

Penetrating Trunk Trauma in Germany in the Context of Trauma Room Management: A 3-Year Case Series

Greta Ahrens*, Claudio von Freyhold-Hünecken, Michael Hoffmann and Nils Proksch

Asklepios Klinik St. Georg, Department of Trauma Surgery, Lohmühlenstraße 5 20099 Hamburg, Germany

*Greta Ahrens and Claudio von Freyhold-Hünecken authors have shared first authorship

*Corresponding authors:

Greta Ahrens

Asklepios Klinik St. Georg, Department of Trauma Surgery, Lohmühlenstraße 5 20099 Hamburg, Germany
<https://orcid.org/0009-0004-8419-454X>

Received: 22 Dec 2025

Accepted: 01 Jan 2026

Published: 05 Jan 2026

J Short Name: Ajsccr

Copyright:

©2025 Greta Ahrens. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and build upon your work non-commercially

Keywords:

Penetrating Trauma; Emergency Surgery

Citation:

Greta Ahrens, Penetrating Trunk Trauma in Germany in the Context of Trauma Room Management: A 3-Year Case Series. *Ame journal of Sur and Clin Case Rep*® 2025; V15(1): 1-7

Abbreviations:

BGA: Blood Gas Analysis; GCS: Glasgow Coma Scale; ISS: Injury Severity Score; GOS: Glasgow Outcome Scale; BP: Blood Pressure; HR: Heart Rate; BE: Base Excess; Hb: Haemoglobin; CPR: Cardiopulmonary Resuscitation; ICU: Intensive Care Unit; DCS: Damage Control Surgery; CT: Computer Tomography; eFAST: Extended Focused Assessment with Sonography for Trauma

1. Abstract

1.1. Introduction

Penetrating injuries to the trunk in polytrauma are associated with high mortality and require a timely, differentiated treatment strategy. In contrast to stab wounds, gunshot wounds show higher mortality in the literature.

The aim of this study is to analyse this patient cohort with regard to mortality and functional outcome.

1.2. Methods

This retrospective study included patients treated between 2021 and 2023 in the surgical trauma bay at a Level-1-trauma centre in Hamburg, Germany (Asklepios Klinik St. Georg) for penetrating truncal stab or gunshot injuries sustained as part of polytrauma. Mortality was defined as survival until hospital discharge. Functional outcome was assessed using the Glasgow Outcome Scale (GOS).

1.3. Results

A total of 53 patients were included. Of these, 45 patients (84.9%) sustained thoracic or abdominal stab wounds and 7 (13.2%) sustained gunshot wounds. Overall, 49 patients (92.5%) survived. Prehospital cardiopulmonary resuscitation (CPR) had been performed in 5 patients (9.4% of cases). During prehospital management, 10 patients (18.9%) had already received a chest tube. The majority of injuries (72.2%) occurred at night (defined as 8:00 pm–08:00 am). Immediate operative interven-

tion in the trauma bay was required for 6 (11.3%) patients, while 37 (69.8%) underwent surgery within the first 12 hours after admission.

The mean hospital length of stay among survivors was 9.5 ± 5.6 days, of which 4.1 ± 4.1 days were spent in the intensive care unit. The mean GOS of survivors was 4.9 ± 0.4 . The mean Injury Severity Score (ISS) was 20.3, with survivors demonstrating a significantly lower ISS of 15.9 ($p = 0.0039$).

1.4. Conclusion

The data from this study show that penetrating injuries can be associated with high survival rates and good functional outcomes. Further prospective studies are needed for differentiation and improved outcome prediction.

2. Introduction

Penetrating trunk injuries (involving the opening of the thoracoabdominal body cavity), which are most commonly caused by stab or gunshot wounds, represent a major challenge in trauma care and require immediate and decisive surgical intervention to optimize mortality [1,2]. Traumatic injuries remain a leading cause of death in individuals under 44 years of age, highlighting the importance of effective trauma management [3]. The contemporary approach to penetrating thoracoabdominal trauma increasingly emphasizes a tailored combination of non-operative management, dedicated imaging (eFAST, CT), and, when indicated, minimally invasive surgical techniques such as laparoscopy, adapted to the specific clinical presentation and injury

pattern of each patient.

