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Penetrating Cardiac Injuries: "Damage Control" and ERAS Ways of Thinking

Abstract

Background. Penetrating stab wounds to the heart are potentially survivable injuries, with reported mortality ranging from 9.7 % to 35 % among patients who arrive at the hospital with signs of life. Management remains challenging and depends on rapid diagnosis, timely surgical intervention, coordinated anesthesiological resuscitation, and streamlined perioperative algorithms.

Aim. To describe the variability of clinical presentation, to analyze and optimize diagnostic, surgical, anesthetic, and postoperative approaches, and to identify management errors based on 23 years of institutional experience.

Materials and Methods. This retrospective cohort study covered a 23-year period and included 67 adult patients who met the inclusion criteria. Patients were stratified into four clinical categories on admission: benign condition, cardiac tamponade, critically unstable, and patients with signs of life or in cardiac arrest. All patients underwent anterolateral thoracotomy (Spangaro incision) for tamponade release, cardiac repair, and management of associated injuries. Anesthetic management consisted of general intravenous anesthesia, with rapid sequence intubation performed in 100 % of cases.

Results. Among the 67 patients, 61 (91.05 %) had isolated cardiac injuries and 6 (8.95 %) had multiple-chamber wounds. Overall survival was 91.05 %. Emergency department thoracotomy (EDT) was performed in 8 patients (11.94 %), with a 50 % survival rate. The distribution of isolated injuries was as follows: LV 29 (47.54 %), RV 24 (39.36 %), RA 4 (6.55 %), and LA 4 (6.55 %). Associated injuries occurred in 15 patients (22.38 %). Mortality was 8.95 %; deaths resulted from cardiac tamponade (4 patients, 66.7 %), exsanguination (1 patient, 16.65 %), and injury to the left anterior descending artery (1 patient, 16.65 %). Postoperative complications occurred in 5 patients (7.46 %).

Patients were subsequently divided into two groups: Standard (n=35) and ERAS-based management (n=32). Implementation of ERAS principles led to a significant reduction in ICU stay (2.2 → 1.6 days, $p<0.05$) and hospital LOS (9.3 → 6.5 days, $p<0.05$) without an increase in complications or mortality.

Conclusion. Survival after penetrating cardiac injury can be improved through the implementation of a simple, rational, and scientifically grounded management strategy that integrates damage-control principles and ERAS-based perioperative optimization.

Keywords: *cardiac trauma, penetrating heart injury, cardiac repair, cardiac tamponade, emergency department thoracotomy, ERAS, echocardiography*

Introduction. The incidence of cardiac injuries is approximately 1 patient per 210 trauma admissions [1]. Mortality in penetrating stab wounds to the heart ranges from 9.7 % to 35 % and is strongly influenced by the time to hospital admission, the patient's physiological category on arrival, the rapidity of surgical intervention, the extent of blood loss, and the quality of anesthesiological and postoperative management [2]. In many regions, including Ukraine, such patients are initially treated in municipal or rural hospitals, where general surgeons frequently manage emergency thoracic trauma.

Damage control surgery (DCS) was introduced in 1993 by Rotondo and Schwab [3] for the treatment of exsanguinating trauma patients and later adapted to multiple surgical disciplines [4]. The core concept emphasizes rapid control of life-threatening hemorrhage, reversal of the lethal triad, temporary measures, and limiting operative time to under one hour.

Enhanced Recovery After Surgery (ERAS) principles, introduced into cardiac and colorectal surgery in the 1990s [5,6] and formalized with the establishment of the ERAS Society in 2003, aim to reduce perioperative stress, optimize physiology, and accelerate functional recovery. Updated ERAS recommendations for emergency laparotomy (2021, 2023) further expanded the applicability of evidence-based multimodal care to acute surgical conditions [7,8,9,10]. Based on these concepts, we attempted to integrate ERAS principles – where feasible – into the perioperative management of patients with penetrating cardiac trauma.

