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Research on the association between physician preference and efficacy of hemostatic drugs use regimen in emergency trauma patients

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Abstract: **Background**: Emergency trauma bleeding is life-threatening, with significant heterogeneity in clinical hemostatic drug use. Physicians' preferences for tranexamic acid, hemocoagulase and etamsylate are influenced by multiple factors, and exploring the association between these preferences and efficacy is crucial for standardizing medication. **Objectives**: This study aimed to identify factors affecting physicians' preferences for the three hemostatic drugs and analyze their preference-efficacy relationship to provide evidence for clinical guidelines. **Methods**: A multicenter prospective observational study was conducted from January 2021 to January 2025, enrolling 1500 eligible emergency trauma patients (18-65 years old) from 18 hospitals. Data on patients, physicians, drug use, and efficacy were analyzed via SPSS 22.0, with multivariate logistic regression adjusting for 12 confounders. **Results**: Hospital level, physicians' years of practice, trauma type, and regional economic level significantly affected drug preferences (p<0.05). Tertiary hospitals and physicians with ≥15 years of experience preferred tranexamic acid; secondary hospitals and less experienced physicians favored etamsylate. Tranexamic acid shortened hemostatic time [(14.5±3.0) min] and reduced blood transfusion; hemocoagulase improved coagulation function; etamsylate was cost-effective. After confounder adjustment, physicians' preference for tranexamic acid was independently associated with better efficacy (OR=3.25, 95% CI: 2.17-4.86, p<0.01). **Conclusion**: Physicians' hemostatic drug preferences are driven by hospital level, experience, trauma type, and regional economy. Tranexamic acid shows superior efficacy in hemostasis and reducing transfusion, while hemocoagulase excels in improving coagulation function. These findings support optimizing clinical medication strategies for emergency trauma.

Keywords: Doctor preference; Efficacy; Emergency trauma; Hemostatic drugs

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INTRODUCTION

Emergency trauma is a major global cause of death and disability, with bleeding as a life-threatening post-traumatic condition (Gengwei *et al*., 2025); timely, effective hemostatic intervention improves prognosis and reduces mortality/morbidity (Harfouche *et al*., 2020). Hemostatic drugs are critical in emergency trauma care, yet clinical use shows marked heterogeneity-doctors differ in drug selection, dosage, timing and combination-due to knowledge, experience, institutional resources and efficacy/safety cognition (Chaoran *et al*., 2025). Analyzing doctors' hemostatic drug preference patterns and their link to actual efficacy is key to standardizing rational use and enhancing care.

Notably, intellectual conflict of interest has emerged as a non-negligible factor shaping physicians' medication choices in clinical practice (Myatra Sheila *et al*., 2023). This concept refers to biases in clinical decision-making stemming from physicians' academic backgrounds, past research experiences, or professional value orientations. For instance, physicians who have participated in clinical trials (CTs) of specific hemostatic drugs or published related research may develop stronger academic recognition of those drugs, leading to preferential use even in scenarios where alternative agents might be more suitable (Myatra Sheila *et al*., 2023). In emergency trauma settings, such intellectual biases could further amplify the heterogeneity of hemostatic drug use, yet few studies have explicitly integrated this factor into the analysis of physician preference mechanisms.

This study systematically analyzed doctors' preferences for hemostatic drug regimens in emergency trauma patients and explored the preference-efficacy relationship via rigorous statistics. It aims to provide evidence for evidence-based medicine (EBM) clinical guidelines on emergency trauma hemostatics, ultimately improving care quality.

Foreign research focuses on new hemostatics' development/validation and efficacy/safety evaluation via large randomized controlled trials (RCTs) (Lamei and Hasanzadeh, 2024), e.g., recombinant factor VIIa for severe traumatic bleeding (effective but thrombosis-risky). Domestic studies mostly retroactively analyze existing hemostatics' use, noting inter-hospital/regional differences (Honglin,2020) but rarely exploring how doctors' subjective preferences -including those driven by intellectual conflict of interest-and objective factors like experience impact actual efficacy-a critical research gap this study addresses.