The urgency and complexity of managing penetrating trunk injuries necessitate a multifaceted approach, including rapid interdisciplinary assessment, potential manual or mechanical resuscitative measures, and definitive surgical intervention. The integration of advanced diagnostic modalities into trauma bay management, such as focused assessment with sonography for trauma (eFAST), computed tomography, and rapidly obtainable laboratory parameters, plays a crucial role in promptly determining the extent of injury and guiding subsequent surgical strategies [4]. Mortality can be reduced through rapid diagnosis, circulatory stabilization, and timely surgical intervention [5].

Over the past decades, an increase in violent crimes and associated penetrating injuries has been observed [6]. Gunshot wounds exhibit higher mortality than stab wounds [7], as they are generally associated with more extensive damage to vital structures. In penetrating trauma, damage-control surgery (DCS), a staged surgical approach that initially addresses life-threatening injuries and delays definitive reconstruction until physiological stability is restored, is of central importance [8].

3. Methods

This retrospective study included patients who were presented between 2021 and 2023 with penetrating trunk injuries to the surgical trauma bay/resus room at a Level-1-trauma Centre in Hamburg, Germany (Asklepios Klinik St. Georg), as part of polytrauma management. For the purposes of this study, the “trunk” was defined as the body excluding extremities, head, and neck.

Mortality was defined as survival to hospital discharge.

Prehospital care includes the “on scene” time and transport time. All patients were initially evaluated and managed according to Advanced Trauma Life Support (ATLS®) guidelines by an interdisciplinary team led by trauma surgery in a major trauma centre. Patients of all ages were included. Clinical and demographic data were extracted from the internal trauma centre database and supplemented with information from electronic medical records.

The primary endpoints of this study were in-hospital mortality and functional outcome among survivors. Functional outcomes were assessed using the Glasgow Outcome Scale (GOS). Secondary variables included demographic characteristics (age, sex, time of injury), Injury Severity Score (ISS), mechanism of injury, and laboratory parameters.

Statistical analysis was performed using one-way ANOVA with non-parametric post hoc Kruskal-Wallis testing in Prism 10 (GraphPad Software). A p-value <0.05 was considered statistically significant. Ethical approval was obtained from the local ethics committee (2025-101630-BO-ff).

4. Results

4.1. Demographics

A total of 53 patients were included in this single-centre study. Basic study characteristics are shown in Table 1. The mean age was 33.66 ± 13.48 years. The distribution of age groups among the injured is shown in Figure 1. The cohort was predominantly male (50:3; 94%), and all deceased patients were male.

