient's first medical contact to the time the physician establishes a definitive treatment plan.
(6) Bedside FAST completion rate: The proportion of patients who completed bedside FAST (or bedside ultrasound) out of the total number of patients, calculated as: (Number of severe trauma patients completing bedside FAST or ultrasound / Total number of severe trauma patients) × 100%.
(7) First-hour resuscitation rate: The proportion of patients who achieved successful resuscitation (systolic blood pressure ≥ 80 mmHg) and had no contraindications for transport (cardiac or respiratory arrest, or unstable vital signs without adequate respiratory, circulatory, and other life-support measures) within one hour of admission, calculated as: (Number of severe trauma patients meeting resuscitation and transport criteria / Total number of severe trauma patients) × 100%.

Statistical analysis

Categorical data are presented as frequencies (percentages), and univariate analysis was performed using the chi-square test. For quantitative data, those with a normal distribution are expressed as mean ± standard deviation, and univariate analysis was performed using the independent two-sample t-test. For data that do not follow a normal distribution, the median (interquartile range) is presented, and univariate analysis was performed using non-parametric tests. A *P*-value of < 0.05 is considered statistically significant.

Results

Characteristics of participants

A total of 366 patients who met the inclusion criteria were enrolled in this study, including 270 males (73.8%)

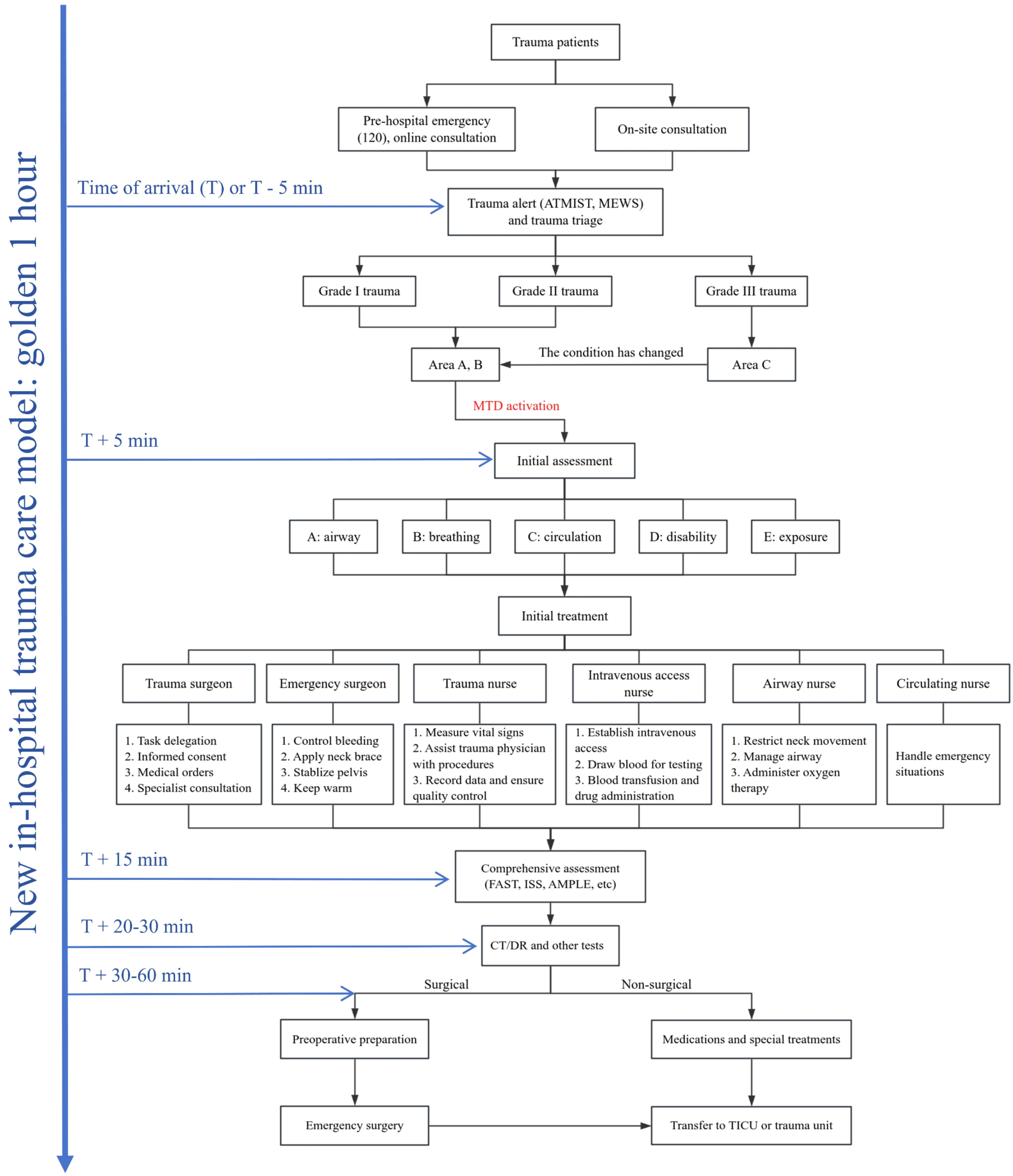

Fig. 2 Flowchart of new in-hospital trauma care model. MEWS, modified Early Warning Score. MTD, multi-disciplinary teams. AMPLE (A: Allergies; M: Medications; P: Past medical history; L: Last meal; E: Events leading to present illness/injury). FAST, focused assessment sonography in trauma

and 96 females (26.2%), with a median age of 56 years (range 44–69). The mean ISS and median time since injury for the patients were 26 and 3 h, respectively. The traditional model group consisted of 213 patients, while the new model group included 153 patients. There were no statistically significant differences between the traditional and new model groups in terms of gender, age, ISS, time of injury, mechanism of injury, or vital signs

Table 1 Comparison of traditional in-hospital trauma care model and new in-hospital trauma care model

Subject	Traditional model	New model
Manpower		
Trauma MDT	No	Yes