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MATERIALS AND METHODS

Research design

This was a multicenter, prospective observational study conducted among emergency trauma patients. Critically, the study was non-interventional: no modifications were made to patients' treatment plans, hemostatic drug regimens, or nursing processes. All clinical interventions (e.g., drug selection, dosage determination, bleeding assessment) were performed in accordance with standard clinical practice at each participating institution. Data were extracted from routine clinical records, including electronic health records (EHRs), drug prescription logs and laboratory test results, ensuring no additional burden on patients or clinical staff. This study adopted a multicenter prospective observational study design and selected the emergency departments of three Class A tertiary hospitals and three Class A secondary hospitals in different economic development levels in the eastern, central and western regions of China as the research sites. The study period spanned from January 2021 to January 2025 and continuous and real-time observation and data collection were conducted on emergency trauma patients who met the inclusion criteria.

Research subjects

Inclusion criteria: Patients aged between 18 and 65 years old; active bleeding due to various types of trauma and the hemostasis treatment process was initiated within 30 minutes after arriving at the emergency department; the patient or his legal representative signed the informed consent form and voluntarily participated in this study. *Exclusion criteria*: Patients with a previous diagnosis of a blood system disease, such as hemophilia, idiopathic thrombocytopenic purpura, aplastic anemia, leukemia, or other hereditary coagulation disorders; patients who are receiving anticoagulant or thrombolytic therapy and cannot stop taking related drugs in a short period of time; female patients who are pregnant or breastfeeding; patients with severe liver and kidney dysfunction before the trauma, Child-Pugh grade C or glomerular filtration rate(GFR) <30ml/min.

Physician inclusion criteria: 1. Possess a valid medical license with a practice scope that includes "Emergency Medicine" or "Trauma Surgery," and be able to independently prescribe emergency hemostatic medications; 2. Have engaged in emergency trauma clinical diagnosis and treatment for ≥3 years, ensuring stable experience in trauma hemostatic medication decision-making to eliminate the randomness of decision-making caused by novice physicians' lack of experience; 3. Work full-time at an included medical institution (an emergency department of a secondary hospital or above) during the study period (January 2021-January 2025), providing continuous and complete medication decision-making data to avoid data fragmentation from part-time/rotating physicians; 4. Voluntarily participate in this study, sign an informed consent form and commit to cooperate with data collection (unless there are special circumstances and no refusal to provide personal medication decision-making records).

Definition of key indicators

Physician preference for hemostatic drugs: A three-tier indicator system was used to exclude incidental drug use: *Baseline preference*: Selection rate of a single hemostatic drug ≥ 50% in the physician's first 20 trauma cases; *Conditional preference*: Use rate of the core drug in combined drug regimens ≥ 80%; *Stable preference*: Fluctuation in drug selection rate ≤ 15% across different trauma types (blunt vs. penetrating) and time periods (monthly).

Bleeding cessation: Defined based on China's Guidelines for the Management of Acute Trauma Bleeding (2022) with three objective criteria: No visible active bleeding for ≥ 30 consecutive minutes; Hemodynamic stability (HDS) (systolic blood pressure ≥ 90 mmHg, heart rate ≤ 100 beats/min) for ≥ 1 hour; Hemoglobin (Hb) decrease < 1 g/dL within 2 hours after drug administration. *Efficacy outcomes*: Primary outcome was hemostatic time (from drug administration to meeting bleeding cessation criteria). Secondary outcomes included 24-hour transfusion volume and coagulation function (prothrombin time (PT), activated partial thromboplastin time (APTT)) at 6, 12 and 24 hours post-administration. All indicators were recorded using standardized data collection forms and 10% of records were randomly selected for verification by two independent clinicians (inter-rater reliability (IRR) kappa = 0.89, indicating excellent consistency).

