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Prehospital physiological parameters associated with acute thoracic intervention in patients with thoracic trauma: a retrospective single-centre cohort study

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Abstract

Purpose

Thoracic trauma can cause life-threatening respiratory and hemodynamic compromise. We examined associations between prehospital physiological parameters and acute thoracic intervention in patients with thoracic trauma.

Methods

This retrospective TraumaRegister DGU® cohort study was conducted at a level I trauma centre (2018–2022). Adults with thoracic trauma were included; patients undergoing prehospital cardiopulmonary resuscitation were excluded. Thoracic intervention comprised prehospital decompression and/or emergency department chest tube placement. Logistic regression and receiver operating characteristic analyses were performed.

Results

Among 387 patients, 104 (26.9%) underwent intervention. In the primary model (n = 317), lower oxygen saturation (SpO_2) (adjusted odds ratio [OR] per percentage-point increase, 0.949; 95% confidence interval [CI], 0.913–0.986) and penetrating trauma (adjusted OR, 9.163; 95% CI, 2.735–30.699) were associated with intervention. In the exploratory alternative model (n = 277), higher respiratory rate was also associated with intervention (adjusted OR per breath/min, 1.071; 95% CI, 1.010–1.135); associations with SpO_2 and penetrating trauma persisted. SpO_2 discrimination was limited (area under the curve, 0.610; 95% CI, 0.540–0.680).

Conclusion

Lower SpO_2 and penetrating trauma were associated with thoracic intervention in the primary model; higher respiratory rate was additionally associated in the exploratory alternative model. Because SpO_2 had limited discriminatory ability, it should not be used alone to guide decisions about thoracic intervention.

Introduction

Thoracic trauma is among the most frequent injury patterns in severely injured trauma patients and remains a major contributor to trauma-related morbidity and mortality. In Germany, approximately 10 million traumatic injuries occur annually, while thoracic injuries are present in nearly half of all severely injured trauma patients documented in the TraumaRegister DGU® [1, 2]. Thoracic trauma is particularly common after high-energy mechanisms such as traffic accidents and falls from height and

may result in life-threatening conditions including pneumothorax, hemothorax, pulmonary contusion, flail chest, and major vascular injury [3].

Several thoracic injuries can rapidly impair oxygenation, ventilation, and hemodynamic stability. Tension pneumothorax in particular represents one of the most time-critical reversible causes of respiratory and circulatory failure in trauma patients and requires immediate recognition and decompression [3, 4]. Current trauma guidelines therefore emphasize rapid prehospital identification of clinically significant thoracic pathology using clinical examination, continuous physiologic monitoring, and focused ultrasound techniques such as extended focused assessment with sonography in trauma (eFAST) [1, 5, 6]. In hemodynamically unstable or severely hypoxemic patients with suspected tension physiology, immediate thoracic decompression is recommended before imaging confirmation [1, 5].

Despite these recommendations, decision-making regarding thoracic decompression in the prehospital environment remains challenging. Clinical examination may be limited by noise, difficult environmental conditions, time pressure, or concomitant injuries. Moreover, physiologic abnormalities such as hypotension, tachycardia, tachypnea, or hypoxemia are not specific for thoracic injury and may also reflect hemorrhagic shock, traumatic brain injury, pain, or stress response [3]. Previous studies demonstrated that the clinical diagnosis of pneumothorax requiring decompression is difficult in the prehospital setting and that classical examination findings alone have limited diagnostic accuracy [8].

Several studies have investigated thoracic trauma management, injury severity, or selected emergency interventions. Registry analyses from the TraumaRegister DGU® demonstrated severity-dependent differences in early thoracic trauma management and highlighted the high prevalence of chest injuries in severely injured patients [2]. Other investigations evaluated physiologic deterioration in thoracic trauma populations or predictors for invasive resuscitative procedures such as resuscitative thoracotomy or resuscitative endovascular balloon occlusion of the aorta (REBOA) [9, 10]. However, comprehensive analyses specifically examining the relationship between prehospital physiologic parameters and subsequent thoracic intervention remain limited.

Therefore, this study examined associations between prehospital physiological parameters and receipt of acute thoracic intervention, defined as prehospital thoracic decompression and/or emergency department chest tube placement, among patients with thoracic trauma at a level I trauma centre. We also described intervention patterns and assessed the discriminatory performance of prehospital oxygen saturation (SpO_2), including an exploratory threshold analysis.

