UDC 617.55-001-089.168:355.48
DOI https://doi.org/10.32782/2226-2008-2026-1-4

P. O. Shklyarevych https://orcid.org/0000-0002-1402-2599

STAGED SURGICAL TREATMENT OF GUNSHOT ABDOMINAL WOUNDS WITH DUODENAL INJURY

Military Medical Clinical Center of the Southern Region, Odesa, Ukraine

UDC 617.55-001-089.168:355.48

P. O. Shklyarevych

STAGED SURGICAL TREATMENT OF GUNSHOT ABDOMINAL WOUNDS WITH DUODENAL INJURY

Military Medical Clinical Center of the Southern Region, Odesa, Ukraine

Background. Combat-related duodenal injuries (DI) are among the most complex abdominal traumas, with high mortality, septic complications, and lasting dysfunction. The most difficult decisions occur at Role 2, where limited resources hinder definitive care. The lack of a standardized algorithm contributes to poor outcomes.

Objective. To develop and assess a surgical algorithm for DI adapted to the tiered system of military evacuation.

Materials and Methods. Thirty service members with DI were studied: 20 managed with the proposed algorithm (main group) and 10 without (comparison). Injury severity was graded by AAST. Outcomes included mortality, complications, feeding initiation, and hospital stay.

Results. Mortality was 10.0 % in the main group versus 80.0 % in the comparison ($p < 0.001$). Complications occurred in 85.0 % vs. 100 %. Enteral feeding started earlier (6.6 ± 0.4 vs. 8.6 ± 1.1 days, $p < 0.05$), and hospital stay was shorter (25.8 ± 4.2 vs. 42.9 ± 6.8 days, $p < 0.05$). The D2 segment was most often affected. Algorithm elements included FAST, laparo-centesis, and laparoscopy at Role 2; CT and endoscopy at Role 3; definitive repair and second-look surgery at Role 4.

Conclusions. The algorithm reduced mortality and complications and allowed flexible tactical adaptation. At Role 2, strict damage control, avoidance of major reconstruction, and preparation for evacuation are essential. These findings support implementing a unified treatment pathway for DPI across the military medical system, adjustable to resources and battlefield conditions.

Keywords: combat trauma, duodenal injury (DI), tactical surgery, medical evacuation.

УДК 617.55-001-089.168:355.48

П. О. Шкляревич

ЕТАПНЕ ХІРУРГІЧНЕ ЛІКУВАННЯ ВОГНЕПАЛЬНИХ ПОРАНЕНЬ ЖИВОТА З УШКОДЖЕННЯМ ДВАНАДЦЯТИПАЛОЇ КИШКИ

Військово-медичний клінічний центр Південного регіону, Одеса, Україна

Бойові ушкодження дванадцятипалої кишки належать до надскладних абдомінальних травм із високою летальністю та ризиком інфекційних ускладнень. Особливо критичним є вибір тактики на етапі Role 2 в умовах дефіциту ресурсів. у дослідженні проаналізовано 30 випадків, з яких 20 лікували за розробленим алгоритмом, а 10 – без нього. Застосування алгоритму дало можливість суттєво знизити летальність (10 % проти 80 %), скоротити госпіталізацію та прискорити відновлення ентерального харчування. Найчастіше уражався сегмент D2. Ключовими елементами стали FAST, лапароцентез і лапароскопія на II рівні, МСКТ та ендоскопія на III, реконструкція і second look на IV. Алгоритм підвищує ефективність допомоги, зменшує ускладнення та сприяє стандартизації хірургічної тактики при бойових пораненнях ДПК.

Ключові слова: бойова травма, дванадцятипала кишка, тактична хірургія, медична евакуація.