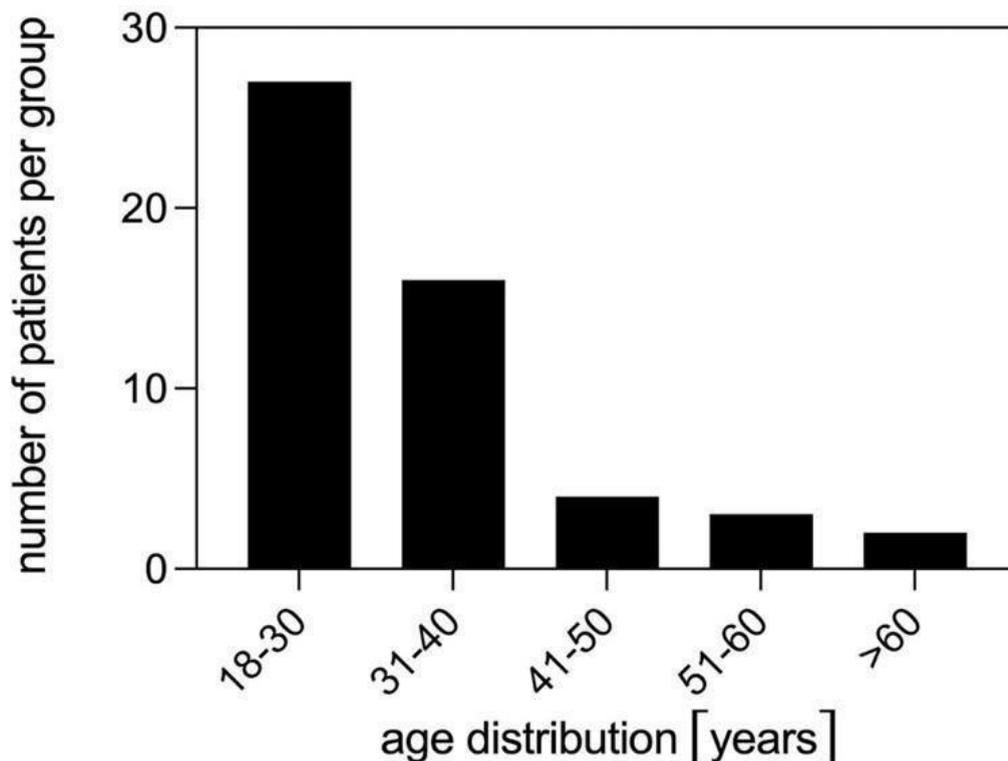


Figure 1: Age distribution- Bar chart showing the age distribution of all patients treated with a penetrating trunk injury. Values are presented as mean, n=53.

Table 1: Basic study characteristics. This table demonstrates the parameters of the study. It is divided in three groups (all, survived, dead). The subgroups are tested against each other stating the significance level. statistical significance was determined using Kruskal Wallis multiple comparison test; n=53.

		All (n=53)	Survived	Deceased	p
Age (years)		33.66 +/- 13.48	33.08 +/-12.67	40.75 +/-22.62	ns 0.5307
Sex-Distribution (M:F)		50:3	46:3	4:0	
male (%)					
CPR pre-hospital		5/53	1/49	4/4	
Cause of accident					
	Stab wounds	45	44		
	- thoracic	17	16	1	
	- abdominal	16	16	1	
	- thorakoabdominal	12	12		
	Gun shot wounds	7	5		
	- thoracic	3	1	2	
	- abdominal	3	3	2	
	- thorakoabdominal	1	1		
	Thoracic impalement	1		1	
Time of accident					
	Day (8:00 a.m. – 8:00 p.m.)	10	10	0	
	Night (8:00 p.m. – 8:00 a.m.)	26	24	2	
Vital sign pre-hospital					
	BP (mmHg)		125.2+/-25.63		
	RR (/min)		18.52+/-4.512		
	HR (/min)		96.44+/-23.12		
	GCS	13.5 +/- 2.82	13.82+/-2.157	3+/-0	Ns (0.1246)
	SpO2 (%)		95.53+/-7.907		
BGA					
	BE (mmol/l)	-2.275+/- 7.229	-1.576+/-6.429	-19.40+/-4.243	Ns (0.0806)
Treatment time (min)					
	Pre-hospital	13.22+/- 8.462	12.91+/-7.837	18.5+/-20.51	Ns (0.9976)
	Time to thoracotomy	83.54 +/- 40.39	89.42+/-36.91	35.0+/-38.96	Ns (0,1365)
Chest tube		10/53	6/49	4/4	
Vital signs Trauma Bay					
	BP (mmHg)	136.6+/- 30.85	138.3+/-29.02	60+/-0	Ns (0.2331)
	HR (/min)	95.75+/- 20.39	95.23+/-20.29	120+/-0	Ns (0.3666)
	SpO2 (%)	96.02+/- 4.502	95.96+/-4.529	99+/-0	Ns (0.7724)
	GCS		14.03+/-1.924		
Duration of stay					
	Trauma Bay	61.66+/- 34.74	64.56+/-34.53	30.50+/-19.94	Ns (0.0084)
	Hospital		9.49+/-5.576		
	ICU (intensive care unit)		4.07+/-4.073		
ISS		20.34 +/- 17.35	15.88+/-7.54	75 +/-0	** (0.0039)
GOS			4.898+/-0.3677		

4.2. Mechanism of Injury

84.9% of patients suffered a stab wound to the thoracic or abdominal region, and only 13.2% a gunshot wound. Among the stab wound subgroup only one patient was deceased after suffering a thoracic stab wound. Regarding gunshot wounds, both thoracic and abdominal injuries were observed. In this patient group, only those who died had thoracic gunshot wounds. Stab wounds had a higher survival rate (97%) than gunshot wounds (71.4%). One patient suffered a thoracic impalement injury. The dominant time period for penetrating injuries was nighttime (defined as the period between 8 PM and 8 AM).