Methods

Study design and setting

This retrospective observational cohort study analyzed trauma patients with thoracic trauma using data derived from the TraumaRegister DGU® at Klinikum Stuttgart, a supraregional level I trauma center in Germany. The study was conducted and reported in accordance with the STROBE statement.

The primary objective was to identify prehospital clinical and physiologic factors associated with thoracic intervention during acute trauma care. Thoracic intervention was defined as prehospital thoracic decompression, emergency department chest tube placement, or both.

Study population

Adult trauma patients with thoracic trauma who were admitted to the emergency department between 2018 and 2022 were eligible for inclusion. Patients were identified using registry-based trauma documentation and hospital coding data from the TraumaRegister DGU®.

Initially, 1,172 trauma patients with 5,963 documented diagnoses were screened. All Abbreviated Injury Scale (AIS) diagnoses related to thoracic trauma were extracted using the keyword “thorax” (n = 901 diagnoses). After linkage of diagnoses to corresponding DGU patient IDs and merging of duplicate entries, 458 patients with thoracic trauma were identified. After application of the initial exclusion criteria, 414 patients with thoracic trauma were identified. Twenty-seven patients with prehospital CPR were subsequently excluded, leaving 387 patients in the final analytical cohort (Figure 1).

Patients younger than 18 years and patients transferred from regional trauma centers were excluded. Transferred patients were excluded because detailed information regarding the initial prehospital management was not consistently available.

Data collection and variables

Clinical, physiologic, and injury-related variables were extracted from the trauma registry database. Demographic variables included age and sex.

Prehospital physiologic variables included: oxygen saturation (SpO2), systolic blood pressure, respiratory rate, heart rate, Glasgow Coma Scale (GCS), National Advisory Committee for Aeronautics (NACA) score, and prehospital intubation status.

These variables were analyzed as markers of early physiologic compromise during prehospital care.

Prehospital physiological variables were taken from the first values documented upon arrival of the first emergency medical service vehicle. These values represent the initial recorded measurements; serial measurements and physiological trends were not evaluated.

Thoracic injury severity was characterized by the maximum AIS score recorded for the thorax (AIS Thorax); AIS Thorax ≥4 was classified as severe thoracic injury.

Trauma-related variables included trauma mechanism (blunt vs. penetrating trauma), Injury Severity Score (ISS), and thoracic injury severity according to the thoracic Abbreviated Injury Scale (AIS Thorax). Injury severity was categorized using ISS thresholds >16 and >25 according to established trauma

severity definitions. These thresholds were used to improve clinical interpretability and to reflect commonly applied definitions of severe and major trauma.

The primary outcome variable was thoracic intervention during acute trauma care, defined as:

1. prehospital thoracic decompression,
2. emergency department chest tube placement,
3. or both.

Secondary descriptive analyses evaluated the timing and location of thoracic interventions. In-hospital mortality was recorded as an additional clinical outcome parameter.

Statistical analysis

Continuous variables were assessed for distribution characteristics using descriptive statistics and visual inspection. Normally distributed continuous variables are presented as mean ± standard deviation (SD), whereas non-normally distributed and ordinal variables are presented as median and interquartile range (IQR).

Comparisons between patients with and without thoracic intervention were performed using independent samples t-tests for normally distributed continuous variables, Mann–Whitney U tests for non-normally distributed or ordinal variables, and chi-square or Fisher's exact tests for categorical variables, as appropriate.

Values recorded as "k.A." were treated as missing. Group comparisons used all patients with available data for the variables being compared. Multivariable logistic regression was restricted to complete cases. The primary model included 317 of 387 patients (81.9%), including 85 patients with thoracic intervention. The exploratory alternative model included 277 of 387 patients (71.6%), including 77 patients with thoracic intervention. Sample sizes therefore varied across analyses.

The primary multivariable logistic regression model included prehospital SpO_2, systolic blood pressure, Glasgow Coma Scale, prehospital intubation, trauma mechanism, and ISS >25. These covariates were selected on clinical grounds to represent prehospital oxygenation, hemodynamic and neurological status, airway management, trauma mechanism, and overall injury severity. Thoracic AIS severity was not included in the primary model because severe thoracic injury was highly prevalent in the cohort, resulting in limited variability. To assess whether the findings of the primary model were robust to adjustment for anatomical thoracic injury severity, an additional sensitivity model was fitted by adding AIS Thorax ≥4 to the primary model. The same complete-case sample was used (n=317, including 85 patients with thoracic intervention).