Trauma resuscitation team	"1 doctor + n nurses" without clear division of responsibilities	"2 doctors + 3 nurses" with clear division of responsibilities
Assessment and training	1. Monthly competency assessments; 2. Lack of penetration of advanced training	1. Monthly competency assessments and simulation drills; 2. Medical staff received ACLS and CTCT training
Method		
Trauma alert and activation	1. Collaboration between EMS, hospital ED, and traffic police (detailed early warning information); 2. Trauma activation based on trauma alert and triage	1. Collaboration between EMS and hospital ED (simple phone alerts); 2. No trauma activation
Initial assessment	ABCDE assessment	Routine specialist assessment
Other treatment	Hospital-wide fast-track services	ED-only fast-track services
Material	TRU with corresponding emergency items	Lack of a TRU and centralized item management
Management	Digital trauma care management platform including electronic handover forms, PDA system, trauma case database, etc.	Lack of a digital trauma care management platform, relying on paper-based handover forms

MDT, Multidisciplinary Team; ACLS: Advanced Cardiovascular Life Support; CTCT: China Trauma Care Training; ED, Emergency Department; EMS, Emergency Medical Services; TRU, Trauma Resuscitation Unit

Table 2 Baseline characteristics of severely injured trauma patients ($n = 366$)

Characteristic	Total (*n* = 366)	Traditional model (*n* = 213)	New model group (*n* = 153)	*P* value
Gender, n (%)				
Male	270 (73.8%)	152 (71.4%)	118 (77.1%)	0.216
Female	96 (26.2%)	61 (28.6%)	35 (22.9%)	
Age, year, median (IQR)	56 (44, 69)	57 (45, 71)	54 (44, 65)	0.093
ISS, mean ± SD	26.1 ± 7.6	26.4 ± 7.2	25.8 ± 8.3	0.165
Time since injury, h, median (IQR)	3.0 (1.5, 5.0)	3.0 (2.0, 5.0)	3.0 (1.0, 4.8)	0.348
Mechanism of injury, n (%)				0.383
Traffic accidents	173 (47.3%)	106 (49.8%)	67 (43.8%)	
Fall from height	85 (23.2%)	45 (21.1%)	40 (26.1%)	
Blow or assault	53 (14.5%)	27 (12.7%)	26 (17.0%)	
Fall	37 (10.1%)	25 (11.7%)	12 (7.8%)	
Others	18 (4.9%)	10 (4.7%)	8 (5.2%)	
Vital signs, median (IQR)				
Heart rate, per min	89 (65, 107)	89 (67, 107)	88 (64, 107)	0.741
Respiratory rate, per min	20 (17, 23)	20 (17, 22)	20 (17, 24)	0.771
Oxygen saturation, %	97 (95, 98)	97 (95, 98)	97 (94, 99)	0.309
Systolic blood pressure, mmHg	126 (103, 152)	125 (103, 152)	131 (91, 154)	0.844

IQR, interquartile range; SD, standard deviation; ISS, injury severity score

upon admission ($P > 0.05$). Participant characteristics are shown in Table 2.