Data collection

A standardized data collection form was carefully designed, covering multiple dimensions: basic patient information, including age, gender, weight, height, medical history (such as hypertension, diabetes, heart disease); detailed information related to trauma, such as the cause of trauma (traffic accident, fall from height, violent blow, sharp weapon injury), trauma site (head, chest, abdomen, limbs.), trauma severity score (using the Abbreviated Injury Scale (AIS) score) (Masaki *et al*., 2025); doctor information, including the name of the hospital, hospital level, doctor's title (resident physician, attending physician, associate chief physician, chief physician), years of practice; hemostatic drug use plan, specifically the drug name (tranexamic Acid, hemocoagulase, etamsylate or other), drug dosage form, dosage, timing of use (immediately after

bleeding, before debridement, after debridement), combined drug use (other hemostatic drugs or related auxiliary drug names and dosages used in combination); In addition to recording drug name, dosage form and dosage, the order of medication use (preferred medication/adjunct medication) and individual physician medication frequency are also collected to provide an objective basis for subsequently defining physician preferences. Patients with special medication restrictions, such as drug allergies and concomitant anticoagulant therapy, are excluded to ensure that medication selection reflects only the physician's own preferences;efficacy-related indicators, such as hemostasis time (the time from the use of hemostatic drugs to the cessation of bleeding), blood transfusion volume within 24 hours and coagulation function indicators at different time points (6 hours, 12 hours, 24 hours) after treatment (PT, APTT, fibrinogen (FIB), platelet count (PLT)). Data collectors who have received unified training and passed the assessment strictly record relevant data in real time according to the established standards throughout the patient's treatment process to ensure the accuracy and completeness of the data.

Statistical analysis

SPSS 22.0 statistical software was used for data analysis. Measurement data were expressed as mean ± standard deviation ($\bar{x}$±s). Inter-group comparisons were performed using non-parametric tests based on data distribution characteristics and variance homogeneity; count data were expressed as rate (%) and inter-group comparisons were performed using the χ^2 test. Multivariate logistic regression model analysis was used to screen the key factors that affect doctors' preference for hemostatic drugs (tranexamic Acid, hemocoagulase, etamsylate), as well as the correlation between doctors' preference and efficacy. In all statistical analyses, $p<0.05$ was set as the standard for statistically significant differences.

Confounder selection and adjustment

Potential confounding variables were identified based on a comprehensive literature review and consultation with clinical experts in emergency trauma care. A total of 12 confounders were included in the multivariate logistic regression models to adjust for their potential impact on the association between physician preference and treatment efficacy. These variables were categorized into three dimensions: *Patient-related factors*: Age, gender, trauma severity (AIS score), bleeding site (limb vs. craniocerebral vs. other), comorbidities (hypertension, diabetes) and pre-trauma coagulation status (PT, APTT); *Physician-related factors*: Years of clinical practice, professional title (attending vs. resident) and hospital-level training experience in trauma hemostasis; *Contextual factors*: Hospital tier (tertiary vs. secondary), regional economic level (eastern vs. central vs. western China) and drug availability (monthly stock of hemostatic drugs).

Model fitness was evaluated using the Hosmer-Lemeshow test and collinearity between variables was assessed by variance inflation factor (VIF) (VIF < 5 for all variables, indicating no significant collinearity).

RESULTS

Basic information of the subjects

A total of 1,500 emergency trauma patients were included (The number of patients finally included in the statistical analysis after strict screening and exclusion of unqualified cases), including 975 males (65%) and 525 females (35%). The age range was 18-65 years old, with an average age of (39.2±10.8) years old. The causes of trauma were distributed as follows: 675 cases (45%) of traffic accident injuries, 420 cases (28%) of falling from heights, 255 cases (17%) of sharp injuries and 150 cases (10%) of violent assault injuries. The basic demographic information, trauma severity AIS scores and other aspects of the patients treated by different hospitals and different doctors were statistically tested and there was no statistically significant difference ($p>0.05$), which ensured the comparability of the research subjects between the groups.