Introduction

In modern conditions of conducting combat operations, the provision of timely and effective surgical care to the wounded is a critical component of the military medical support system [1; 2]. Tactical medicine, which is developing at the intersection of military surgery, logistics, and emergency medicine, operates with the concept of staged medical evacuation, within which surgical interventions are integrated according to the severity of injury, distance from the combat zone, and availability of resources [1]. The first medical actions on the battlefield (Tactical Combat Casualty Care) are aimed at saving life with minimal means by temporary control of bleeding, ensuring airway patency, and rapid evacuation, without performing surgical manipulations. Starting from Role 2, which is represented by mobile surgical groups and stabilization points, the first surgical intervention is performed, known as damage control surgery, which aims to save life by stopping massive bleeding, combating shock, and preventing multiple organ failure [2; 3]. At the next level – Role 3 – the third level in case of DI is considered as a stabilization stage, where measures are carried out to stabilize the condition of the wounded and additional examination (using all necessary technical capabilities) with further evacuation to Role 4. If necessary, programmed relaparotomy (according to DCS tactics), control of bleeding, percutaneous transhepatic cholecystostomy under ultrasound guidance are performed [2; 4]. The final stage – Role 4 – involves providing a full spectrum of medical care in military medical centers on the territory of the state or beyond it, including reconstructive surgery and long-term recovery [2; 5]. Thus, the structure of providing surgical care in tactical medicine is based on the principles of staging, mobility, adaptability, and continuity, which makes it possible to ensure maximum survival of the

wounded in extremely difficult conditions of modern combat.

At the Role 2 stage – a mobile stabilization surgical unit – the choice of treatment tactics for combat DI is accompanied by a number of unresolved clinical and tactical issues that remain the subject of active discussion in the military surgical community [2; 3; 6]. The absence of a unified approach at this critical stage creates risks of variability in decision-making and directly affects patient survival and prognosis. In particular, there are still no clear criteria regarding the feasibility of primary reconstruction of the damaged duodenum in unstable patients. In cases of localized injuries that do not exceed 50 % of the circumference of the intestinal wall, primary suturing may be technically possible. However, under conditions of limited time, lack of full anesthesiological support, and limited resources, such tactics may lead to suture failure, peritonitis, and death [6]. In such situations, temporary solutions are more often chosen: packing, clip application, external drainage of the gallbladder, and transfer of definitive reconstruction to the next stage – Role 4.

A separate issue is the use of pyloric exclusion in combination with gastrojejunostomy, which is considered in injuries of D1–D2 segments, especially with combined pancreatic injury [7]. However, the implementation of this technique in Role 2 conditions is significantly limited both by the duration of the operation, which exceeds the critical threshold (60 minutes), and by the need for high surgical qualification. In addition, there are no consolidated indications for choosing this method in combat trauma.

No less debatable is the issue of resection of an intestinal segment in conditions of significant crushing or complete avulsion of a part of the duodenum [8; 9]. Although duodenojejunostomy and other types of reconstruction are considered standard for high-grade injuries (III–IV according to AAST), their implementation at Role 2 remains an exception rather than the rule [6]. In practice, the approach of biliary decompression (percutaneous transhepatic cholecystostomy), staged surgical interventions, and diagnostic laparoscopy (if equipment allows) predominates.

An even more complex situation arises in combined injuries of the duodenum, pancreas, and major vessels [10]. Such combinations are associated with an extremely high mortality risk; however, the algorithm of actions at Role 2 remains undefined.

The issue of criteria for safe evacuation of patients after primary intervention also remains unresolved. There is no unified opinion regarding the optimal timing of transport, hemodynamic stability limits, or laboratory parameters that could be used as universal criteria for evacuation decision-making [1; 2, 11].

The use of negative pressure therapy (VAC) in an open abdominal cavity also requires standardization [12]. Although VAC therapy may be effective in posterior DI, its use in combat conditions is limited by technical difficulties and lack of standardized protocols.

Thus, the absence of unified regulated approaches to the treatment of DI at Role 2 determines the urgent need to develop a standardized algorithm that would include clear indications for primary suturing, reconstruction, drainage, use of VAC systems, criteria for evacuation safety, and selection between temporary and definitive surgical strategies. Such an algorithm must be adapted to the realities of military medicine, resource limitations, and dynamic tactical conditions. Its implementation will improve survival, reduce complications, and form a unified surgical doctrine for DI in combat conditions.

Objective. To prove the effectiveness of the proposed algorithm of surgical care in DI at Role 2–4 levels of medical support compared to the existing surgical treatment tactics.

Materials and Methods

The results of treatment of 30 patients with combat DI were analyzed, including 20 patients (main group) treated according to the developed algorithm and 10 patients (comparison group) treated without using the proposed recommendations.