Preliminary experience suggested that the application of ERAS components may reduce the length of ICU stay (from 2.2 to 1.6 days) and hospital LOS (from 9.3 to 6.5 days), without increasing complications. This observation aligns with modern literature demonstrating that survival in penetrating cardiac trauma depends not only on surgical technique, but also on coordinated multidisciplinary management and structured perioperative pathways.

The aim of this study was to describe the clinical patterns of penetrating cardiac injuries, to analyze and optimize diagnostic, surgical, anesthetic, and postoperative management algorithms, and to identify recurrent perioperative errors based on 23 years of experience at a high-volume trauma center.

The aim of this study was to describe the variable patterns of clinical presentation, analyse and optimise diagnostic, surgical, anaesthesiological, and postoperative algorithms, and identify management errors based on 23 years of experience.

Materials and methods

Study Design and Setting

This was a retrospective cohort study conducted at Kyiv City Clinical Hospital No. 17 over a 23-year period (January 2000 – December 2023). The study included adult patients presenting with penetrating stab wounds to the heart who underwent emergency surgical treatment. Reporting follows the STROBE guidelines for observational studies.

Ethical Approval

The study protocol received approval from the Health Research Ethics Committee of Shupyk National Healthcare University of Ukraine (Protocol #3, 10 October 2025). All procedures adhered to the principles of the Declaration of Helsinki. Written informed consent was obtained when applicable, recognizing that many critically unstable patients were unable to provide consent due to life-threatening conditions.

Data Sources

Clinical data were extracted from hospital medical documentation, including emergency department notes, eFAST reports, chest radiographs, operative reports, perioperative anesthetic charts, ICU monitoring sheets, and discharge summaries.

Study Population and Eligibility Criteria

A total of 67 consecutive adult patients (≥18 years) with penetrating stab wounds to the heart met the inclusion criteria. Patients declared dead on arrival without any signs of life were excluded. All patients were managed in the polytrauma department according to ATLS principles.

During operation, the mean estimated blood loss was 1291 ml (range 200-3500 ml). The mean hemopericardium volume was 255 ml (150-600 ml). Fifteen patients (22.38 %) had associated injuries (lung injury in 5 cases and vascular injuries to the internal thoracic artery or pericardiacophrenic artery in 10 cases).

Admission Classification and Initial Management

Upon arrival, patients were categorized into four clinical groups:

1. **Benign condition**
2. **Cardiac tamponade**
3. **Critically unstable**
4. **Patients with signs of life or in cardiac arrest**

This classification was based on physiological status and correlated with diagnostic findings. Resuscitation began immediately using warm crystalloids, blood products, and permissive hypotension principles.

Preoperative diagnostics included eFAST (performed in all patients) and chest X-ray (when feasible). Antibiotic prophylaxis with II–III generation cephalosporins and tetanus prophylaxis were administered according to guidelines.

Indications for Thoracotomy

Thoracotomy was performed for:

- cardiac arrest on arrival,
- positive eFAST (fluid in the pericardial or pleural cavity),
- chest X-ray findings suggestive of hemothorax or globular-shaped heart.

All surgical procedures were performed via anterolateral thoracotomy (Spangaro incision).

Anesthetic and Perioperative Management

General intravenous anesthesia was used in all patients. The choice of drug combination was based on hemodynamic parameters:

- **Sodium oxybutyrate + ketamine** in 37 patients (55.2 %)
- **Propofol + ketamine** in 22 patients (32.8 %)
- **Propofol + fentanyl** in 8 patients (12 %)

Rapid sequence intubation (RSI) was performed in 100 % of patients. Intraoperative and postoperative monitoring included ECG, invasive arterial pressure, central venous pressure, pulse oximetry, and capnography.

Massive transfusion strategies followed a damage control resuscitation approach, prioritizing blood components over crystalloids.

Formation of Standard and ERAS Groups

Following data analysis, patients were divided into two management subgroups:

- **Standard care group**: 35 patients
- **ERAS-implemented group**: 32 patients

ERAS elements included warmed infusions, early extubation, early mobilization, optimized analgesia, glucose control, maintenance of normothermia, and postoperative ECHO-guided inotropic titration.