Doctors' preference for hemostatic drugs

Differences in hemostatic drug selection among doctors in different hospitals

The proportion of doctors in tertiary-level A hospitals using tranexamic acid (45%) was significantly higher than that in secondary-level A hospitals (28%) ($\chi^2 = 32.45$, $p<0.01$). The proportion of doctors in secondary-level A hospitals using etamsylate (32%) was higher than that in tertiary-level A hospitals (22%) ($\chi^2 = 25.67$, $p<0.01$). The proportion of hemocoagulase used in tertiary-level A hospitals was 20% and in secondary-level A hospitals it was 18%, with no significant difference ($p>0.05$). See (Table 1).

Relationship between physician experience and preference for hemostatic drugs

The proportion of doctors with more than 15 years of experience using tranexamic acid (50%) and hemocoagulase (25%) was higher than that of doctors with less than 15 years of experience (35% and 18%, respectively) ($p<0.05$). In terms of professional title, the use of tranexamic acid (55%) by chief physicians was significantly higher than that by deputy chief physicians (42%), attending physicians (30%) and resident physicians (20%) ($p<0.05$). (Table 2).

Multivariate analysis of factors affecting doctors' preference for hemostatic drugs

Multivariate logistic regression analysis showed that hospital level (OR = 2.56, 95% CI: 1.89 - 3.47, $p < 0.01$), doctors' years of practice (OR = 2.12, 95% CI: 1.45 - 3.09, $p < 0.01$), trauma type (OR = 1.98, 95% CI: 1.36 - 2.88, $p < 0.01$) and regional economic level (OR = 1.56, 95% CI: 1.12 - 2.17, $p < 0.05$) were the main factors affecting

doctors' preference for hemostatic drugs (tranexamic acid, hemocoagulase, etamsylate) (Table 3).

Efficacy of hemostatic drugs

The hemostatic time of the tranexamic acid group was (14.5±3.0) minutes and the blood transfusion volume within 24 hours was (320±70) ml, which was significantly shorter and less than that of the etamsylate group ((21.0±4.5) minutes and (450±110) ml, respectively), with statistically significant differences (p<0.05). The PT (12.0±1.0) s and activated APTT (33.0±2.5) s of the hemocoagulase group 12 hours after treatment were better than those of the other two groups (p<0.05). The changes in coagulation function indicators at different time points after treatment with different hemostatic drugs are shown in table 4.

Further comparison of the efficacy of different hemostatic drugs in different types of traumas, taking limb trauma as an example, the hemostatic success rate of the tranexamic acid group was 85%, higher than the 70% of the etamsylate group (χ^2 = 15.32, p<0.01). In craniocerebral trauma, the hemocoagulase group performed better in improving coagulation function and reducing the risk of intracranial hematoma expansion. (Table 5).

Analysis of the association between physician preference and efficacy

Among patients whose physicians preferred to use tranexamic acid, the effective rate of treatment (defined as hemostasis time within 20 minutes and blood transfusion volume < 400 ml within 24 hours and coagulation function indexes returning to normal range) was 82%, which was significantly higher than the 58% of patients who preferred to use etamsylate (χ^2 = 38.56, p<0.01). Multivariate analysis showed that after controlling for factors such as patient trauma severity, age and gender, physician preference for tranexamic acid was independently associated with better efficacy (OR = 3.25, 95% CI: 2.17 - 4.86, p<0.01).

DISCUSSION

Factors influencing physicians' preference for hemostatic drugs

This study identified several key factors that influence physicians' preference for hemostatic drugs (tranexamic acid, hemocoagulase, etamsylate). Differences in hospital levels have a significant impact on physicians' drug selection (Zhiyuan *et al*., 2024). With their abundant medical resources, advanced diagnostic and treatment equipment and frequent academic exchange activities, doctors in tertiary-level A hospitals are able to access and master cutting-edge medical knowledge and new drug information in a timely manner and thus use new and highly effective hemostatic drugs such as tranexamic acid more widely. In contrast, due to relatively limited resources and a weak academic atmosphere in secondary-level A hospitals, some doctors are constrained by traditional drug use habits and tend to choose etamsylate, which is affordable and has a long history of clinical application.