To determine the severity of DI, the classification of the American Association for the Surgery of Trauma (AAST, 2018) was used [13]. The duration of hospital stay, number of complications, and mortality were evaluated.

The mean age of patients in the main group was 38.3 ± 2.3 years, and in the comparison group – 36.5 ± 3.5 years ($p > 0.05$).

Based on the analysis of current approaches to the management of DI [2; 6–10], we developed a structured treatment algorithm (Fig. 1).

Diagnostic Measures

Role 2 (Level 2 of medical care):

– Assessment of the patient's general condition;
– Determination of blood group and Rh factor, laboratory testing;
– Evaluation of the characteristics, size, and localization of entry and exit wounds;
– Emergency ultrasound examination using the FAST protocol [14];
– Abdominal radiography in two projections (or computed tomography if available and the patient is stable);
– Laparocentesis using the "floating catheter" technique (or gauze-assisted abdominal revision);
– Diagnostic laparoscopy (if indicated and equipment is available).

Role 3 (Level 3 of medical care):

– Reassessment of the patient after evacuation;
– Laboratory investigations;
– Full abdominal ultrasound examination;
– Radiography of the abdomen and other anatomical regions (as indicated);
– Multislice computed tomography;
– Video endoscopic examinations as required;
– Diagnostic laparoscopy (if indicated).

Role 4 (Level 4 of medical care):

– Reassessment after evacuation to Role 4;
– Comprehensive laboratory evaluation;
– Full abdominal ultrasound examination;
– Radiography (as indicated);
– Multislice computed tomography;
– Full video endoscopic evaluation (fibrogastroduodenoscopy, ERCP);
– Diagnostic and dynamic (second-look) laparoscopy.