Surgical Technique

In all patients, the pericardium was opened widely and parallel to the phrenic nerve. Clots were evacuated in cases of tamponade. When the patient presented in cardiac arrest, open cardiac massage was initiated immediately.

Bleeding control was achieved through manual finger tamponade, followed by definitive repair. Ventricular injuries were closed with U-stitches using 5-0 Ethibond on a large needle with two needle holders; atrial injuries were repaired with 4-0 or 5-0 Prolene under a Satinsky clamp. Pledgets were not used in penetrating cardiac trauma in this series.

Outcome Measures

Primary outcomes

- Mortality
- ICU length of stay (ICU-LOS)
- Total hospital length of stay (LOS)

Secondary outcomes

- Distribution and type of cardiac injuries
- Associated injuries
- Volume of transfusion
- Use of inotropic support
- Postoperative complications

Statistical Analysis. Data were analyzed retrospectively using R software (version 4.3.3).

Normality was assessed using the Shapiro–Wilk test.

- Continuous variables were expressed as **mean ±SD** or **median (IQR)** as appropriate.
- Categorical variables were summarized as **counts and percentages**.

Comparisons between Standard vs ERAS groups used:

- Independent samples t-test or Mann–Whitney U test for continuous variables
- χ^2 test or Fisher's exact test for categorical variables

A **p-value <0.05** was considered statistically significant.

Results. Over a 23-year period, 67 patients sustained penetrating stab wounds to the heart and met the inclusion criteria. The cohort consisted of 65 males (97 %) and 2 females (3 %), with a mean age of 35.42±6.93 years (range 18-67). Time from injury to hospital admission ranged from 0.5 to 2 hours. At presentation, 10 patients (14.9 %) were asymptomatic, while Beck's triad was observed in 8 patients (11.9 %). Another 8 patients (11.9 %) arrived in cardiac arrest. Beck's triad was seen exclusively in patients with cardiac tamponade and was absent in cases of massive pleural bleeding.

The time from admission to the operating room was exceptionally short (0-0.15 hours). Chest X-ray was performed in 52 patients (77.6 %), while eFAST was conducted in all patients. Pericardial fluid was categorized as negative, inconclusive (<40 ml), or positive. Emergency department thoracotomy (EDT) was required in 8 patients (11.94 %), with a survival rate of 50 %.

The operative approach consisted of an anterolateral thoracotomy, left-sided in 63 patients (94 %) and right-sided in 4 patients (6 %). Three predominant bleeding patterns were noted. Blood confined to the pericardium occurred in 16 patients, with volumes ranging from 150 to 600 ml (median 255 ml). Isolated pleural bleeding occurred in 12 patients, with blood loss ranging from 200 to 2500 ml (mean 1291.6 ml). Combined pericardial and pleural bleeding was documented in 39 patients, with pericardial blood volumes ranging from 40 to 500 ml (mean 171.8 ml) and pleural blood loss ranging from 100 to 3500 ml (mean 1060.25 ml).

Intraoperatively, isolated cardiac chamber injuries were identified in 61 patients (91 %), whereas multiple-chamber injuries were present in 6 patients (9 %). The distribution of isolated injuries included 29 left ventricular injuries (47.54 %), 24 right ventricular injuries (39.36 %), 4 right atrial injuries (6.55 %), and 4 left atrial injuries (6.55 %). Multiple-chamber combinations consisted of RV+LV in 3 patients, LA+LV in 2 patients, and RV+RA in 1 patient. All patients with multi-chamber injuries had hemopericardium of 150-300 ml accompanied by massive hemothorax of 1300-3500 ml.

Intraoperative steps are presented in Figure 1.

Postoperative management required transfusion in 53 patients (79.1 %), ranging from 1 to 7 units of packed red blood cells to maintain hemoglobin levels above 70 g/L. Inotropic support was necessary in 59 patients (88 %). In 40 patients (59.7 %), the combination of dobutamine and norepinephrine was used; 9 patients (13.4 %) required epinephrine; and 10 patients (14.9 %) were stabilized with norepinephrine alone. Time to achieve hemodynamic stability ranged from 6 hours to 9 days.