The comparison of emergency care metrics between the two groups

The average time to establish effective circulatory access in the new model group was 9.44 ± 3.18 min, significantly shorter than the 13.66 ± 3.36 min in the traditional model group ($P < 0.001$). Similarly, compared to the traditional model group, the new model group showed significantly shorter times for the establishment of artificial airways, blood transfusion preparation, and completion of whole-body CT, formulation of definitive treatment plans (all $P < 0.05$, Table 3). Additionally, the new model group had a significantly higher bedside FAST completion rate and a higher resuscitation success rate within the first hour compared to the traditional model group ($P < 0.05$, Table 3).

The comparison of clinical outcomes between the two groups

The prognosis of patients in the new and traditional model groups was compared. The results indicated that the proportions of patients who were discharge against medical advice, transferred to a trauma ward/TICU, or had other outcomes were similar between the two groups. The proportion of patients undergoing emergency surgery was slightly higher in the new model group

Table 3 The comparison of emergency care metrics between the traditional and new model groups (*n* = 366)

Metrics	Traditional model group (*n* = 213)	New model group (*n* = 153)	*P* value
Time to establishment of artificial airway, min, mean ± SD	36.90±12.23	23.91±9.07	0.003
Time to establishment of effective circulatory access, min, mean ± SD	15.66±3.36	9.44±3.18	<0.001
Emergency transfusion preparation time, min, mean ± SD	48.84±5.73	31.06±4.67	<0.001
Time to complete whole-body CT scan, min, mean ± SD	57.18±8.26	42.17±7.28	<0.001
Time to definitive treatment plan, min, mean ± SD	77.45±6.26	59.50±6.35	<0.001
Bedside FAST completion rate, n (%)	113 (53.1%)	142 (92.8%)	<0.001
First-hour resuscitation rate, n (%)	151 (70.9%)	130 (85.0%)	0.002

SD, standard deviation; CT, computed tomography; FAST, focused assessment with sonography for trauma

Table 4 The comparison of clinical outcomes between the traditional and new model groups (*n* = 366)

Indicators	Traditional model group (*n* = 213)	New model group (*n* = 153)	*P* value
Disposition of emergency patients, n (%)			
DAMA	36 (16.9%)	24 (15.7%)	0.757
Emergency surgery	46 (21.6%)	44 (28.8%)	0.117
Trauma ward/TICU	100 (46.9%)	71 (46.4%)	0.918
Death	21 (9.9%)	7 (4.6%)	0.061
Others	10 (4.7%)	7 (4.6%)	0.957
Complications, n (%)	51 (23.9%)	14 (9.2%)	< 0.001
DIC	12 (5.6%)	2 (1.3%)	0.033
MODS	23 (10.8%)	9 (5.9%)	0.101
ARDS	16 (7.5%)	3 (2.0%)	0.018
Length of stay, d, median (IQR)	17.5 (10.0, 26.0)	20.0 (12.0, 28.5)	0.218
In-hospital mortality, n (%)	26 (12.1%)	9 (5.9%)	0.045

DAMA, discharge against medical advice; TICU, trauma intensive care unit; DIC, disseminated intravascular coagulation; MODS, multiple organ dysfunction syndrome; ARDS, acute respiratory distress syndrome; IQR, interquartile range

(*n* = 44, 28.8%) compared to the traditional model group (*n* = 46, 21.6%). Additionally, the proportion of patients who died in the ED was lower in the new model group (*n* = 7, 4.6%) than in the traditional model group (*n* = 21, 9.9%), while the differences were not statistically significant ($P > 0.05$). In terms of complications, the incidence of DIC and ARDS was significantly lower in the new model group ($P < 0.05$). Furthermore, the overall in-hospital mortality rate was significantly lower in the new model group ($P < 0.05$). However, there was no significant difference in the median length of hospital stay between the two groups (Table 4).

Discussion

This study introduced a new trauma care model in the ED and validated its effectiveness in improving the efficiency of in-hospital emergency care and outcomes of severely injured trauma patients. Our results demonstrated that the new model significantly improves various emergency care indicators and helps reduce in-hospital mortality and complication rates in severely injured patients. Therefore, the implementation of this model is of great significance for optimizing the emergency care process for such patients.