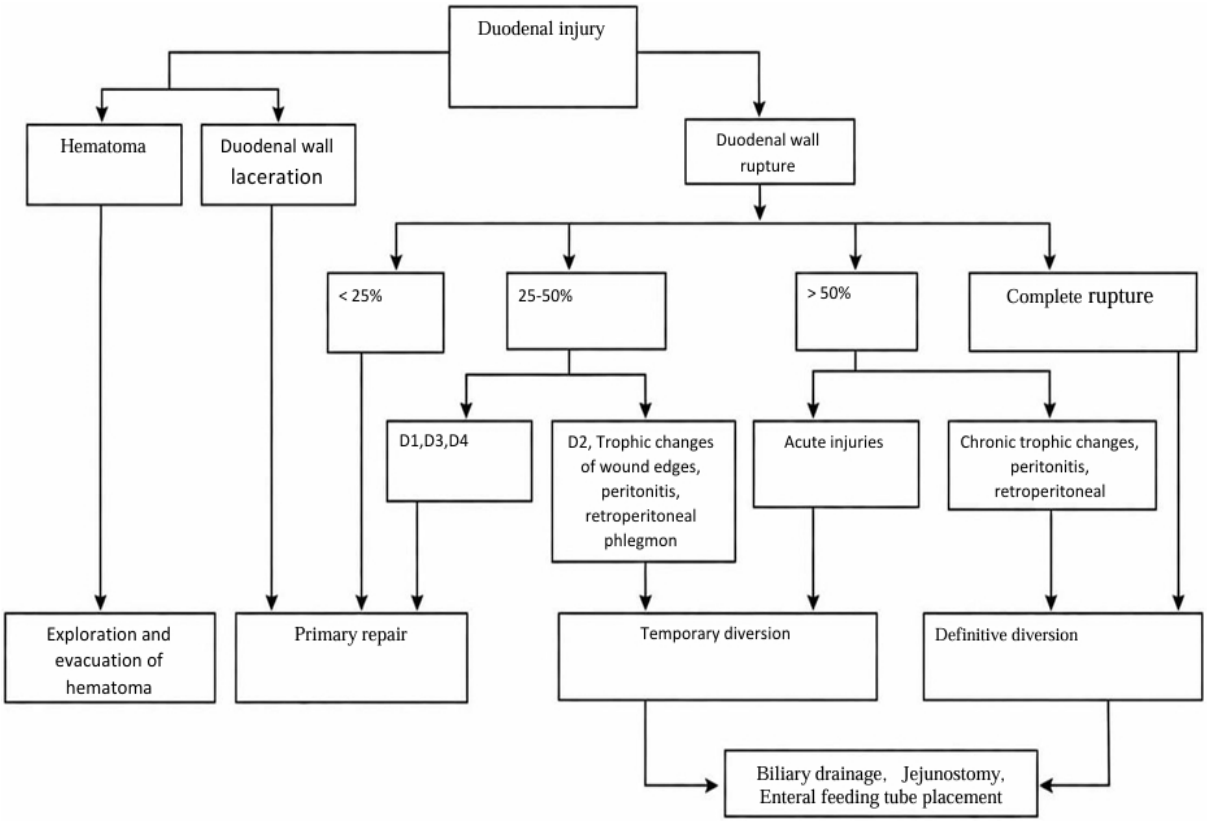

Fig. 1. Algorithm for DI management

The study was conducted in accordance with modern bioethical standards [15]. All participants or their authorized representatives provided informed consent. The study protocol No. 163 was approved by the Ethics Committee of the National Medical University named after O. O. Bohomolets (07.11.2022).

Statistical analysis was performed using frequency and variance analysis with Statistica 14.1.25 software (TIBCO, USA) [17].

Research results and their discussion

The second segment of the duodenum (D2) was most frequently affected: in 8 patients (40.0 %) of the main group and in 5 patients (50.0 %) of the comparison group. According to the AAST classification, in the main group there was 1 case of grade I injury, 9 cases (45.0 %) of grade II, and 10 cases (50.0 %) of grade III injury. In the comparison group, grade II injuries predominated (8 cases, 80.0 %), while grade I and III injuries occurred in one case each. No statistically significant difference between the groups was found ($p > 0.05$) (Table 1).

Table 1

Distribution of injuries according to the AAST classification

Grade	Main group (n = 20)	Comparison group (n = 10)
I	1(5.0 %)	1(10.0 %)
II	9(45.0 %)	8(80.0 %)
III	10(50.0 %)	1(10.0 %)
IV	–	–

In most cases, surgical intervention was performed within 24 hours after injury; however, in 7 patients (35.0 %) of the main group, surgery was delayed beyond this period. The primary surgical procedure was laparotomy with primary closure of the defect and duodenal decompression. The Strong procedure was performed in 8 cases (40.0 %) in the main group and in 6 cases (60.0 %) in the comparison group. Postoperative mortality was 10.0 % in the main group and reached 80.0 % in the comparison group ($\chi^2 = 11.72$; $p = 0.0006$).

Postoperative complications were observed in 85.0 % of patients in the main group (17 cases) and in 100 % of patients in the comparison group ($\chi^2 = 1.61$; $p = 0.20$), with sepsis being the most common complication (Table 2).

Table 2

Postoperative outcomes

Parameter	Main group	Comparison group	Statistics
Mortality	2(10.0 %)	8(80.0 %)	$\chi^2 = 11.72$; $p = 0.0006$
Complications	17(85.0 %)	10(100 %)	$\chi^2 = 1.61$; $p = 0.20$

Thoracic complications were observed in 5 patients (25.0 %) in the main group, while wound complications occurred in 7 patients (35.0 %). Fistula formation was recorded in 2 patients (10.0 %) in the main group and in all patients in the comparison group. One patient in the main group required reoperation. Bile leakage was observed in three patients, and disseminated intravascular coagulation (DIC syndrome) was diagnosed in one patient in the comparison group (Table 3).

Table 3

Structure of postoperative complications

Complication	Main group	Comparison group
Sepsis	17(85.0 %)	10(100 %)
Thoracic complications	5(25.0 %)	7(70 %)
Wound complications	7(35.0 %)	8(80 %)
Fistulas	2(10.0 %)	10(100 %)
Reoperation	1(5.0 %)	4(40 %)
Bile leakage	3	9(90 %)
DIC syndrome	–	1(10 %)

The mean time to initiation of enteral feeding was 6.6 ± 0.4 days in the main group and 8.6 ± 1.1 days in the comparison group ($p < 0.05$). The mean length of hospital stay was 25.8 ± 4.2 days in the main group and 42.9 ± 6.8 days in the comparison group ($p < 0.05$). Thus, implementation of the improved treatment algorithm significantly reduced mortality and improved functional outcomes in patients with DI (Table 4).