The overall mortality rate was 8.95 %. Mortality was 5.08 % in isolated injuries and 50 % in multi-chamber injuries. Fatal outcomes included two patients with left ventricular injuries (one with tamponade and one with massive hemothorax) and one patient with a right ventricular injury involving the anterior descending artery. Postoperative complications occurred in 6 patients (8.95 %), including one case requiring re-thoracotomy, two cases of wound dehiscence, and three cases of acute renal failure, all of which resolved without dialysis.

Patients were divided into Standard (35 patients) and ERAS (32 patients) groups. Implementation of ERAS principles resulted in a significant reduction in ICU stay (2.2 → 1.6 days, $p < 0.05$) and overall hospital stay (9.3 → 6.5 days, $p < 0.05$), without an increase in transfusion requirements, inotropic support, complications, or mortality. These findings suggest that improved recovery was attributable to perioperative optimization rather than differences in injury severity.

The results of patient examination and treatment are presented in Tables 1, 2, and 3.

Discussion. Penetrating cardiac injuries remain among the most formidable challenges in thoracic trauma, requiring rapid diagnosis, coordinated multidisciplinary management, and decisive surgical intervention. The modern damage control philosophy has substantially influenced the approach to such patients by prioritizing the arrest of life-threatening hemorrhage, cor-