4.3. Clinical and Laboratory Parameters

Prehospital vital signs were recorded only in survivors: The survivors showed a shorter pre-hospital rescue time, minimal base excess, and tended to have more physiological blood pressure and heart rate values.

4.4. Prehospital and In-Hospital Management

Prehospital cardiopulmonary resuscitation (CPR) was required in 9.4% of patients. All patients undergoing cardiopulmonary resuscitation died after hospital admission. The mean prehospital treatment time was 13.22 ± 8.46 minutes, with no significant

difference between survivors and non-survivors (12.91 ± 7.84 vs. 18.5 ± 10.51 min; $p = 0.9976$). Prehospital chest drains were placed in 18.9% of patients.

In-hospital, 11.3% of patients underwent immediate surgery in the trauma bay, while 69.8% required operative management within 12 hours of admission. The mean “time to thoracotomy/laparotomy” was 83.54 ± 40.39 minutes, with non-significantly shorter times in deceased patients (35.0 ± 38.96 min; $p = 0.1365$). Thoracostomy was performed in 18.87% of in-hospital cases, including all deceased patients.

Treatment time of the survivor-subgroup in the trauma bay/ resus room was non-significantly longer ($64,56 \pm 34,53$ min vs. $30,50 \pm 19,94$ min, $p = 0,0084$).

4.5. Outcome

Of the 53 patients included, 49 survived (92.5%). Among survivors, the mean hospital length of stay was 9.49 ± 5.58 days, including 4.07 ± 4.07 days in the intensive care unit (ICU). The mean Glasgow Outcome Scale (GOS) score among survivors was 4.9 ± 0.38 . The mean Injury Severity Score (ISS) for the cohort was 20.34, with survivors having a significantly lower ISS of 15.88 ($p = 0.0039$; Figure 2).