An exploratory alternative complete-case model was fitted to examine additional prehospital physiological variables. This model additionally included age, respiratory rate, and heart rate, and

excluded prehospital intubation. Because it used a different set of covariates, it was considered exploratory rather than a formal sensitivity analysis.

Each patient contributed one observation. Linearity in the logit for continuous predictors was assessed separately for each model using Box–Tidwell interaction terms. The joint likelihood-ratio tests showed no statistically significant evidence of nonlinearity in the primary model ($\chi^2(3)=1.72$, $p=.632$), the exploratory alternative model ($\chi^2(6)=4.38$, $p=.625$), or the AIS-adjusted sensitivity model ($\chi^2(3)=1.53$, $p=.675$). The maximum variance inflation factor (VIF) and minimum tolerance were 1.85 and 0.54 in the primary and AIS-adjusted sensitivity models, and 1.37 and 0.73 in the exploratory alternative model. No complete or quasi-complete separation was detected in any model. Penetrating trauma was present in 16 patients in the primary and AIS-adjusted sensitivity models (12 with and 4 without thoracic intervention), and in 15 patients in the exploratory alternative model (11 with and 4 without thoracic intervention).

Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. All p-values were two-sided, and $p<0.05$ was considered statistically significant. No adjustment for multiple comparisons was performed; p-values should therefore be interpreted as exploratory.

Receiver operating characteristic (ROC) analysis was performed in patients with available prehospital SpO_2 data. The area under the curve (AUC) and its 95% confidence interval were estimated using DeLong's method. The AUC was tested against 0.5. Lower SpO_2 values were defined as indicating a higher likelihood of thoracic intervention. An exploratory optimal threshold was identified using the Youden index.

All statistical analyses were performed using IBM SPSS Statistics Version 27 (IBM Corp., Armonk, NY, USA).

Ethics

The study was approved by the Ethics Committee of the University Hospital Tübingen as part of a doctoral dissertation (project number 673/2023BO2). TraumaRegister DGU® data from Klinikum Stuttgart covering the period from 2018 to 2022 were analyzed. The study was conducted in accordance with the Declaration of Helsinki and its later amendments. Due to the retrospective registry-based study design and analysis of pseudonymized data, informed consent was waived by the ethics committee.

Results

Study population

A total of 387 trauma patients with thoracic trauma were included in the final analysis. Thoracic intervention, defined as prehospital thoracic decompression and/or emergency department chest tube placement, was performed in 104 patients (26.9%); 283 patients (73.1%) did not undergo thoracic intervention.

Baseline characteristics

Baseline characteristics are summarized in Table 1. Patients undergoing thoracic intervention were younger than patients without intervention (47.8 ± 20.0 vs. 53.8 ± 20.2 years, p=0.010). The overall distribution of trauma mechanism differed between groups (p<0.001), with penetrating trauma more frequent in the intervention group (14.3% vs. 2.6%). The proportion of patients with ISS >25 was also higher in the intervention group (44.2% vs. 31.8%, p=0.023), whereas the difference in ISS >16 was not statistically significant (76.0% vs. 66.1%, p=0.063). The proportion of patients with AIS Thorax ≥4 did not differ significantly between groups (90.4% vs. 85.9%, p=0.240).

Patients undergoing thoracic intervention had lower prehospital SpO_2 (90.5 ± 10.4% vs. 94.2 ± 5.8%, p=0.001) and systolic blood pressure (118.6 ± 35.1 vs. 128.2 ± 33.2 mmHg, p=0.022). Respiratory rate and heart rate were higher in the intervention group (18 [IQR 14–22] vs. 16 [IQR 14–20] breaths/min, p=0.006; and 100 [IQR 85.5–118.8] vs. 92 [IQR 80–110] beats/min, p=0.004, respectively). NACA scores were also higher in the intervention group (median 5 [IQR 4–5] vs. 4 [IQR 4–5], p=0.014). GCS scores and prehospital intubation rates did not differ significantly between groups (p=0.526 and p=0.118, respectively). In-hospital mortality was 9.6% in the intervention group and 7.4% in the group without intervention; this difference was not statistically significant (p=0.481).