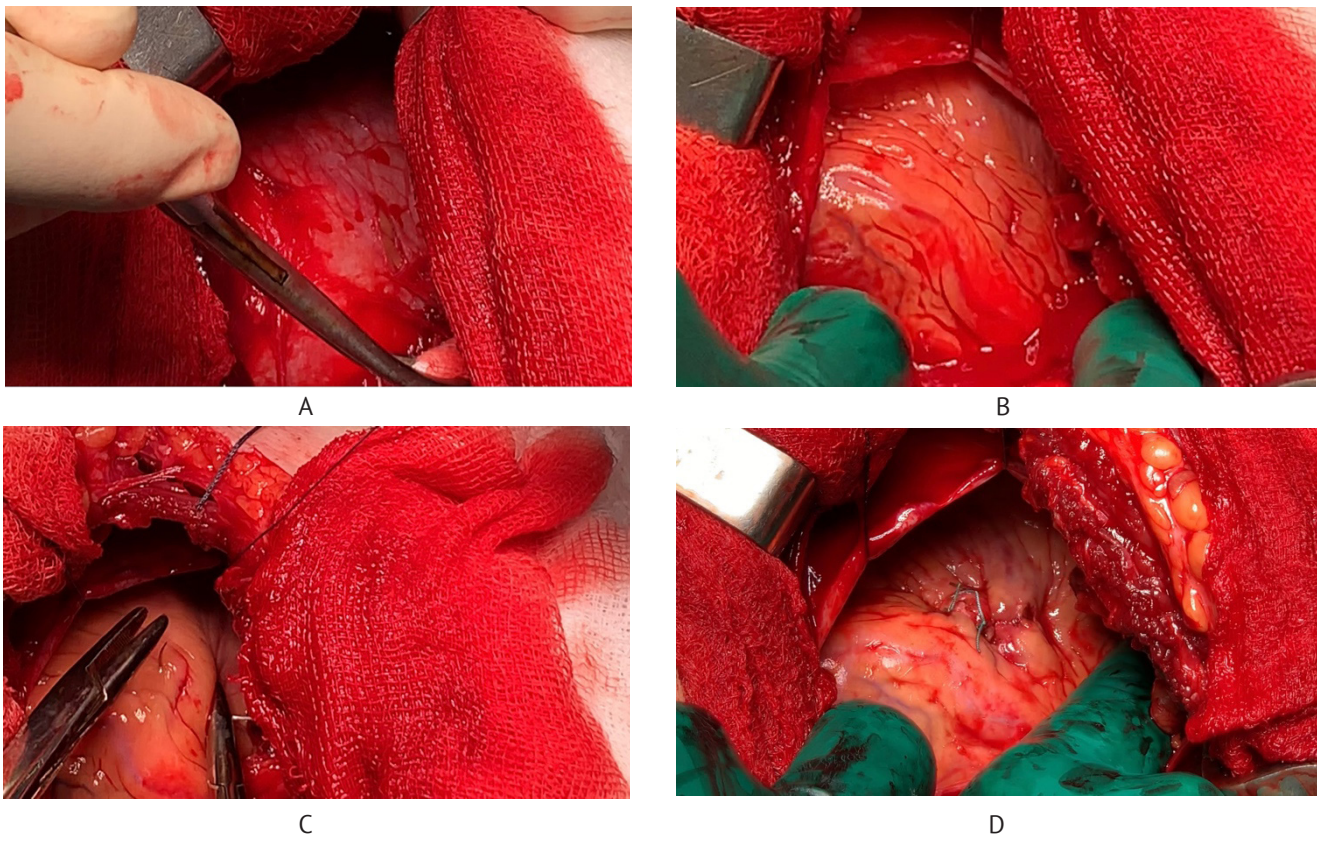

Figure 1. *Intraoperative views: A – the hole in the pericardium; B – opened the pericardium widely; C – the technique of suturing the heart with 2 needleholders; D – heart wound after it was sutured*

Table 1

Baseline characteristics at admission

Variable	Benign (n=13)	Tamponade (n=16)	Critically unstable (n=30)	Lifeless w/ SOL (n=8)	Total (n=67)
Time to admission, h	0.5-2.0	0.5-2.0	0.3-1.0	0.3-1.0	0.5-2.0
No symptoms	10	–	–	–	10 (14.9 %)
Beck's triad	–	8	–	–	8 (11.9 %)
Cardiac arrest	–	–	–	8	8 (11.9 %)
Chest X-ray done	13 (100 %)	12 (75 %)	27 (90 %)	0	52 (77.6 %)
eFAST positive	✓	✓	✓	✓	100 %
EDT performed	–	–	–	8	8 (11.9 %)

Table 2

Types of cardiac and associated injuries

Injury type	Benign	Tamponade	Critically unstable	Lifeless	Total
Isolated injuries	12	15	28	6	61 (91 %)
– LV	1	8	16	4	29
– RV	8	5	10	1	24
– RA	3	1	–	–	4
– LA	1	1	2	–	4
Multiple injuries	–	1	2	3	6 (9 %)
Associated injuries	2	1	6	6	15

Table 3

Comparison of outcomes in Standard vs ERAS groups

Variable	Standard (n=35)	ERAS (n=32)	p-value
ICU stay, days	2.2	1.6	**<0.05**
LOS, days	9.3	6.5	**<0.05**
pRBC transfusion	28 (80 %)	25 (78 %)	n.s.
Inotropic support	32 (91 %)	27 (84 %)	n.s.
Complications	4 (11 %)	2 (6 %)	n.s.
Mortality	1 (2.9 %)	1 (3.1 %)	n.s.

rection of the lethal triad, and minimizing operative time to under one hour. These principles, combined with the implementation of ERAS-based perioperative strategies, formed the foundation of management in our cohort.

Despite decades of experience with penetrating cardiac injuries, outcomes continue to depend on multiple interrelated factors, including the interval from injury to hospital admission, the physiological category of the patient at presentation, the extent of cardiac damage, the effectiveness of anesthesiological resuscitation, and the speed of operative control. E. Degiannis [11] proposed a practical clinical classification that divides patients according to their physiological state upon arrival. We adopted this classification in our study, and its use contributed to streamlined triage, reduced diagnostic delays, and faster operative access. Such an approach is likely one of the factors contributing to the relatively low mortality rate observed in our series compared with published historical data.

The variability of clinical presentation remains a hallmark of penetrating cardiac trauma. Patients may arrive in a seemingly stable condition without significant symptoms, yet rapidly deteriorate. Conversely, classic Beck's triad, often highlighted as a textbook sign of tamponade, appeared in only 11.9 % of our patients—consistent with reported rates of 10-30 %. The clinical picture was shaped primarily by the degree of hemorrhage, with patients suffering massive pleural bleeding presenting more frequently in shock or near cardiac arrest [12]. This further underscores the importance of early imaging and immediate operative readiness.