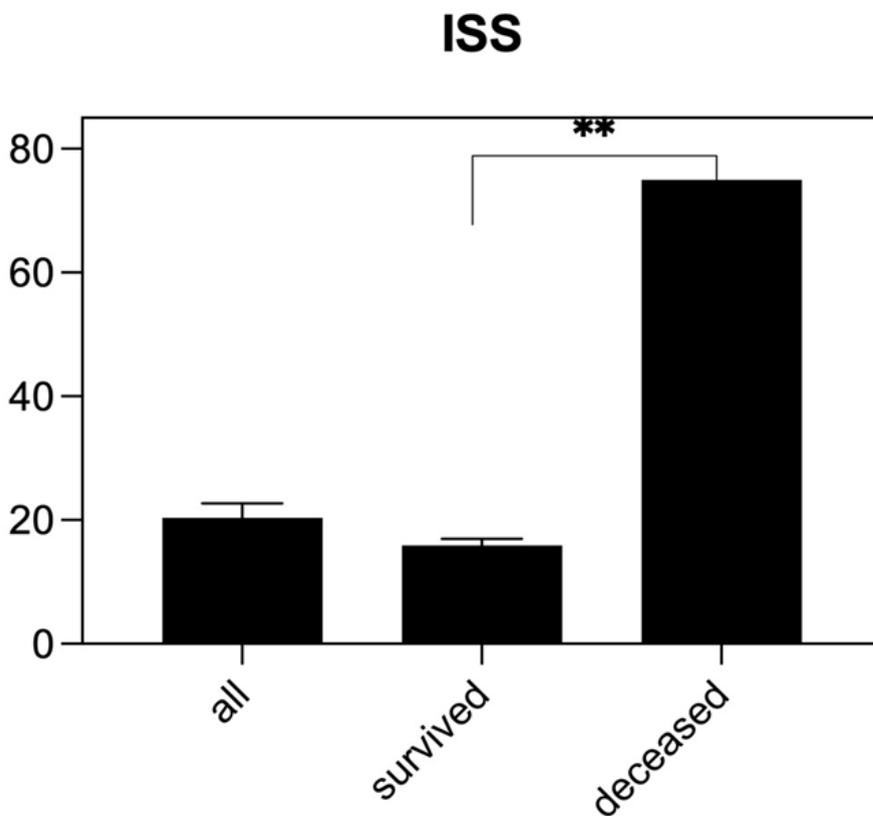


Figure 2: Injury Severity Score (ISS). Bar chart showing the Injury Severity Score (ISS) for all patients and separated by survival status. Values are presented as mean \pm standard error, * indicates experimental groups that are significantly different from the control group (** = $p < 0.01$, statistical significance was determined using Kruskal Wallis multiple comparison test; $n=53$).

5. Discussion

This 3-year case series demonstrates that penetrating trunk injuries, despite their potential severity, can be associated with high survival rates and favourable functional outcomes. In our cohort, 92.5% of patients survived, and the mean Glasgow Outcome Scale (GOS) among survivors was 4.9, indicating near-complete functional recovery. These findings are consistent with international studies reporting high survival rates with rapid, standardized trauma care (5,9,10).

5.1. Interdisciplinary Trauma Management

Due to the complexity of penetrating trunk injuries, interdisciplinary trauma management plays a critical role. Trauma surgery is central to acute intervention, with nearly 60% of polytrauma patients requiring operative management [11]. Early recognition and proactive management of physiological derangements are essential for survival. Successful treatment relies on coordinated expertise from trauma surgery, anaesthesiology, radiology, and other surgical specialties, including general/visceral and vascular surgery. This multidisciplinary approach ensures rapid, structured, and solution-oriented care for complex injury patterns [12].

5.2. Trends in Penetrating Trauma

In Europe, penetrating trauma is less common than in North America or Africa. A systematic review by Van Breugel et al. [13]. Reported a prevalence of approximately 4% in Europe, compared to ~16% in North America [13]. In Germany, the average prevalence of penetrating trauma is also ~4%, but our centre reports ~10% among emergency cases, including extremity injuries. Studies show, that penetrating injuries occur more often in the past years – even in Germany [14]. Urban areas such as Berlin, Frankfurt, and Hamburg have seen a rising incidence of penetrating trunk injuries between 2010 and 2019 with a overall mortality of 10-12%, with gunshot wounds being particularly lethal [15-17]. In our cohort, overall mortality was 7.5%, lower than previously reported, whereas gunshot wounds exhibited a mortality of 28.6%.

Up to 38% of penetrating injuries are located in the abdomen. In the United States, 35% of patients in urban trauma centres and up to 12% in suburban or rural centres sustain penetrating abdominal trauma [18-20]. Consistent with the literature, 36.54% of patients in our cohort presented with an abdominal penetrating injury.

In men under the age of 45, penetrating abdominal trauma occurs five times more frequently and represents one of the leading causes of morbidity and mortality in low- and middle-income countries [21,22]. The demographic distribution in our study cohort closely mirrors these previously reported findings.

5.3. Mechanism of Injury and Mortality

Gunshot wounds demonstrated significantly higher mortality than stab wounds, consistent with prior literature [7,10,23]. In our cohort, the mortality associated with gunshot wounds was

28.57%, compared with only 2% for stab wounds. This substantial difference underscores the markedly higher lethality of ballistic trauma, which is typically associated with greater tissue destruction. The increased lethality is attributable to the kinetic energy transfer, tissue cavitation, and injury to vital organs along the projectile path [24]. Thoracic gunshot injuries were particularly fatal, emphasizing the importance of rapid diagnosis and surgical intervention as described beforehand [15-17,25].

