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First experience of laparoscopic colon resection with primary anastomosis for combat-related thoracoabdominal trauma with through-and-through colon injury

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Ключові слова: бойова травма, торакоабдомінальна травма, лапароскопічний анастомоз, лінійний ендоскопічний степлер.

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Aim: to demonstrate the possibilities and advantages of laparoscopic surgery in combat-related abdominal penetrating trauma with colon injury.

Materials and methods. This case report presents the first experience of laparoscopic colon resection with primary anastomosis for combat-related thoracoabdominal trauma with through-and-through colon injury. A 47-year-old serviceman sustained an explosive penetrating thoracoabdominal injury (dropping explosives from a drone) operated 10 hours after. Initial management at Role 2 included chest tube drainage, surgical debridement, and wound sealing of the chest. CT: penetrating gunshot wound with internal and external damage to the lower lobe of the left lung, perforation of the diaphragm on the left, and transverse colon perforation with a retained metal fragment, pneumoperitoneum, drained hemopneumothorax, and a gunshot fracture of the posterior third of the 5th left rib. Exploratory laparoscopy revealed no free fluid in the abdominal cavity. Surgery: the diaphragmatic perforation was sutured with a 3-0 V-loc barbed suture, the segment of the transverse colon was resected using two Endo-GIA 60 linear staplers according to the severity of injury (AAST Grade 3) and non-viable edges of colon wound. To ensure mobility, a side-to-side antiperistaltic anastomosis was performed using an Endo-GIA 60 stapler (blue cartridge). The anastomosis site was reinforced with a single-layer 3-0 V-loc suture. The procedure was completed with abdominal drainage and port site closure.

Results. Postoperative recovery was without complications. The abdominal drain was removed on the 2nd day, and the pleural drain on the 5th day after the control CT scan. Follow-up after 1.5 month – returned to military service. Our case demonstrates that laparoscopic surgery can be a useful option for combat-related colon injuries when tissue damage is minimal and the patient's condition is stable. The absence of massive hemoperitoneum and contamination confirms the feasibility of primary repair or anastomosis.

Conclusions. Laparoscopic surgery for combat-related penetrating abdominal trauma with colon injuries is feasible and safe in stable patients. If there are no multiple colon injuries or significant contamination, primary repair or stapled anastomosis is a suitable option.

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Перший досвід лапароскопічної резекції ободової кишки з первинним анастомозом при бойовій торакоабдомінальній травмі з наскрізним пошкодженням ободової кишки

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Мета роботи – продемонструвати можливості та переваги лапароскопічної хірургії при бойовій проникній травмі живота з пошкодженням товстої кишки.

Матеріали і методи. Цей клінічний випадок є першим досвідом лапароскопічної резекції товстої кишки з первинним анастомозом при бойовій торакоабдомінальній травмі з наскрізним ушкодженням товстої кишки. Військовослужбовець віком 47 років отримав вибухове проникне торакоабдомінальне поранення (скид з дрону) та прооперований через 10 годин. Первинна допомога на другому рівні включала дренування плевральної порожнини, хірургічну обробку та герметизацію рани грудної клітки. Результати КТ: наскрізне вогнепальне поранення з наскрізним пошкодженням нижньої частки лівої легені, пошкодженням лівого куполу діафрагми, наскрізним пораненням поперечної ободової кишки з наявністю металевого осколка, пневмоперитонеум, дренований гемопневмоторакс, вогнепальний перелом задньої третини V ребра зліва. Під час оглядової лапароскопії вільної рідини в черевній порожнині не виявлено. Операція: поранення діафрагми зашите шовним матеріалом 3-0 V-loc; враховуючи тяжкість травми (3 ступінь за AAST) і нежиттєздатність країв, здійснили резекцію сегмента поперечно-ободової кишки за допомогою

двох лінійних ендоскопічних степлерів Endo-GIA 60; беручи до уваги достатню мобільність, виконано антиперистальтичний анастомоз бік-у-бік за допомогою лінійного степлера Endo-GIA 60 (блакитний картридж). Технічний отвір зашито одношаровим швом 3-0 V-loc. Надалі здійснили дренування черевної порожнини та ушивання портів.

Результати. Післяопераційний період минув без ускладнень. Дренаж із черевної порожнини видалено на 2 добу, плевральний дренаж – на 5 добу після контрольного КТ-обстеження. Спостереження через 1,5 місяця показало, що пацієнт повернувся на військову службу. Наведений клінічний випадок демонструє, що лапароскопічну хірургію з первинним анастомозом можна застосовувати при вогнепальних пораненнях товстої кишки, коли пацієнт перебуває у стабільному стані та немає масивного гемоперитонеуму, контамінації.