Non-invasive diagnostic modalities such as chest X-ray, eFAST, and transthoracic ECHO play crucial roles in the initial assessment. While chest X-ray remains limited in its sensitivity for cardiac injury [13], it nevertheless detected important findings such as globular cardiac silhouette or unilateral opacity in our cohort. eFAST was universally performed and demonstrated high sensitivity, consistent with existing literature. Nevertheless, certain limitations persist, particularly in cases with minimal pericardial accumulation. Echocardiography remains the gold standard for rapid identification of hemopericardium and ongoing cardiac compromise [14,15,16,17]. Although MDCT offers excellent sensitivity for structural cardiac injuries, it was not utilized in our cohort due to the emergent nature of presentation, the physiological instability of many patients, and the imperative to avoid delays to operative management [18].

The anesthesiological challenges in these patients are profound. Severe shock, metabolic derangements, arrhythmias, and active hemorrhage create a narrow therapeutic window. Induction of anesthesia must be carried out with agents that maintain hemodynamic stability, and in our study etomidate and ketamine were the agents of choice. Rapid sequence intubation was performed in all patients due to the emergency nature of the presentation. In-hospital cardiac arrest in these cases necessitates immediate open cardiac massage, as closed chest compressions generate only 20-25 % of baseline cardiac output and provide insufficient cerebral perfusion [19]. EDT remains the only meaningful option for survival in patients with penetrating thoracic trauma and cardiac arrest.

Surgical exploration consistently revealed distinct patterns of bleeding, ranging from isolated hemopericardium to massive pleural hemorrhage, or a combination of both. Intraoperatively, the presence of haemopericardium may be suspected from its bulging, tense, or white-bluish colour [20].

It is a mistake not to open the pericardium solely because it appears «normal». We always open the pericardium when there is suspicion of cardiac injury.

Meticulous opening of the pericardium parallel to the phrenic nerve, complete evacuation of clots, and rapid identification of bleeding sites were critical components of operative success. After opening the pericardium and releasing the tamponade (if present), the heart may be observed in one of two states: asystole or ventricular fibrillation. Defibrillating the heart during cardiac standstill is erroneous, as it may further damage the myocardium.

Open cardiac massage is performed with two hands, avoiding compression of the heart against the thoracic spine or sternum. Its effectiveness can be assessed using arterial line waveforms or end-tidal CO_2 ($EtCO_2$). Our technique relied on finger pressure for immediate hemostasis, followed by definitive chamber-specific repair with U-stitches for ventricular injuries or Prolene sutures for atrial injuries. Pledgets were not used, which is consistent with emerging trauma literature noting their limited applicability in this setting.

The mortality rate in our study was 8.95 %, which aligns with the lower boundary of reported global ranges (9.7-35 %). Mortality was significantly higher in patients with multiple-chamber injuries (50 %), reflecting the severity of physiological collapse associated with such wounds [21]. Complications were relatively infrequent and included wound dehiscence and acute renal failure, all of which were successfully managed.

There is only 3 prospective studies on penetrating cardiac injuries with positive scientific inquiry [22,23,24]

In these papers, the cardio-vascular and respiratory elements of the Trauma Score (CVRS) on admission were analysed and introduced into practice. In stab wounds, a CVRS of 0 and asystole were not shown to predict survival. Cardiopulmonary arrest was the only indication for performing thoracotomy, which was statistically significant (mortality rate 82.6 % versus 33.3 %). Mortality correlated with the grade of injury, but this grading system is not surgeon-friendly and is impractical in the operating room. A CVRS score of 0 predicts a mortality of 94 % ($p<0.001$).

The subxiphoid pericardial window is an alternative to eFAST; it is an invasive procedure that requires intubation and general anaesthesia.

Pericardiocentesis is now rarely performed in cases of penetrating cardiac trauma. We did not perform it for any patient.

In 1942, Griswold and Maguire recommended that every large hospital should have an operating room and surgical instruments available at all times.