5.4. Current Management Algorithms

Time to surgical intervention is a critical determinant of outcome. Early transfer to specialized trauma centres and prompt surgery are associated with improved survival, with some studies reporting a 66% reduction in mortality when patients are rapidly handed over to the operating team [26-28]. In our cohort, prehospital treatment time was shorter among survivors, whereas deceased patients exhibited a shorter “time to thoracotomy/laparotomy,” reflecting that hemodynamically stable patients with isolated injuries may not require immediate surgery.

5.5. Timing of Surgery

Most patients underwent operative management within 12 hours, with 11.3% operated on directly in the trauma bay. Early surgical intervention is crucial, particularly for unstable patients, and aligns with recommendations from established trauma centres [26-28]. The mean “time to thoracotomy/laparotomy” of 83 minutes in our cohort demonstrates the efficiency of local trauma and operative workflows, even during the COVID-19 pandemic, when preoperative testing sometimes caused minor delays.

5.6. ICU and Hospital Stay

Survivors spent a mean of 4.1 days in the ICU and 9.5 days in the hospital, consistent with literature reports [5,9,18]. These data underscore that rapid, targeted care, including early surgery and intensive therapy, positively impacts functional outcomes.

5.7. ISS and Functional Outcome

The significant difference in Injury Severity Score between survivors (15.88) and non-survivors (75.0) highlights the prognostic relevance of overall injury burden ($p = 0.0039$) [5,21,22].

The Injury Severity Score (ISS) is an established and internationally recognised metric for the objective quantification of traumatic injury severity. It correlates strongly with mortality, morbidity, and the duration of hospital stay in severely injured patients. In our study, a marked and statistically significant difference in mean ISS was observed between survivors (15.88) and non-survivors (75.0), underscoring the powerful prognostic value of this scoring system. This finding aligns with previous studies that similarly identified the ISS as a robust predictor of survival following penetrating thoracic and abdominal trauma [13,29].

The pronounced discrepancy in ISS between both groups illustrates that not only the mechanism but more importantly the extent of injury and the number of involved organ systems are decisive for survival. An ISS exceeding 50 is repeatedly associ-

ated in the literature with mortality rates above 80%, particularly in cases involving combined thoracoabdominal trauma and massive haemorrhage. A comparable pattern was observed in our cohort: all patients presenting with an ISS \geq 50 died despite adherence to established trauma management principles, underscoring the inherent limits of modern acute care in the context of extreme injury patterns. Pre-Hospital surgery is related to high intra-hospital mortality – in this study 100%. This is also coherent to already published data with some studies claiming mortality rate of 95% [30]. This shows the very limited indication width [31].

Functional outcome was assessed using the Glasgow Outcome Scale (GOS). The mean score of 4.9 ± 0.38 among survivors reflects an almost complete functional recovery at the time of discharge. This favourable outcome suggests effective acute trauma care, timely surgical management, and high-quality post-operative and intensive care within our centre. When compared with outcomes reported in international cohorts [32-34], these results appear notably positive, which may be attributable to rapid operative intervention and adherence to standardised trauma protocols such as ATLS®.

6. Limitations

This study has limitations that have to be considered while interpreting results. First, it is a retrospective, single-centre analysis, introducing potential selection and information bias. Prehospital data were sometimes incomplete, including exact transport times and transfusion management. Second, the sample size ($n = 53$) is relatively small, limiting statistical power and generalizability, particularly for subgroup analyses (e.g., stab vs. gunshot injuries). Third, long-term follow-up was not performed; functional and psychosocial outcomes beyond hospital discharge remain unknown. Operative heterogeneity was not fully captured, as intraoperative parameters such as surgical approach, duration, blood loss, transfusion volumes, and postoperative complications were not analysed. Finally, these data originate from an urban, high-volume trauma centre, and findings may not generalize to facilities with different resources. Despite these limitations, this study provides valuable insights into penetrating trunk trauma care and outcomes in a specialized urban setting and can inform future multicentre prospective studies.

7. Conclusion

Penetrating trunk injuries represent a significant challenge to healthcare systems but are associated with good clinical outcome with adequate time and treatment management.