Висновки. Лапароскопічна операція при бойовій проникній травмі живота з пошкодженням товстої кишки є доцільною і безпечною у стабільних пацієнтів. Якщо немає множинних ушкоджень товстої кишки або калової контамінації, то первинний анастомоз є можливим і безпечним.

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Since the first publications on colon trauma in combat, mortality rates have decreased from 90 % to 3 %. However, the abdominal sepsis rate remains higher than 20 %, underscoring the importance of improving the management of colon injuries in trauma medicine [1,2]. While treatment approaches for colon injuries have evolved significantly, many controversial aspects still require further attention. For instance, the choice between traditional proximal diversion and primary repair in military surgery remains debatable [3,4].

In cases of colonic injuries during colonoscopy, studies have demonstrated the successful use of passing sutures and endoscopic linear staplers to close colonic perforations [5,6]. These studies suggest that laparoscopic primary repair is safe and effective for colonic perforations and may have advantages over the open approach.

Moreover, the role and feasibility of laparoscopic surgery in combat penetrating abdominal trauma are not clearly defined. The number of publications on the use of laparoscopy in combat penetrating abdominal trauma is small [7,8]. Unfortunately, some of these publications are related to the war in Ukraine [9,10,11].

Laparoscopic surgery for penetrating abdominal gunshot wounds was initially used for hepatic hemostasis [12,13]. A conventional laparoscopic approach is recommended for hemodynamically stable patients with abdominal trauma [14]. Common laparoscopic interventions include operations on the small bowel, mesentery, and colon. Small bowel perforations can be repaired with double-layer suturing, while larger defects may require resection and intracorporeal or extracorporeal anastomosis. New hemostatic agents may help in mesenteric vascular injury repair during laparoscopy [15]. Other researchers describe laparoscopic Hartmann's resections, which may be applicable for traumatic colon injuries [15,16].

The absence of data in literature on laparoscopic colon resection with primary anastomosis for combat-related penetrating abdominal trauma was the reason to share our clinical case.

Aim

To demonstrate the possibilities and advantages of laparoscopic surgery in combat-related abdominal penetrating trauma with colon injury.

Materials and methods

This case report presents the first experience of laparoscopic colon resection with primary anastomosis for combat-related thoracoabdominal trauma with through-and-through colon injury.

Case description

A 47-year-old serviceman sustained an explosive penetrating thoracoabdominal injury (dropping explosives from a drone) in November 2024. Initial management at Role 2 included chest tube drainage, surgical debridement, and wound sealing of the chest. The patient was evacuated to the Zaporizhzhia Military Hospital (Role 3).

On arrival, the patient's condition was moderate to severe.

Glasgow Coma Scale: 15/15. BMI: 22.1 kg/m^2. Blood pressure: 130/80 mmHg. Heart rate: 88 bpm. SpO_2: 94 %. Hb: 111 g/L. RBC: 3.2 × 10^6/μL. WBC: 23.6 × 10^6/μL. Hematocrit: 27 %.

Focused assessment with sonography for trauma: negative. CT: penetrating gunshot wound with internal and external damage to the lower lobe of the left lung, perforation of the diaphragm on the left, and transverse colon perforation with a retained metal fragment; pneumoperitoneum, drained hemopneumothorax, and gunshot fracture of the posterior third of the 5th left rib *(Fig. 1)*.

Laparoscopic surgery was planned because the patient was hemodynamically stable and there were no signs of systemic inflammatory response.

Surgical technique. The patient was positioned on the operating table in a semi-Fowler's position. The operating surgeon and camera assistant were positioned on the patient's right side. The first trocar was placed above the umbilicus, achieving an abdominal pressure of 12–14 mmHg. Two additional trocars were placed to the right and left of the umbilicus.

Exploratory laparoscopy revealed no free fluid in the abdominal cavity. The greater omentum was adjacent to the left diaphragm perforation (approximately 2.0 × 1.5 cm) *(Fig. 2)*.

Using atraumatic forceps, the omentum was removed. The laparoscope was inserted into the left pleural cavity, revealing 200 mL of clotted blood, which was aspirated. The diaphragm perforation was sutured with a 3-0 V-loc barbed suture *(Fig. 3)*.