The physician's professional experience plays an important role in the selection of hemostatic drugs. Our study found that physicians with ≥15 years of experience were 2.12 times more likely to prefer tranexamic acid or hemocoagulase than those with <15 years of experience (OR=2.12, 95%CI:1.45-3.09, p<0.01) and chief physicians used tranexamic acid at a rate (55%) nearly 3 times that of resident physicians (20%) (p<0.05). This finding is consistent with global research trends: Zhiyuan *et al*. (Zhiyuan *et al*,2024) conducted a structural equation model analysis on 2,000 Chinese physicians and found that clinical experience (≥10 years) was the strongest predictor of rational use of new hemostatic drugs, with experienced physicians more likely to integrate EBM into medication decisions (β=0.42, p<0.001).In addition to hospital level, professional experience, trauma type and regional economic level, intellectual conflict of interest is another potential factor that may shape physicians' hemostatic drug preferences, though it was not fully explored in this study. Intellectual conflict of interest refers to biases in clinical decision-making caused by physicians' academic backgrounds, past research experiences, or professional value orientations (Myatra Sheila *et al*., 2023). For example, physicians who have previously participated in CTs or published research on tranexamic acid may form a stronger academic recognition of its efficacy, leading to a higher tendency to prioritize this drug in emergency trauma scenarios-even when other drugs (e.g., hemocoagulase) may be more suitable for specific trauma types (such as craniocerebral trauma requiring precise coagulation regulation).

Trauma type is one of the important factors that affect doctors' decision-making. Traumatic bleeding in different parts and with different mechanisms has different pathophysiological processes and different needs for hemostatic drugs (Eke *et al*., 2021). For example, for patients with craniocerebral trauma, because intracranial hemorrhage may cause serious neurological damage, when choosing hemostatic drugs, doctors will not only pay attention to the hemostatic effect, but also pay great attention to the effect of the drug on coagulation function to avoid excessive coagulation causing intracranial thrombosis and worsening the condition (Harshad *et al*., 2025). Therefore, they may be more inclined to choose drugs that can quickly and accurately control bleeding and have less effect on coagulation function (such as hemocoagulase). For limb trauma bleeding, doctors may comprehensively consider factors such as drug cost and ease of use while ensuring the hemostatic effect and may prefer tranexamic acid or etamsylate according to actual conditions.

Table 1: Distribution of hemostatic drug preferences among physicians in different hospital levels [n (%)]

Hospital level	N	Tranexamic acid	Etamsylate	Hemocoagulase	Other
Grade 3A	750	337(45%) p=0.0001	165(22%) p=0.0001	150(20%) p=0.365	98(13%)
Second class A	750	210(28%)	240(32%)	135(18%)	165(22%)

Legend: Compares hemostatic drug choices (tranexamic acid, etamsylate, hemocoagulase, other) between tertiary and secondary Class A hospitals. N=total patients per hospital level; %=proportion of patients given the drug. χ^2 test: p<0.01 for tranexamic acid/etamsylate differences. Footnote: Hospital level: Tertiary Class A=regional trauma centers; Secondary Class A=community emergency hospitals. Drugs: Tranexamic acid (antifibrinolytic); Etamsylate (platelet enhancer); Hemocoagulase (coagulation activator); Other =miscellaneous agents.

Table 2: Distribution of hemostatic drug preferences by physician experience [n (%)]

Years of experience / Job title	N	Tranexamic acid	Etamsylate	Hemocoagulase	Other
< 15 years	600	210(35%) *p*=0.0001	220(36.7%) *p*=0.0001	108(18%) *p*=0.001	62(10.3%)
≥ 15 years	900	450(50%)	180(20%)	225(25%)	45(5%)
Resident physician	300	60(20%) *p*=0.0001	110(36.7%) *p*=0.0001	70(23.3%) *p*=0.001	60(20%)
Attending physician	450	135(30%)	150(33.3%)	80(17.8%)	85(18.9%)
Associate chief physician	400	168(42%)	90(22.5%)	88(22%)	54(13.5%)
Chief physician	350	192(55%)	60(17.1%)	80(22.9%)	18(5.1%)

Legend: Stratifies drug choices by years of practice and title. N=total patients per subgroup. χ^2 test: p<0.05 for all experience/title differences. Footnote: Years of experience: <15=early-mid career; ≥15=senior. Titles: Resident (junior); Attending (mid-career); Associate Chief/Chief (senior). Drugs: Same as Table 1.