Thoracic intervention patterns

Thoracic intervention patterns are summarized in Table 2. A prehospital thoracic intervention was performed in 26 patients (6.7%), including 13 patients who also underwent emergency department chest tube placement. Emergency department chest tube placement was performed in 91 patients (23.5%), including these 13 patients. Thirteen patients (3.4%) underwent prehospital intervention only, and 78 (20.2%) underwent emergency department chest tube placement only.

Multivariable analysis

Multivariable logistic regression analysis is presented in Table 3. The analysis included 317 complete cases, of whom 85 underwent thoracic intervention. After adjustment for the other variables in the model, lower prehospital SpO_2 was associated with thoracic intervention (adjusted OR per 1-percentage-point increase, 0.949; 95% CI, 0.913–0.986; p=0.007). Penetrating trauma was also associated with

thoracic intervention (adjusted OR, 9.163; 95% CI, 2.735–30.699; p<0.001). Systolic blood pressure, GCS, prehospital intubation, and ISS >25 were not significantly associated with the outcome.

In the exploratory alternative model (Online Resource 1), which additionally included age, respiratory rate, and heart rate but excluded prehospital intubation, 277 complete cases were analyzed, including 77 patients with thoracic intervention. Lower SpO_2 (adjusted OR per percentage-point increase, 0.944; 95% CI, 0.905–0.984; p=0.007), higher respiratory rate (adjusted OR per breath/min increase, 1.071; 95% CI, 1.010–1.135; p=0.021), and penetrating trauma (adjusted OR, 6.337; 95% CI, 1.797–22.351; p=0.004) were associated with thoracic intervention. The other variables in this model were not significantly associated with the outcome.

In an additional sensitivity model including AIS Thorax ≥4, lower prehospital SpO_2 remained associated with thoracic intervention (adjusted OR per 1-percentage-point increase, 0.952; 95% CI, 0.916–0.989; p=0.011). AIS Thorax ≥4 was not independently associated with the outcome (adjusted OR, 2.489; 95% CI, 0.860–7.204; p=0.093). The estimate for penetrating trauma remained imprecise (adjusted OR, 12.955; 95% CI, 3.473–48.320; p<0.001; Online Resource 1).

Discriminatory performance of prehospital SpO2

Among the 353 patients with available prehospital SpO_2 measurements, the discriminatory ability of SpO_2 for identifying patients who underwent thoracic intervention was limited (area under the receiver operating characteristic curve, 0.610; 95% CI, 0.540–0.680; p=0.002). The Youden index identified a threshold of ≤87%, with a sensitivity of 27.4% and a specificity of 92.6%. At a threshold of ≤90%, sensitivity was 38.9% and specificity was 80.2%.

Discussion

In this single-centre cohort, lower prehospital SpO_2 and penetrating trauma were associated with receipt of acute thoracic intervention in the primary adjusted model. SpO_2 alone showed limited discrimination, while the exploratory alternative model also identified an association between respiratory rate and intervention.

Thoracic trauma remains one of the most frequent injury patterns in trauma patients and contributes substantially to early trauma-related mortality [1–4]. Several studies have described epidemiology, injury severity, and management strategies in thoracic trauma populations; however, comparatively little evidence exists regarding the relationship between prehospital physiologic parameters and subsequent thoracic intervention [9–13]. Our findings add information on real-world intervention patterns and the associations between prehospital physiology and thoracic intervention in a single-centre trauma cohort.

Patients undergoing thoracic intervention had lower prehospital SpO_2 and systolic blood pressure, as well as higher respiratory and heart rates, in univariable comparisons. These findings are consistent with

previous observations that thoracic trauma associated with respiratory compromise may present with physiological instability [10, 11]. Zeineddin et al. reported lower systolic blood pressure and higher heart rates in patients requiring invasive resuscitative procedures such as REBOA or resuscitative thoracotomy [10]. Similarly, Keneally et al. described physiological derangement in military patients with thoracic trauma [11]. However, these physiological findings are not specific to thoracic injury and may also reflect other injuries or systemic responses to trauma.