Table 4

Comparison of recovery parameters

Parameter	Main group	Comparison group	p
Time to enteral feeding (days)	6.6 ± 0.4	8.6 ± 1.1	< 0.05
Length of hospital stay (days)	25.8 ± 4.2	42.9 ± 6.8	< 0.05

The surgical management of combat-related abdominal trauma with DI at Role 2–4 levels of medical care in the main group was based on the following principles: adherence to the "golden hour" concept, application of damage control surgery (DCS), strict compliance with the staged approach to care, use of minimally invasive diagnostic and therapeutic methods (including ultrasound-guided interventions), adequate anesthesiological support, application of modern hemostatic and electrosurgical techniques, mobilization of the duodenum according to Kocher–Clermont and Cattell–Braasch (right medial visceral rotation), ultrasound-guided biliary drainage (when indicated), and a multidisciplinary approach to the development of the diagnostic and treatment algorithm.

Role 2 (Level 2 of medical care) At Role 2, the primary surgical interventions for DI included closure of defects. In cases of severe tissue destruction or complete rupture of a duodenal segment, temporary clipping of the wound edges was performed, with mandatory gastric decompression. Hemorrhage control was achieved by ligation, suturing, or electrocoagulation of bleeding vessels. When necessary, gauze packing of the abdominal cavity was performed using hemostatic materials or combined hemostatic techniques.

Role 3 (Level 3 of medical care) At Role 3, surgical interventions were primarily stabilizing in nature and included more detailed patient assessment using available diagnostic resources, including advanced imaging modalities. Within the framework of damage control surgery, programmed relaparotomy could be performed, along with control of residual bleeding and, when indicated, percutaneous transhepatic cholecystostomy under ultrasound guidance. After stabilization, patients were evacuated to Role 4 for definitive treatment.

Role 4 (Level 4 of medical care) At Role 4, the third phase of DCS was implemented, which in cases of severe injury could be divided into several surgical stages. Surgical procedures included duodenal diverticulization by suturing the pyloroduodenal junction, formation of an antecolic gastroenterostomy with a Braun enteroenterostomy (afferent loop length 40–50 cm). In cases of D1 segment injury with destruction of the pyloroduodenal junction, antrectomy was performed with formation of a gastroenterostomy on a long loop, also with Braun anastomosis. For severe injuries of the D2 segment (AAST grade III–IV), pancreatoduodenal resection or duodenectomy with external drainage of the common bile duct and pancreatic duct without anastomosis formation was indicated. Indications for total pancreatectomy included massive gunshot injuries of the duodenum (grade III–IV according to Moore classification), destructive pancreatic necrosis, or recurrent erosive hemorrhage. In injuries of the D3–D4 segments, the formation of a duodenojejunostomy is considered acceptable. In such cases, a perforated microirrigator may be introduced through the cystic duct into the afferent loop to provide local sanitation. In cases of duodenal suture failure, negative pressure therapy using the EndoVAC system proved to be effective. In the presence of purulent-inflammatory complications (subdiaphragmatic or subhepatic abscesses), ultrasound-guided puncture and drainage interventions within the framework of interventional ultrasonography are applied. Thus, the nature and extent of surgical interventions in combat-related abdominal trauma with duodenal injury are determined both by the level of medical care and by the patient's clinical condition, injury topography, intensity of combat activity in a given area, and evacuation capabilities. A certain overlap of surgical procedures may occur between Role 3 and Role 4 levels, particularly in situations where aeromedical evacuation is unavailable, and Role 3 facilities are compelled to assume part of the functions of higher-level specialized care.

At Role 2, the primary objective is to preserve vital functions through temporary damage control. In this context, damage control surgery (DCS) [9] involves the use of simple yet effective techniques, including primary repair of the intestinal defect (when feasible), temporary clipping of wound edges in cases of extensive damage, gastric decompression, abdominal packing in cases of hemorrhage, and ligation or coagulation of bleeding vessels. However, it is precisely at this stage that significant controversy exists regarding the extent of the primary surgical intervention.