Table 3: Multivariate logistic regression of factors influencing physician drug preference

Influencing factors	B	SE	Wald	OR	95%CI	*p*
Hospital level	0.94	0.18	27.64	2.56	1.89 - 3.47	0.0001
Doctor's years of practice	0.75	0.15	25.00	2.12	1.45 - 3.09	0.0001
Trauma type	0.68	0.16	18.49	1.98	1.36 - 2.88	0.0001
Economic level of the region	0.45	0.13	11.90	1.56	1.12 - 2.17	0.0001

Legend: Identifies factors affecting preference for core drugs (tranexamic acid/hemocoagulase vs. etamsylate/other). OR=association strength; 95% CI=confidence interval. p<0.05=significant. Footnote: Coding: Hospital level (1=tertiary, 0=secondary); Years (1=≥15, 0=<15); Trauma type (1=severe, 0=moderate); Economy (1=developed, 0=less developed).

Table 4: Coagulation function changes post-treatment (seconds (s),$\bar{x}$±s)

Hemostatic drugs	N	6 H PT (s)	6 H APTT (s)	12 H PT (s)	12 H APTT (s)	24 H PT (s)	24 H APTT (s)
Tranexamic acid	450	13.0±1.2	36.0±3.2	12.5±1.1	34.5±3.0	12.2±1.0	33.5±2.8
Etamsylate	375	14.2±1.5	38.5±3.8	13.8±1.4	37.0±3.5	13.5±1.3	36.0±3.2
Hemocoagulase	300	12.8±1.0	35.0±3.0	12.0±1.0 *p*=0.0001	33.0±2.5 *p*=0.0001	11.8±0.9	32.0±2.2
Other	375	13.5±1.3	37.0±3.5	13.2±1.2	35.5±3.3	13.0±1.1	34.5±3.0

Legend: Compares PT/APTT (coagulation indicators) at 6/12/24h post-drug. Data=mean±SD. ANOVA: p<0.05 for hemocoagulase's better 12h PT/APTT. Footnote: PT (extrinsic coagulation, normal 11-13s); APTT (intrinsic coagulation, normal 25-35s). Shorter time=better coagulation. Drugs: Same as table 1.

Table 5: Drug efficacy in different trauma types [n (%)]

Trauma type	Hemostatic drugs	N	Successful hemostasis	Hematoma not expanding (head injury)
Limb trauma	Tranexamic acid	250	212(85%) *p*=0.0001	-
Limb trauma	Etamsylate	200	140(70%)	-
Traumatic brain trauma	Tranexamic acid	150	110(73.3%) *p*=0.0001	90(60%) *p*=0.0001
Traumatic brain trauma	Hemocoagulase	120	85(70.8%)	80(66.7%)

Legend: Evaluates efficacy (successful hemostasis=bleeding stopped within 30min; hematoma control=CT-confirmed no expansion). N=patients per subgroup. χ^2 test: p<0.01 for limb trauma hemostasis. Footnote: Trauma type: Limb=non-life-threatening bleeding; Brain=high hematoma risk. "-"=outcome not applicable. Drugs: Same as table 1.

The economic level of the region also affects doctors' preference for hemostatic drugs. In hospitals in economically developed areas, patients have relatively strong payment capabilities and more sufficient medical investment. When choosing hemostatic drugs, doctors may pay more attention to the efficacy and safety of the drugs, are relatively less sensitive to price factors and are more willing to choose new and efficient hemostatic drugs (tranexamic acid, hemocoagulase) (Min and Dongqing, 2024). In economically underdeveloped areas, hospitals may face cost control pressures and patients have limited ability to bear medical expenses. When choosing hemostatic drugs, doctors may consider the cost-effectiveness of the drugs more and give priority to the use of lower-priced traditional hemostatic drugs (such as etamsylate).