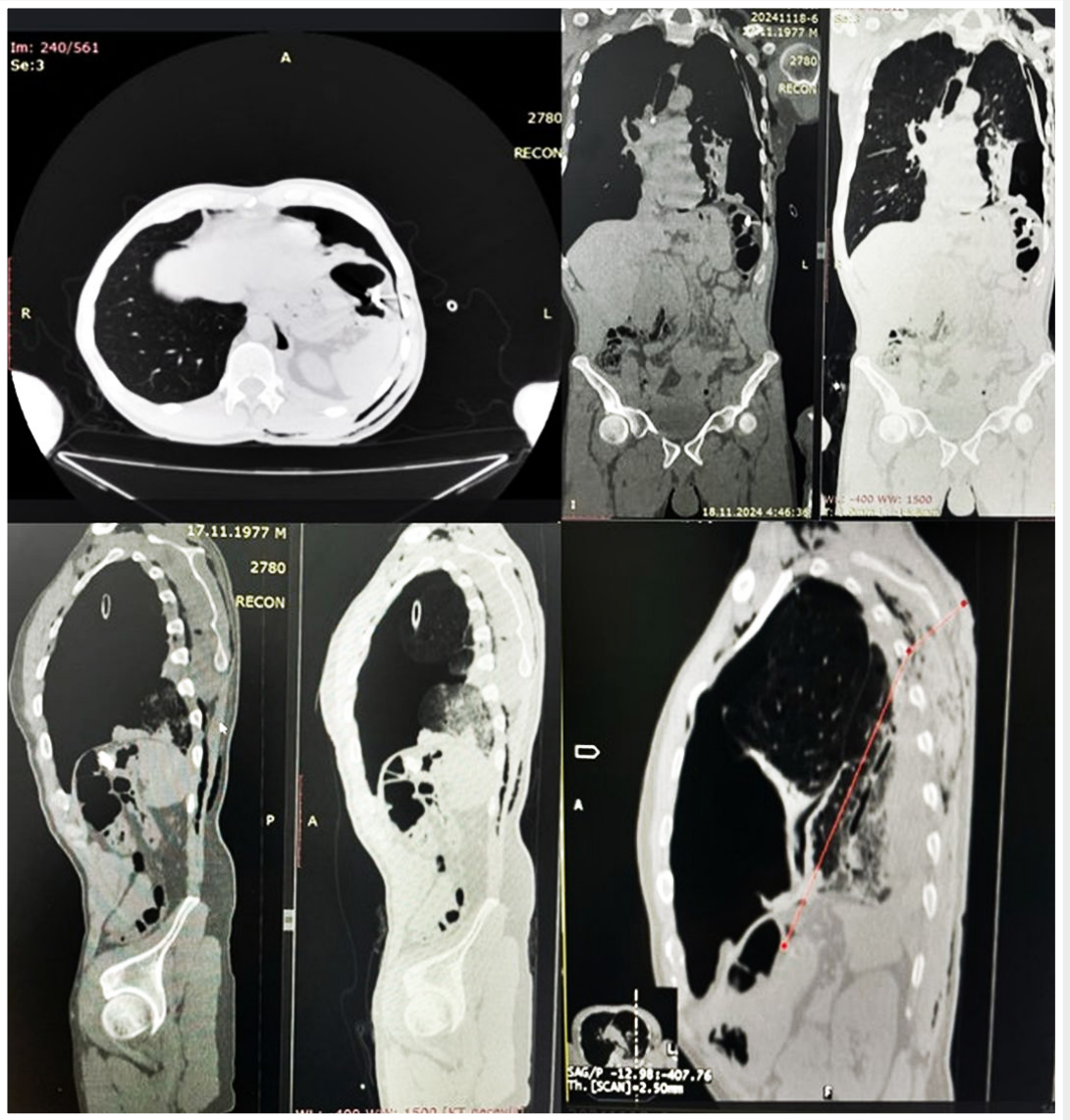

Fig. 1. CT-scans. Penetrating gunshot wound with internal and external damage to the lower lobe of the left lung, perforation of the diaphragm on the left, and transverse colon perforation with a retained metal fragment.

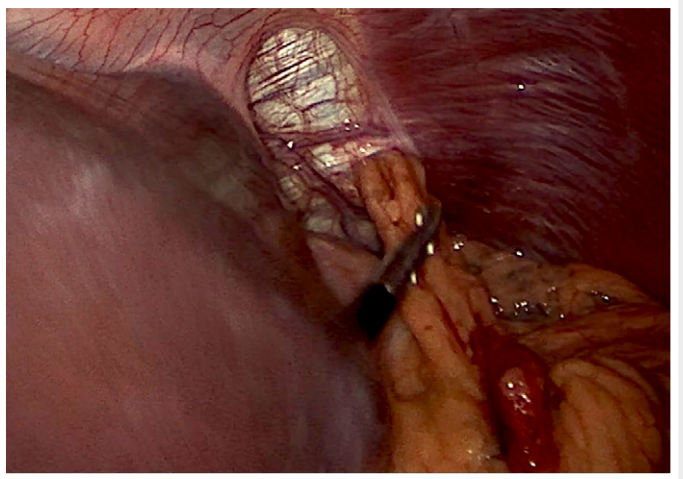

Fig. 2. Laparoscopy: greater omentum adhered to the left diaphragm perforation.