Our case series demonstrates that, with rapid and standardized trauma management, penetrating trunk injuries are associated with high survival rates and favourable functional outcomes. Gunshot wounds remain a significant risk factor for mortality. Early operative intervention, adherence to damage-control principles, and selective minimally invasive procedures are critical to reducing mortality and promoting functional recovery. Interdisciplinary care and structured treatment algorithms are key determinants of successful patient outcomes.

The aim of this study is to emphasize the importance of coordinated, interdisciplinary trauma management and to raise awareness of optimal strategies for the treatment of patients presenting with penetrating injuries.

8. Conception and Study Design

GA, NP; Literature Review: GA, CF; Data acquisition: GA, CF; Data Analysis and Interpretation: GA, CF; Drafting of the manuscript: GA, CF; Critical revision: NP, MH; All authors approved the final manuscript and consented to its publication.

References

- Glinz W. Special Considerations in Penetrating Chest Injuries. In: Glinz W, editor. Chest Trauma: Diagnosis and Management [Internet]. Berlin, Heidelberg: Springer Berlin Heidelberg. 1981; 70-7.
- Freeark RJ. Penetrating Wounds of the Abdomen. *New England Journal of Medicine*. 1974; 291(4): 185-8.
- Haagsma JA, Graetz N, Bolliger I, Naghavi M, Higashi H, Mullany EC. The global burden of injury: incidence, mortality, disability-adjusted life years and time trends from the Global Burden of Disease study 2013. *Injury Prevention*. 2016; 22(1): 3-18.
- Hirsberg A, Mattox KL. 'Damage control' in trauma surgery. *Journal of British Surgery*. 1993; 80(12): 1501-2.
- Bieler D, Kollig E, Hackenberg L, Rathjen J, Lefering R, Franke A. Penetrating injuries in Germany – epidemiology, management and outcome an analysis based on the TraumaRegister DGU®. *Scand J Trauma Resusc Emerg Med*. 2021; 29(1).
- Holmberg L, Mani K, Linder F, Wanhainen A, Wahlgren CM, Andréasson H. Penetrating trauma on the rise– nine-year trends of severe trauma in Sweden. *European Journal of Trauma and Emergency Surgery*. 2024; 50(6): 3189-97.
- Descamps C, Hamada S, Hanouz JL, Vardon-Bounes F, James A. Gunshot and stab wounds in France: descriptive study from a national trauma registry. *European Journal of Trauma and Emergency Surgery*. 2022; 48(5): 3821-9.
- Lamb CM, Macgoey P, Navarro AP, Brooks AJ. Damage control surgery in the era of damage control resuscitation. Vol. 113, *British Journal of Anaesthesia*. Oxford University Press. 2014; 242-9.
- Martin MJ, Brown CVR, Shatz D V, Alam H, Brasel K. Evaluation and management of abdominal gunshot wounds: A Western Trauma Association critical decisions algorithm. *Journal of Trauma and Acute Care Surgery*. 2019; 87(5): 1220-7.
- Tonus C, Preuss M, Kasperek S, Nier H. Ad quates Management von Stich- und Schussverletzungen. *Der Chirurg*. 2003; 74(11): 1048-56.
- Elbaih AH, Abdallah BS, Ismail MT. Evaluate the incidence, topography, management, and outcomes in patients with polytrauma in the Suez Canal and Sinai areas. *African Journal of Emergency Medicine*. 2023; 13(1): 30-6.
- Gogna S, Latifi R, Choi J, Con J, Prabhakaran K. Early versus delayed complex abdominal wall reconstruction with biologic mesh following damage-control surgery. *Journal of Trauma and Acute Care Surgery*. 2021; 90(3): 527-34.
- Van Breugel JMM, Niemeyer MJS, Houwert RM, Groenwold RHH. Global changes in mortality rates in polytrauma patients ad-