After multivariable adjustment, lower SpO_2 remained associated with thoracic intervention, whereas systolic blood pressure and GCS did not. Penetrating trauma was also associated with the outcome. This finding is clinically plausible because hypoxemia may reflect impaired ventilation or oxygenation resulting from pneumothorax, hemothorax, pulmonary contusion, or tension physiology [3, 6]. In contrast, hypotension and tachycardia may result from hemorrhage, traumatic brain injury, pain, sedation, or a systemic stress response rather than isolated thoracic pathology. The ROC analysis showed limited discrimination, and the exploratory threshold should not be interpreted as a stand-alone indication for intervention. In the exploratory alternative model, which additionally included age, respiratory rate, and heart rate, higher respiratory rate was also associated with thoracic intervention. These exploratory findings should be interpreted cautiously because the model included fewer complete cases, and the estimate for penetrating trauma was imprecise, as reflected by its wide confidence interval.

Current trauma guidelines recommend thoracic decompression in unstable trauma patients with suspected tension pneumothorax or severe thoracic compromise [1, 5]. Nevertheless, predicting which patients will undergo thoracic intervention during acute trauma care remains challenging, particularly in the prehospital setting. Occelli et al. demonstrated the limited diagnostic performance of physical examination findings alone in identifying blunt traumatic pneumothorax requiring early decompression [8]. Our findings similarly show that individual physiological measurements should be interpreted in the context of the overall clinical assessment. The present analysis does not establish a threshold for determining whether thoracic intervention should be performed.

AIS Thorax ≥ 4 did not differ significantly between patients with and without thoracic intervention. Although severe thoracic injury patterns were common throughout the cohort, thoracic intervention was associated with several physiological measures and with ISS > 25 in univariable analysis. This may reflect that intervention decisions are influenced by dynamic clinical status and the overall injury pattern, rather than thoracic anatomical injury severity alone. Previous TraumaRegister DGU® analyses have also described differences in early thoracic management according to injury severity [9]. These findings should be interpreted in light of the selected population treated at a supraregional level I trauma centre.

The association between lower SpO_2 and thoracic intervention persisted after additional adjustment for AIS Thorax ≥ 4. However, the confidence interval for AIS Thorax ≥ 4 was wide; this result should not be interpreted as evidence that anatomical injury severity is unrelated to intervention.

Emergency department chest tube placement was more frequent than prehospital thoracic intervention in this cohort. Of 26 patients who received a prehospital intervention, 13 also underwent emergency

department chest tube placement; 13 patients received a prehospital intervention only. This pattern may reflect differences in clinical context, diagnostic information, and decision-making between prehospital and hospital care. Emergency department chest tube placement may also follow imaging findings or subsequent clinical evolution. The registry data do not allow us to determine the reasons for individual intervention decisions.

In-hospital mortality was not significantly different between patients with and without thoracic intervention. Therefore, this cohort does not support describing thoracic intervention as a marker of higher mortality. The study was designed to examine associations with intervention, and the mortality comparison should be interpreted as a descriptive secondary finding.

Limitations

This study has several limitations. First, this was a retrospective single-center registry analysis, which limits causal interpretation and generalizability. Second, physiologic parameters represent surrogate markers of clinical status and may be influenced by pain, sedation, catecholamine administration, or associated injuries. Third, detailed clinical findings such as thoracic ultrasound results, auscultation findings, respiratory distress, or physician decision-making processes were not available within the TraumaRegister DGU®. Future studies integrating structured prehospital ultrasound findings may improve physiologic risk stratification. Fourth, documentation completeness varied between variables, and missing data may have influenced statistical analyses. Complete-case analyses reduced the sample size, particularly in the exploratory alternative model, and potential selection bias related to missing data cannot be excluded. In addition, thoracic intervention was analyzed as a combined outcome including both prehospital thoracic decompression and emergency department chest tube placement. Although this approach reflects overall acute thoracic intervention during trauma care, the clinical thresholds triggering intervention may differ between prehospital and in-hospital settings. Furthermore, the registry does not systematically capture the exact indication for thoracic intervention or differentiate between pneumothorax, hemothorax, tension physiology, or prophylactic drainage strategies. ROC analysis was exploratory and based on retrospective registry data. The identified discriminatory performance of SpO2 therefore requires prospective external validation. Patients requiring prehospital cardiopulmonary resuscitation were excluded. Because traumatic cardiac arrest is managed within a distinct, cause-directed resuscitation framework that prioritizes early treatment of reversible causes, including chest decompression, the present findings should not be extrapolated to this population [7].

Finally, the high prevalence of severe thoracic injury patterns within this supraregional level I trauma center cohort may limit transferability to less severely injured trauma populations or lower-level trauma systems.