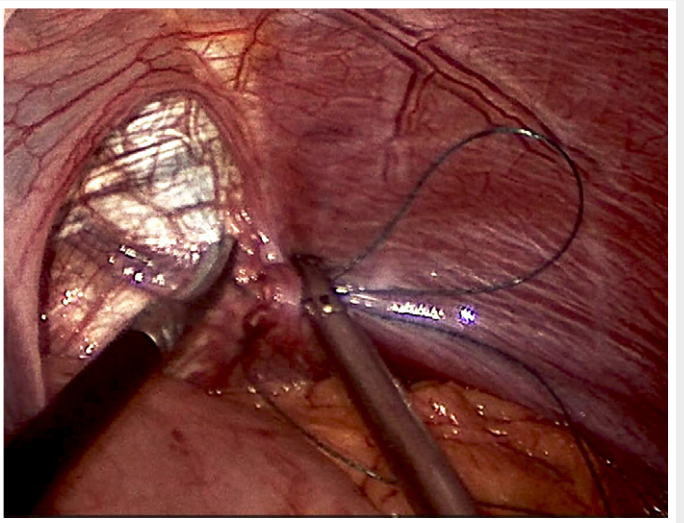

Fig. 3. The diaphragm perforation was sutured with a 3-0 V-loc barbed suture.

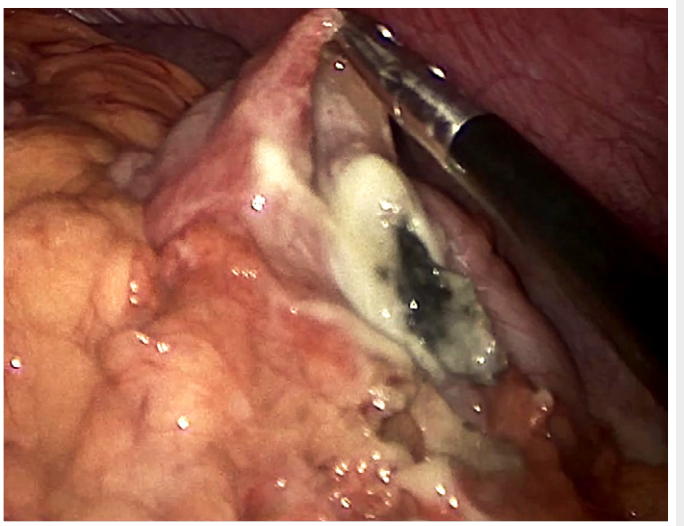

Fig. 4. Laparoscopy: exit wound of colon contained a metal fragment.

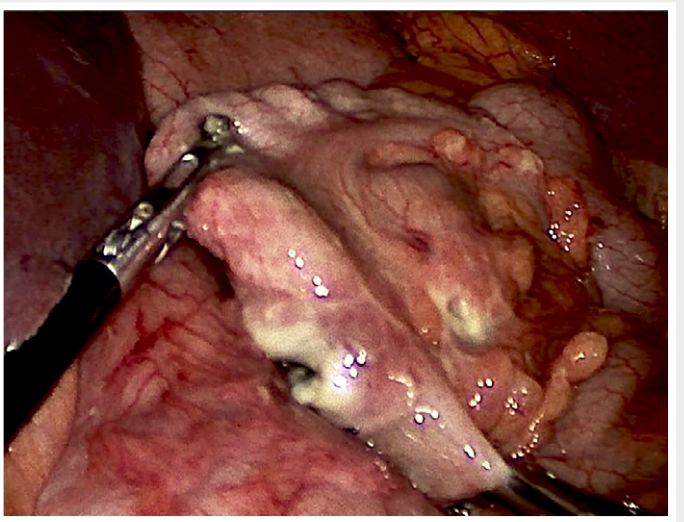

Fig. 5. Laparoscopy: a through-and-through colonic colon injury.