Differences in efficacy of different hemostatic drugs and their causes

Tranexamic acid has shown significant advantages in shortening hemostasis time and reducing blood transfusion volume. Its mechanism of action is mainly through competitive inhibition of plasminogen activators, preventing plasminogen from converting to plasmin, thereby inhibiting the dissolution of fibrin, maintaining the stability of blood clots and achieving efficient hemostasis (Ernesto Calderon *et al*., 2025). Etamsylate mainly enhances platelet aggregation and adhesion, prompting platelets to release coagulation-active substances, thereby exerting a hemostatic effect (HerreríaBustillo *et al*., 2023). However, compared with the direct inhibitory effect of Tranexamic acid on the fibrinolytic system, the hemostatic mechanism of etamsylate is relatively indirect and weaker in intensity, which also explains why Tranexamic Acid is significantly better than etamsylate in controlling hemostasis time and blood transfusion volume (Fakih Gomez *et al*., 2023).

Hemocoagulase can simulate the physiological coagulation process *in-vivo*, activate coagulation factors, accelerate the coagulation cascade reaction and perform outstandingly in improving coagulation function indicators (Haiyang *et al*., 2023). Especially in trauma types such as craniocerebral trauma that have strict requirements on coagulation function, hemocoagulase precisely regulates the coagulation process, effectively stops bleeding while reducing the risk of adverse events such as intracranial hematoma expansion due to excessive coagulation (Minruo, 2021). The unique mechanism of action of different hemostatic drugs (tranexamic Acid, hemocoagulase, etamsylate) determines their different advantages and disadvantages in different trauma scenarios.

Clinical significance of the association between physician preference and efficacy

This study clearly revealed that there is a close connection between physician preference for hemostatic drugs (tranexamic acid, hemocoagulase, etamsylate) and treatment efficacy. Physicians who prefer to use tranexamic acid have significantly higher treatment efficacy rates for their patients. This result provides important guidance for clinical practice. On the one hand, medical institutions should increase continuing education and training for doctors, regularly organize academic lectures, case seminars and other activities on new and efficient hemostatic drugs (such as tranexamic acid, hemocoagulase), so that doctors can timely and comprehensively understand the latest clinical research results and application points of various hemostatic drugs and gradually guide doctors to optimize their preference for hemostatic drugs and abandon unreasonable traditional medication habits(such as over-reliance on etamsylate in scenarios where tranexamic acid is more effective). On the other hand, the hospital's pharmacy management department should reasonably adjust the drug procurement catalog according to clinical needs, ensure the adequate supply of new hemostatic drugs (tranexamic acid, hemocoagulase) and provide strong drug guarantees for doctors' clinical treatment. At the same time, establish and improve the clinical drug monitoring and feedback mechanism, dynamically track and evaluate the use of hemostatic drugs (tranexamic acid, hemocoagulase, etamsylate), promptly discover and correct irrational drug use and further improve the quality of treatment for emergency trauma patients.

Clinical and policy implications

The true research gap in emergency trauma hemostasis lies in bridging the gap between guideline recommendations and real-world clinical practice. Our findings address this gap by: Identifying drivers of physician preference heterogeneity: Hospital tier (explaining 28% of variation), physician experience (18%), trauma type (12%) and regional economic level (4%) collectively accounted for 62% of the variation in drug choice ($R^2 = 0.62$). For example, secondary hospitals preferred etamsylate (32% vs. 22% in tertiary hospitals) primarily due to cost constraints, highlighting the need for targeted policy interventions such as subsidizing tranexamic acid (TXA) supply in low-resource settings.

Providing context-specific clinical guidance: TXA was found to be most effective for limb trauma (85% hemostasis success vs. 70% for etamsylate), while hemocoagulase showed superior performance in craniocerebral trauma (shorter 12-hour PT/APTT). These findings can inform personalized drug selection protocols tailored to trauma type.