Conclusion

In this cohort of trauma patients with thoracic trauma, lower prehospital SpO_2 and penetrating trauma were associated with thoracic intervention. The discriminatory ability of SpO_2 was limited, and it should not be used as a stand-alone decision threshold. Prospective multicentre studies incorporating detailed clinical findings and structured ultrasound data are needed to evaluate these associations further.

Declarations

Author's contributions

LR and MB drafted the manuscript. All authors critically revised the manuscript and approved the final version.

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Not applicable.

Data availability

The data analysed in this study are available from the corresponding author upon reasonable request and subject to approval by TraumaRegister DGU®.

Ethics approval and consent to participate

The study was approved by the Ethics Committee of the University Hospital Tübingen as part of a doctoral dissertation (project number 673/2023BO2). TraumaRegister DGU® data from Klinikum Stuttgart covering the period from 2018 to 2022 were analyzed. The study was conducted in accordance with the Declaration of Helsinki and its later amendments. Due to the retrospective registry-based study design and analysis of pseudonymized data, informed consent was waived by the ethics committee.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

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Tables

Table 1. Baseline characteristics of patients with and without thoracic intervention.

Variable	No thoracic intervention (n = 283)	Thoracic intervention (n = 104)	p-value
Age, years	53.8 ± 20.2	47.8 ± 20.0	0.010
Male sex, n (%)	220 (77.7)	79 (76.0)	0.712
Blunt trauma, n/N available (%)	264/271 (97.4)	87/91 (95.6)	<0.001*
Penetrating trauma, n/N available (%)	7/271 (2.6)	13/91 (14.3)	—
ISS >16, n (%)	187 (66.1)	79 (76.0)	0.063
ISS >25, n (%)	90 (31.8)	46 (44.2)	0.023
AIS Thorax ≥4, n (%)	243 (85.9)	94 (90.4)	0.240
Prehospital SpO_2, %	94.2 ± 5.8 (n = 258)	90.5 ± 10.4 (n = 95)	0.001
Prehospital systolic blood pressure, mmHg	128.2 ± 33.2 (n = 255)	118.6 ± 35.1 (n = 94)	0.022
Respiratory rate, breaths/min	16 (14–20) (n = 228)	18 (14–22) (n = 81)	0.006
Heart rate, beats/min	92 (80–110) (n = 257)	100 (85.5–118.8) (n = 94)	0.004
GCS score	14 (11–15) (n = 274)	14 (10–15) (n = 103)	0.526
NACA score	4 (4–5) (n = 100)	5 (4–5) (n = 32)	0.014
Prehospital intubation, n/N available (%)	82/272 (30.1)	38/98 (38.8)	0.118
In-hospital mortality, n (%)	21 (7.4)	10 (9.6)	0.481

Data are presented as mean ± standard deviation, median (interquartile range), or number (percentage), as appropriate. Percentages are based on the group total except for trauma mechanism and prehospital intubation, where they are based on non-missing observations; available denominators are shown. Missing data: trauma mechanism, n = 25; prehospital intubation, n = 17; prehospital SpO_2, n = 34; systolic blood pressure, n = 38; respiratory rate, n = 78; heart rate, n = 36; GCS, n = 10; NACA score, n = 255.

* The p-value refers to the overall comparison of blunt and penetrating trauma.

Table 2. Distribution of thoracic interventions

Intervention	n (%)
No thoracic intervention	283 (73.1)
Prehospital intervention only	13 (3.4)
Emergency department intervention only	78 (20.2)
Both prehospital and emergency department intervention	13 (3.4)
Total	**387 (100.0)**

Values are presented as n (% of the total cohort, N=387). Categories are mutually exclusive. The “both” category includes patients who received a thoracic intervention both prehospital and in the emergency department.

Table 3. Multivariable logistic regression analysis of factors associated with thoracic intervention

Variable	Adjusted OR	95% CI	p-value
SpO_2 (per 1 percentage-point increase)	0.949	0.913–0.986	0.007
Systolic blood pressure (per mmHg increase)	0.997	0.989–1.006	0.554
Glasgow Coma Scale (per 1-point increase)	1.019	0.931–1.115	0.689
Prehospital intubation	1.209	0.570–2.563	0.621
Penetrating trauma	9.163	2.735–30.699	<0.001
ISS >25	1.637	0.892–3.004	0.112

The model included 317 complete cases. The outcome was receipt of any thoracic intervention. Odds ratios are adjusted for all variables listed in the table. SpO_2, systolic blood pressure, and Glasgow Coma Scale are reported per one-unit increase.