- mitted to the ICU - A systematic review. Vol. 15, World Journal of Emergency Surgery. BioMed Central Ltd. 2020.
14. Schürmann J, Michael M, Picker O, Bieler D, Heitkötter K. Development of violence-associated penetrating trauma in the Düsseldorf metropolitan region over a 5-year period (GewPen study). *Anaesthesiologie*. 2024; 73(7): 444-53.
 15. Bieler D, Franke AF, Hentsch S, Paffrath T, Willms A. Schuss- und Stichverletzungen in Deutschland – Epidemiologie und Outcome. *Unfallchirurg*. 2014; 117(11): 995-1004.
 16. Ajayi B, Guthrie H, Trompeter A, Tennent D, Lui DF. The rising burden of penetrating knife injuries. *Injury Prevention*. 2021; 27(5): 467-71.
 17. Schürmann J, Michael M, Picker O, Bieler D, Heitkötter K. Development of violence-associated penetrating trauma in the Düsseldorf metropolitan region over a 5-year period (GewPen study). *Anaesthesiologie*. 2024; 73(7): 444-53.
 18. Nadikuditi S, Utharaj NS, Krishnamurthy V, Kumar K, Hiriyur Prakash M. Penetrating Abdominal Trauma: Descriptive Analysis of a Case Series from an Indian Metropolitan City. *Cureus*. 2022.
 19. Arafat S, Alsabek MB, Ahmad M, Hamo I, Munder E. Penetrating abdominal injuries during the Syrian war: Patterns and factors affecting mortality rates. *Injury*. 2017; 48(5): 1054-7.
 20. Nishimura T, Sakata H, Yamada T, Terashima M, Shirai K. Different Patterns in Abdominal Stab Wound in the Self-Inflicted and Assaulted Patients: An Observational Analysis of Single Center Experience. *J Med Sci*. 2017.
 21. Shenkutie WT, Kaso T, Kaso AW, Agero G. Outcomes and Its Associated Factors among Patients with Abdominal Trauma Requiring Laparotomy at Asella Referral and Teaching Hospital, South Central Ethiopia: A Retrospective Cross-Sectional Study. *The Scientific World Journal*. 2024; 2024(1).
 22. Abdulkadir A, Mohammed B, Sertse E, Mengesha MM, Gebremichael MA. Treatment outcomes of penetrating abdominal injury requiring laparotomy at Hiwot Fana Specialized University Hospital, Harar, Ethiopia. *Front Surg*. 2022; 9.
 23. Mandal AK, Sanusi M. Penetrating chest wounds: 24 years experience. *World J Surg*. 2001; 25(9): 1145-9.
 24. Stefanopoulos PK, Hadjigeorgiou GF, Filippakis K, Gyftokostas D. Gunshot wounds: A review of ballistics related to penetrating trauma. *Journal of Acute Disease*. 2014; 3(3): 178-85.
 25. Holmberg L, Mani K, Linder F, Wanhainen A, Wahlgren CM, Andréasson H. Penetrating trauma on the rise- nine-year trends of severe trauma in Sweden. *Eur J Trauma Emerg Surg [Internet]*. 2024.
 26. Haslam NR, Bouamra O, Lawrence T, Moran CG, Lockey DJ. Time to definitive care within major trauma networks in England. *BJS Open*. 2020; 4(5): 963-9.
 27. Beeharry MW, Moqem K. The London Major Trauma Network System: A Literature Review. *Cureus*. 2020; 9.
 28. Shackelford SA, del Junco DJ, Mazuchowski EL, Kotwal RS, Remley MA. The Golden Hour of Casualty Care. *Ann Surg*. 2024; 279(1): 1-10.
 29. Boukerrouche A. Damage control surgery Concept. *Open Journal of Trauma*. 2019; 3(1): 006-9.
 30. Willis CD, Cameron PA, Bernard SA, Fitzgerald M. Cardiopulmonary resuscitation after traumatic cardiac arrest is not always futile. *Injury [Internet]*. 2006; 37(5): 448-54.
 31. Weegeenaar C, Perkins Z, Lockey D. Pre-hospital management of traumatic cardiac arrest 2024 position statement: Faculty of Pre-hospital Care, Royal College of Surgeons of Edinburgh. *Scand J Trauma Resusc Emerg Med*. 2024; 32(1).