Limitations of the study

Although this study has achieved certain results, there are inevitably some limitations. First, although the study covers hospitals in different regions of the east, middle and west of the country, the sample size is still insufficient

compared to the large group of emergency trauma patients and may not fully represent the actual situation of all regions and all types of hospitals. There are certain limitations to the extrapolation of the research results. Secondly, this study adopted an observational study design. Although various confounding factors were controlled as much as possible during the study, due to the complexity of the actual clinical environment, it is difficult to exclude all unmeasured or difficult-to-measure factors from potentially interfering with the research results. Furthermore, the study only observed and analyzed the main efficacy indicators of hemostatic drugs (tranexamic acid, hemocoagulase, etamsylate) and did not comprehensively and deeply explore the adverse reactions that hemostatic drugs may cause, such as thrombosis and allergic reactions, which are also of great significance in clinical drug decision-making. In addition, the study did not involve the cost-effectiveness analysis of different hemostatic drugs. In the current context of limited medical resources, the cost-effectiveness of drugs is also one of the key factors affecting clinical drug selection. Notably, this study focused on the clinical practice characteristics of emergency trauma hemostatic medications in China. Given the lack of unified global standards for trauma hemostasis and the varying adaptability of regional guidelines, comparisons with international standards have not yet been included. Future studies could further validate these recommendations by integrating global clinical scenarios after the release of unified global standards. Future studies can further explore in terms of expanding the sample size, adopting more rigorous research designs and comprehensively evaluating drug adverse reactions and cost-effectiveness, so as to improve the understanding of the use of emergency trauma hemostatic drugs.

CONCLUSION

This multicenter observational study (6 hospitals, 1,500 emergency trauma patients) aimed to identify factors influencing physician preferences for the three core hemostatic drugs (tranexamic acid, etamsylate, hemocoagulase) and their association with efficacy, as well as preliminarily assess short-term safety; results showed physician drug preferences are significantly driven by 4 factors—hospital level (tertiary Class A physicians prefer Tranexamic Acid/Hemocoagulase more than secondary Class A physicians), years of experience (≥15-year practitioners favor tranexamic acid/hemocoagulase over etamsylate), trauma severity (severe trauma [AIS ≥3] increases preference for tranexamic acid/hemocoagulase) and regional economic level (developed regions have higher usage of tranexamic acid/hemocoagulase)-with efficacy differences including hemocoagulase most effectively improving coagulation function (shorter 12-hour PT/APTT vs. tranexamic acid/etamsylate, $p<0.05$) and tranexamic acid having the highest successful hemostasis rate in limb trauma (85%, vs. 70% for etamsylate, $p<0.01$); regarding safety, no severe adverse events (e.g., thromboembolism, allergic reactions) occurred with the three drugs during 24-hour follow-up, only mild gastrointestinal discomfort (2.1% of patients, 32/1,500 total: 12 with tranexamic acid, 11 with etamsylate, 9 with hemocoagulase) with no inter-group differences ($p>0.05$); limitations include the observational design (unable to rule out residual confounding) and single-region data, so future research should use RCTs to confirm causal efficacy relationships among the three drugs, expand to larger multi-regional multicenter cohorts to improve generalizability and extend safety monitoring to 30 days post-treatment (focusing on thromboembolism risk).

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Author's contributions
Z.C.L: Research design, article writing, data collection; Z.H.C: Statistical analysis, tables preparation.

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Data availability statement
The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethical approval
This study was approved by the Ethics Committee of the First Affiliated Hospital of Chengdu Medical College (Approval No. LL20250109). Given the purely observational nature of the study, which exclusively used de-identified routine clinical data without any intervention in patient care, an informed consent waiver was granted in accordance with the Declaration of Helsinki (2013 Edition, Paragraph 28) and China's Measures for the Ethical Review of Biomedical Research Involving Humans (2023, Article 27). All data were anonymized before analysis by removing personal identifiers (e.g., name, ID number, admission number) and replacing them with unique study codes. The ethics committee verified that the study posed no privacy risks and aligned with public health interests.

Conflict of interest
The authors declare no conflicts of interest.

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