Figures

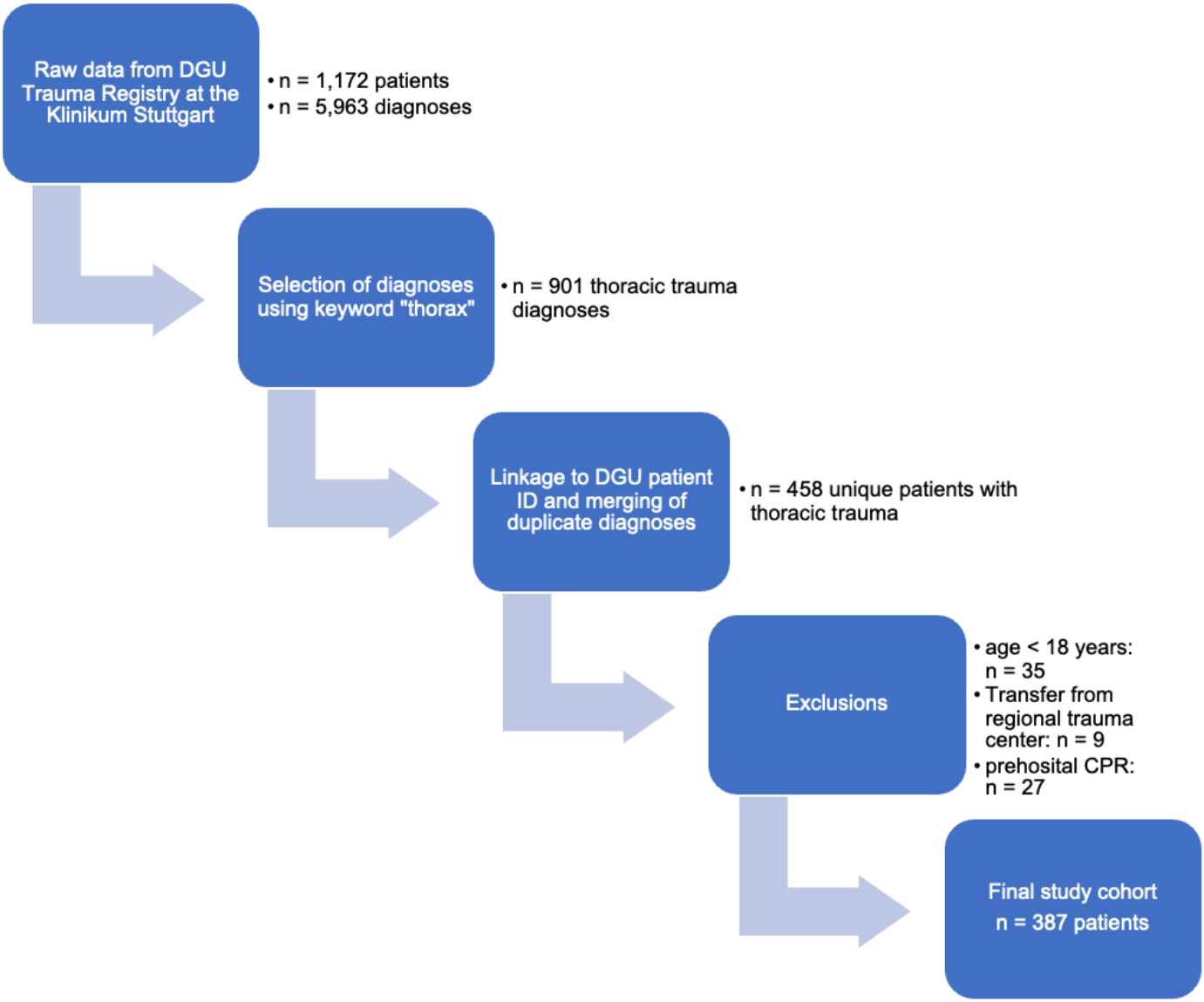


Figure 1

Flow diagram showing patient screening, identification of patients with thoracic trauma, application of exclusion criteria, and derivation of the final analytical cohort

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- ESM1.pdf