Timely emergency care is critical to the prognosis of trauma patients, especially those with severe multiple injuries, as delays can lead to deterioration or death. Trauma-related deaths typically occur in three peaks: the first peak, or "immediate death," happens within seconds to minutes of injury, where most patients cannot be saved; the second peak occurs within minutes to hours; and the third peak happens days to weeks later, due to complications or worsening conditions [22]. The second peak is the most critical window for life-saving intervention, which is why the "golden hour" has become the ideal target in trauma emergency care systems. However, our study found that the median time from injury to hospital admission for severely injured patients was 3 h. This delay is significantly longer than the response times in developed countries, and is a common issue in China and other developing nations [23, 24]. Factors such as late detection, long distances, traffic congestion, and limited emergency resources (e.g., helicopter ambulances) contribute to these delays [25, 26]. As a result, the time left in the golden window of treatment after the injury is already very limited for these patients. Moreover, our study indicated that under the traditional trauma care model, the time from the first medical contact to the finalization of definitive treatment plan was 77.45±6.26 min, which is longer than reported in other studies [27, 28]. Therefore, improving in-hospital emergency care efficiency is crucial.

This study demonstrated that the implementation of the new in-hospital trauma care model significantly shortened the time required for patient treatment, particularly in trauma assessment, resuscitation preparation, and treatment initiation. Specifically, ED physicians and nurses immediately initiate the trauma early alert before or upon patient admission, enabling rapid MDT consultations and unified treatment planning. This approach effectively reduces treatment delays caused by waiting for consultations and prevents the shirking of responsibility between departments [29]. Particularly in the management of polytrauma patients, the team is able to quickly reach a consensus and develop a unified resuscitation plan tailored to the patient's overall condition, ensuring that each treatment measure is promptly implemented, thereby reducing mortality and improving patient prognosis [30]. Regionally, similar initiatives, such as those at the Second Affiliated Hospital of Zhejiang University, have focused on improving traditional models, with emergency and critical care departments leading the efforts, supported by other surgical departments [11]. In contrast, our MDT-based model emphasizes integration across departments to ensure more seamless trauma care. Internationally, Altamirano et al. reported that improving acute trauma surgery models reduced mortality and length of stay; however, their strategy primarily involved increasing staffing and establishing dedicated surgical facilities, addressing challenges distinct from ours, which focused on personnel training and process optimization [31]. Although this study did not include a cost-effectiveness analysis, existing research highlights the economic impact of trauma care improvements. Zhou et al. found that establishing trauma centers significantly improved outcomes for polytrauma patients but increased hospital costs, with median expenses rising from ¥72,620.70 to ¥99,616.10 ($P = 0.004$) [32]. This underscores the need for future research on cost-effectiveness in similar settings.

This study has several limitations. First, as a retrospective observational study, the lack of randomization may introduce potential bias or confounders, despite the fact that there were no significant differences in key baseline characteristics between groups. Second, being a single-center study, its findings were influenced by the medical practices of a specific region or hospital, making it of limited generalizability. Finally, the study did not include a cost-effectiveness analysis of the two models, which could provide valuable insights into resource allocation, economic feasibility, and strategies to optimize healthcare resource utilization. This represents a critical direction for future research.

Conclusion

The new in-hospital trauma care model significantly enhanced the in-hospital emergency care efficiency for severely injured patients, reduced in-hospital mortality, and decreased the incidence of complications, which may serve as a useful reference for developing countries in similar settings.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12873-025-01203-1.

Supplementary Material 1

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Author contributions
Q.Z. and Y.Z.: Funding acquisition, Investigation, Methodology, Writing - original draft. T.K. and C.L.: Investigation, Data curation, Formal analysis, Writing - review & editing. Y.X.: Resources, Software, Writing - original draft. Y.X. and S.L.: Supervision, Validation, Writing - original draft. X.L.: Conceptualization, Project administration, Writing - review & editing. All authors have reviewed and approved the final manuscript.

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Data availability
The data of this study are available from the corresponding author upon reasonable request.

Declarations

Ethical approval and consent to participate
This study adhered to the Declaration of Helsinki and was approved by the Ethics Committee of the First Affiliated Hospital of Wenzhou Medical University (KY2024-R341). Informed consent from participants was waived due to the retrospective nature of the study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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