Mattox KL pioneered the role of thoracotomy and cardiorrhaphy in the emergency centre.

In the postoperative period, continuous ECG and echocardiographic monitoring are crucial.

The level of troponin I may be informative when interpreted alongside ECG changes and segmental myocardial wall motion abnormalities. Complete heart block and other conduction system disturbances may necessitate temporary cardiac pacing.

Acute heart failure requires inotropic drugs (dobutamine, epinephrine, levosimendan, norepinephrine, or their combinations) and may even necessitate mechanical circulatory support devices such as an intra-aortic balloon pump, Impella, or ECMO [25].

Echocardiographic findings were abnormal in 17.4 % of patients after penetrating cardiac trauma: pericardial effusion 47 %, wall motion abnormalities 42 %, and reduced ejection fraction (EF) 42 % [26].

Prolonged hypovolemic shock and metabolic acidosis may contribute to acute renal failure, necessitating haemodialysis in 14.3 % of cases [27].

An important component of our study was the comparison between standard management and an ERAS-integrated perioperative approach. Although traditionally applied in elective surgery, elements of ERAS – such as the maintenance of normothermia, optimized analgesia, early correction of derangements, targeted hemodynamic management, and postoperative ECHO-guided inotropic titration – proved feasible even in emergency thoracic trauma. Implementation of these principles resulted in a statistically significant reduction in ICU stay (from 2.2 to 1.6 days, $p<0.05$) and hospital length of stay (from 9.3 to 6.5 days, $p<0.05$), without an increase in postoperative complications, transfusion requirements, or mortality. These findings support the concept that structured perioperative optimization can meaningfully improve recovery even in patients with exsanguinating, life-threatening thoracic trauma.

Furthermore, the observed similarity in injury severity, transfusion needs, inotropic requirements, and complication profiles between the two groups suggests that the improved recovery in the ERAS cohort was attributable to optimized perioperative care, not differences in baseline severity. These findings reinforce current trauma literature, which emphasizes that survival in penetrating cardiac trauma is determined not solely by surgical repair, but by coordinated multidisciplinary management, rapid diagnostics, and evidence-based resuscitation strategies.

Finally, the practical algorithm constructed from our experience offers a clear, reproducible, and clinically useful pathway for managing penetrating cardiac injuries. Early recognition of physiological status, rapid triage, immediate imaging, and decisive operative action form the core of effective care. Many perioperative pitfalls highlighted throughout our analysis – such as delayed pericardial opening, misinterpretation of imaging, or inappropriate resuscitation – can be avoided by adherence to established trauma principles and continuous interprofessional training.

At the conclusion of this study, we propose a practical, evidence-informed algorithm for the management of patients with penetrating cardiac injuries.

Algorithm for patients with penetrating cardiac injuries

E. Degianis classification of patients at arrival:

1) lifeless with any signs of life or cardiac arrest at admission – EDT in the OR;

2) critically unstable – OR (eFAST±X-ray in the OR);

3) cardiac tamponade – OR (eFAST±X-ray in the OR);

4) benign presentation – eFAST+X-ray – OR.

Conclusions. Penetrating cardiac injuries remain among the most lethal forms of thoracic trauma, yet survival can be significantly improved when management is rapid, structured, and grounded in evidence-based principles.

1. Classification of patients into benign, tamponade, critically unstable, or cardiac arrest categories proved essential for rapid triage and minimised delays to operative intervention.
2. Anterolateral thoracotomy is the preferred incision in patients with penetrating cardiac injuries.
3. The crucial role of anaesthesiological management lies in effective damage control resuscitation, rapid sequence intubation, haemodynamic-guided inotropic therapy, and maintenance of normothermia.
4. Incorporation and adaptation of ERAS principles into emergency thoracic trauma care demonstrated measurable clinical benefits.