In contrast to the main group, surgical management in the comparison group did not include systematic application of the damage control surgery concept, staged treatment according to levels of medical care, or a multidisciplinary decision-making algorithm. Minimally invasive and ultrasound-guided interventions were not utilized, including puncture-drainage techniques and percutaneous transhepatic cholecystostomy. Additionally, advanced surgical technologies such as active decompression techniques, negative pressure therapy (EndoVAC), programmed relaparotomy, and interventional ultrasonography were not

applied. In most cases, the surgical approach was limited to conventional laparotomy with primary repair of the injury, without clear differentiation of tactics based on the level of medical care. On the one hand, proponents of limited surgical intervention argue [17] that in unstable patients, under conditions of time constraints, limited instrumentation, or insufficient surgical expertise, any attempt at definitive reconstruction may lead to worsening hemorrhage, progression of shock, and fatal complications. On the other hand, some surgeons attempt to perform immediate definitive repair or even anastomosis, particularly in isolated injuries of AAST grade I–II. However, both literature data and analysis of clinical outcomes indicate [17] that such an approach is justified only in hemodynamically stable patients with limited injuries, when evacuation is either delayed or technically impossible.

Furthermore, there is ongoing debate regarding the appropriateness of using pyloric exclusion or biliary drainage at this stage [18]. These techniques may be beneficial in injuries involving the D1–D2 segments, particularly when combined with pancreatic injury; however, their implementation under Role 2 conditions requires sufficient surgical experience, operative time, and anesthesiological support, which are not always available. Thus, balancing the aggressiveness of surgical intervention with patient safety at this stage remains a key factor in clinical decision-making.

Following initial intervention at Role 2, patients should be evacuated as early as possible to Role 3 or Role 4 levels for further evaluation, repeat surgery (relaparotomy), and definitive anatomical reconstruction. Delayed definitive reconstruction allows stabilization of the metabolic state, restoration of hemodynamics, and reduction of the risk of suture failure and septic complications.

In general, the surgical management of combat-related DI should be based on the principle of survival and staged stabilization. The effectiveness of treatment depends not only on the choice of surgical technique but also on the coordination of a multidisciplinary team, including surgeons, anesthesiologists, intensive care specialists, traumatologists, and evacuation units. Such team interaction ensures an adaptive surgical strategy tailored to the dynamically changing clinical condition of the wounded patient and the operational situation in the combat zone.

Conclusions

1. The implementation of the developed surgical algorithm for combat-related DI, adapted to a multilevel medical support system, was associated with a significant improvement in treatment outcomes, including a reduction in postoperative mortality from 80.0 % to 10.0 %, shorter hospital stay, and earlier initiation of enteral nutrition.
2. Standardization of the staged surgical approach reduced the severity of the postoperative course and demonstrated a tendency toward a lower incidence of septic complications, including sepsis, fistula formation, and bile leakage, as well as a decreased need for reoperations.
3. The greatest clinical effectiveness of the proposed algorithm was observed in patients with AAST grade II–III DI, in whom its application resulted in significantly improved survival and functional outcomes.
4. The implementation of a unified algorithm for the management of DI within the military medical evacuation system is justified and appropriate, as it enhances the controllability of the treatment process, reduces variability in surgical decision-making, and improves overall clinical outcomes.