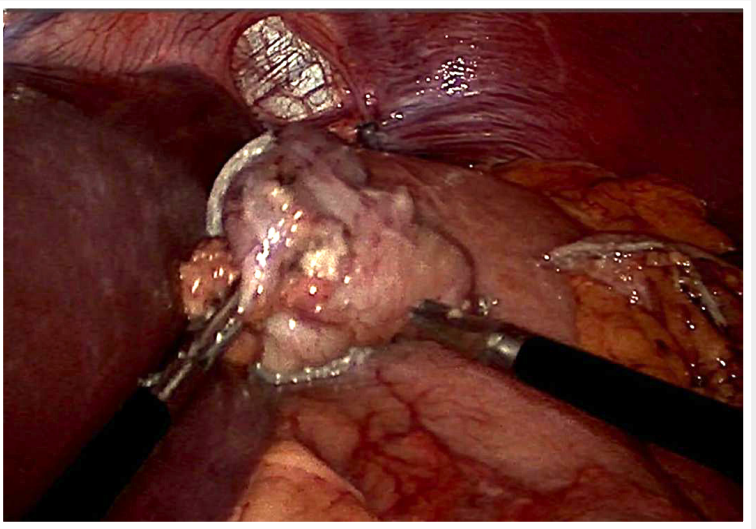

Fig. 6. Laparoscopy: resected segment of transverse colon.

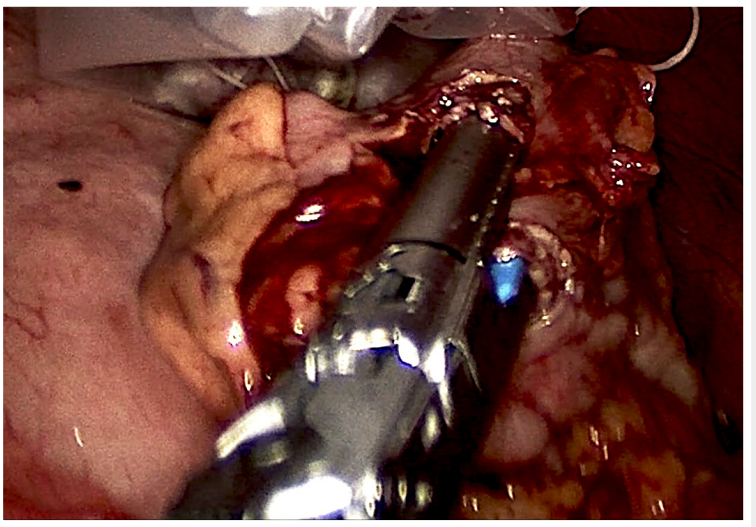

Fig. 7. Linear stapler anastomosis.

Further examination revealed an inflammatory mass in the transverse colon near the splenic flexure. A through-and-through colonic injury of colon was identified: the entry wound (4–5 mm) was sealed with fibrin, while the exit wound contained a metal fragment (17 mm) *(Fig. 4, 5)*.

The metal fragment was removed using a magnetic device.

Given the injury's severity (AAST Grade 3) and the non-viable edges, a segment of the transverse colon was resected using two Endo-GIA 60 linear staplers (gold cartridge) *(Fig. 6)*.

The specimen was placed in a polyethylene bag and removed. To ensure mobility, a side-to-side antiperistaltic anastomosis was performed using an Endo-GIA 60 stapler (blue cartridge) *(Fig. 7)*.

The anastomosis site was reinforced with a single-layer 3-0 V-loc suture. The procedure was completed with abdominal drainage and port site closure.

YouTube link.

Postoperative recovery was without complications. The abdominal drain was removed on the 2nd day, and the pleural drain on the 5th day after the control CT scan. Follow-up after 1.5 month – returned to military service.

Discussion

Colorectal injuries are classified as penetrating, blunt, or iatrogenic, and treatment strategies depend on the mechanism. Penetrating trauma, responsible for majority of colorectal injuries, often results from gunshots or stabbing. High-velocity projectiles cause more extensive tissue damage than low-velocity injuries, which are more commonly seen in survivors of penetrating abdominal injuries in the ongoing war in Ukraine. In non-destructive colon injuries, primary repair is the standard treatment, regardless of risk factors [17]. However, guidelines for destructive colon injuries remain controversial due to their lower incidence and limited data.

Our case demonstrates that laparoscopic surgery may be a viable treatment option for combat-related colon injuries when tissue damage is minimal and the patient's condition is stable. The absence of massive hemoperitoneum and contamination confirms the feasibility of primary repair or anastomosis.

Conclusions

1. Laparoscopic surgery for combat-related penetrating abdominal trauma with colon injuries is feasible and safe in stable patients.

2. If there are no multiple colon injuries or significant contamination, primary repair or stapled anastomosis is a suitable option.

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