Final Statements

Prospects for Further Research. Future studies should focus on long-term follow-up of patients with penetrating cardiac injuries with proposed algorithm and implemented ERAS concepts to confirm their efficacy and safety, reduce mortality and complication rates

Ethical Approval. The study protocol received approval from the Health Research Ethics Committee of Shupyk National Healthcare University of Ukraine (Protocol #3, 10 October 2025). All procedures adhered to the principles of the Declaration of Helsinki. Written informed consent was obtained when applicable, recognizing that many critically unstable patients were unable to provide consent due to life-threatening conditions.

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Use of Artificial Intelligence. No artificial intelligence tools were used in any stage of this study, including data collection, analysis, interpretation, or manuscript preparation. All research procedures and documentation were carried out exclusively by the author.

Materials and methods. The authors of the manuscript consciously declare that the work uses the results of their own clinical studies, which were systematized and analyzed by the authors. Primary data include generalized patient indicators, laboratory results, protocols and obtained quantitative characteristics. All materials are stored in the archive of the research group and can be provided upon reasonable request to the corresponding author, taking into account the requirements of confidentiality and ethical norms.

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Проникаючі поранення серця: мислення в стилі «damage control» та ERAS

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Резюме

Проникаючі ножові поранення серця є потенційно виживаними травмами, при яких зареєстрована смертність коливається від 9,7 % до 35 % серед пацієнтів, які надходять до лікарні з ознаками життя. Лікування залишається складним і залежить від швидкої діагностики, своєчасного хірургічного втручання, скоординованої анестезіологічного забезпечення та оптимізованих періопераційних алгоритмів.

Мета. Дослідження полягло у тому, щоб описати варіабельність клінічної картини, проаналізувати та оптимізувати діагностичні, хірургічні, анестезіологічні та післяопераційні підходи, а також виявити помилки управління на основі 23-річного досвіду роботи установи.

Матеріали та методи. Це ретроспективне когортне дослідження охоплювало 23-річний період і включало 67 дорослих пацієнтів, які відповідали критеріям включення. Пацієнти були розділені на 4 категорії: незагрозливий стан, тампонада серця, критично нестабільні та пацієнти із ознаками життя чи зупинкою серцевої діяльності при надходженні. Усім пацієнтам була проведена передньобокова торакотомія (розріз Спангаро) для усунення тампонади, зашивання серця та лікування супутніх пошкоджень. Анестезіологічне лікування включало загальну внутрішньовенну анестезію, у 100 % випадків - швидку послідовну інтубацію.

Результати. Серед 67 пацієнтів у 61 (91,05 %) були ізольовані поранення серця, а у 6 (8,95 %) – багатокамерні поранення. Загальна виживаність склала 91,05 %. Реанімаційна торакотомія була проведена у 8 пацієнтів (11,94 %) з виживаністю 50 %. Розподіл ізольованих травм був таким: ЛШ 29 (47,54 %), ПШ 24 (39,36 %), ПП 4 (6,55 %) та ЛП 4 (6,55 %). Супутні пожкодження виникли у 15 пацієнтів (22,38 %). Смертність склала 8,95 %; смерть настала внаслідок тампонади серця (4 пацієнти, 66,7 %), крововтрати (1 пацієнт, 16,65 %) та пошкодження лівої передньої низхідної артерії (1 пацієнт, 16,65 %). Післяопераційні ускладнення виникли у 5 пацієнтів (7,46 %). Пацієнтів пізніше розділили на дві групи: стандартна (n=35) та лікування на основі ERAS (n=32). Впровадження принципів ERAS призвело до значного скорочення тривалості перебування у відділенні інтенсивної терапії (2,2 → 1,6 дня, $p<0,05$) та тривалості перебування в лікарні (9,3 → 6,5 дня, $p<0,05$) без збільшення кількості ускладнень або смертності.

Висновки. Виживання після проникаючого поранення серця можна покращити шляхом впровадження простої, раціональної та науково обґрунтованої стратегії лікування, яка поєднує принципи контролю пошкоджень та періопераційну оптимізацію на основі ERAS.

Ключові слова: *травма серця, проникаючі поранення серця, ушивання поранення серця, тампонада серця, невідкладна реанімаційна торакотомія, прискорене відновлення після операції, ЕХО – кардіографія.*

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