BIBLIOGRAPHY

1. Butler FK Jr, Blackbourne LH, Eastridge BJ, et al., editors. Tactical Combat Casualty Care Handbook. 5th ed. Washington (DC): Joint Trauma System; 2023. Available from: https://jts.health.mil/assets/docs/TCCC-Guidelines-and-Curriculum/TCCC_Handbook_5th_Ed_2023_Final.pdf.
2. Ordoñez CA, Parra MW, Millán M, et al. Damage control in penetrating duodenal trauma: less is better – the sequel. *Colomb Med (Cali)*. 2021;52(2):e4104509. https://doi.org/10.25100/cm.v52i2.4509.
3. NATO. Allied Joint Publication 4.10 (AJP-4.10): Allied Joint Doctrine for Medical Support. Edition B, Version 1. Brussels: NATO Standardization Office; 2020. Available from: https://www.coemed.org/files/stanags/01_AJP/AJP-4.10_EDC_V1_E_2228.pdf.
4. Department of Defense, Joint Trauma System. JTS Trauma System Toolkit. San Antonio (TX): Joint Trauma System; 2020. Available from: https://jts.health.mil/index.cfm/CPGs/cpgs.
5. Department of the Army, Office of The Surgeon General, Borden Institute. Emergency War Surgery. 5th ed. Falls Church (VA): Borden Institute; 2017. Available from: https://medcoe.army.mil/borden-tb-ews.
6. Obadiel YA, Albrashi AA, Saeed MA, Jowah HM. Incidence and Management of Duodenal Trauma in a War Setting: Insights From a Military Hospital in Yemen. *Cureus*. 2025;17(1):e77323. https://doi.org/10.7759/cureus.77323.
7. Park SJ, Shin HJ, Lee S. Time from Injury to Initial Operation May Be the Sole Risk Factor for Postoperative Leakage in AAST-OIS 2 and 3 Traumatic Duodenal Injury: A Retrospective Cohort Study. *J Clin Med*. 2022;11(12):3396. https://doi.org/10.3390/jcm11123396.
8. Coccolini F, Kobayashi L, Kluger Y, et al. Duodeno-pancreatic and extrahepatic biliary tree trauma: WSES-AAST guidelines. *World J Emerg Surg*. 2019;14:56. https://doi.org/10.1186/s13017-019-0278-6.
9. Khoroshun E, Khomenko I, Shypilov S, Makarov V, Nehoduyko V, Petiunin O. Dosvid operatyvnoho likuvannia boiovoi travmy pidshlunkovoi zalozy [Experience in surgical treatment of combat-related pancreatic injury]. *Med Nevidkladnykh Staniv*. 2024;20(8). https://doi.org/10.22141/2224-0586.20.8.2024.1808 (In Ukrainian).
10. Pereira BM, de Campos Telles D, Vieira AL. Damage Control Pancreatoduodenectomy for Severe Pancreaticoduodenal Trauma: A Multicentric Case Series in Colombia. *Panam J Trauma Crit Care Emerg Surg*. 2020;9(1):19–24. https://doi.org/10.5005/jp-journals-10030-1262.

11. Navsaria PH. Military Trauma, Civilian Trauma. Vascular Trauma. *Curr Trauma Rep*. 2023;9(4):423–431. https://doi.org/10.1007/s40719-023-00277-y
12. Bellio G, Costantino F, Riviello R. Emergency surgery damage control procedures: which, when and how? – a narrative review of the literature. *Ann Laparosc Endosc Surg*. 2024;9:23. https://doi.org/10.21037/ales-23-44.
13. American Association for the Surgery of Trauma. Injury Scoring Scale. Lisle (IL): AAST; 2018. Available from: https://www.aast.org/trauma-acs-resources/trauma-tools/injury-scoring-scale.html.
14. Savoia P, Jayanthi SK, Chammas MC. Focused assessment with sonography for trauma (FAST). *J Med Ultrasound*. 2023;31(2):101–106. https://doi.org/10.4103/jmu.jmu_12_23.
15. Diggs LP, Gregory S, Choron RL. Review of Traumatic Duodenal Injuries: Etiology, Diagnosis, and Management. *Am Surg*. 2023;89(5):1989–1996. https://doi.org/10.1177/00031348211065091.
16. Cogbill TH, Moore EE, Feliciano DV, et al. Conservative management of duodenal trauma: a multicenter perspective. *J Trauma*. 1990;30(12):1469–1475.
17. Hollands M. Duodenal injuries: surgical management adapted to circumstances. *Injury*. 2003;34(3):167–172. https://doi.org/10.1016/s0020-1383(02)00373-1.
18. Choron RL, Teichman AL, Bargoud CG, et al. Outcomes among trauma patients with duodenal leak following primary versus complex repair of duodenal injuries: An Eastern Association for the Surgery of Trauma multicenter trial. *J Trauma Acute Care Surg*. 2023;95(1):151–159. https://doi.org/10.1097/TA.0000000000003972.

Надійшла до редакції 24.08.2025.
Прийнята до друку 26.02.2026.
Електронна адреса для листування Doctorpavlentius@Gmail.com