



DESCRIPTION OF SELECTED CASES OF PATIENTS WITH CHEST INJURIES TREATED AT THE DEPARTMENT OF GENERAL, ONCOLOGICAL, METABOLIC AND THORACIC SURGERY

Opis wybranych przypadków pacjentów po urazach
klatki piersiowej leczonych w Klinice Chirurgii Ogólnej,
Onkologicznej, Metabolicznej i Torakochirurgii



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Abstract

The article presents clinical cases of patients admitted to the Trauma Centre of the Military Medical Institute – National Research Institute in the second half of 2024. Patients were treated in accordance with current medical knowledge in the Department of General, Oncological, Metabolic and Thoracic Surgery and the Department of Anaesthesiology and Intensive Care. Effective pleural drainage was the most common minimally invasive method used in our patients. Some cases required a more complex procedure, such as video assisted thoracoscopic surgery. Surgical approaches using the Matrix or Stratos set, which allows for chest reconstruction after injuries with rib fractures, was the most expensive techniques used. Modern contemporary surgical techniques, such as video assisted thoracoscopic surgery, are used not only for elective oncological surgeries, but also in traumatic emergency patients. A minimally invasive approach in a trauma patient reduces hospital stay, recovery time, and exclusion from professional life. Considering the needs of the Polish Armed Forces in terms of thoracic procedures, which are addressed by the Military Institute of Medicine – National Research Institute in Warsaw, the paper indicates increasing challenges in this field of medicine. The procedures described below are a standard known from prestigious European thoracic surgery centers. The constant development of thoracic surgery seems to be justified, especially in the military health service. We believe that continuous education and implementation of these techniques is crucial for maintaining proper protection of the Polish Armed Forces.

Streszczenie

W artykule przedstawiono przypadki kliniczne chorych, którzy trafili do Centrum Urazowego Wojskowego Instytutu Medycznego – Państwowego Instytutu Badawczego w drugim półroczu 2024 roku. Pacjenci byli leczeni zgodnie z aktualną wiedzą medyczną w Klinice Chirurgii Ogólnej, Onkologicznej, Metabolicznej i Torakochirurgii oraz Klinice Anestezjologii i Intensywnej Terapii. Skuteczny drenaż opłucnej był małoinwazyjną, najczęściej stosowaną metodą. Niektórzy pacjenci wymagali bardziej skomplikowanej procedury jaką jest chirurgia torakoskopowa wspomagana wideo. Inną metodą, ale najdroższą pod względem materiałowym, była operacja z wykorzystaniem systemu Matrix lub Stratos, która umożliwia rekonstrukcję klatki piersiowej po urazach ze złamaniami żeber. Nowoczesne techniki operacyjne, takie jak chirurgia torakoskopowa wspomagana wideo, nie są wykorzystywane wyłącznie w onkologicznych operacjach planowych, ale znajdują zastosowanie również u pacjentów urazowych w trybie dyżurowym. Użycie małoinwazyjnych technik u pacjenta urazowego skraca czas hospitalizacji, rekonwalescencji i wykluczenia z życia zawodowego. Biorąc pod uwagę potrzeby Sił Zbrojnych RP w zakresie procedur torakochirurgicznych, na które odpowiada Wojskowy Instytut Medyczny – Państwowy Instytut Badawczy w Warszawie, przedstawiony artykuł wskazuje, że wyzwania w tej dziedzinie medycyny są

coraz większe. Opisane poniżej procedury stanowią standard, znany z prestiżowych europejskich ośrodków torakochirurgicznych. Stały rozwój torakochirurgii wydaje się uzasadniony, szczególnie w wojskowej służbie zdrowia. Potrzeba ciągłego kształcenia i wdrażania tych technik jest zdaniem autorów kluczowa dla utrzymania właściwej ochrony Sił Zbrojnych RP.

Keywords: thoracic surgery; minimal invasion; VATS; military medicine

Słowa kluczowe: torakochirurgia; minimalna inwazja; VATS; medycyna wojskowa

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Introduction

The Department of General, Oncological, Metabolic and Thoracic Surgery with the Unit of Thoracic Surgery supports the Trauma Centre for patients with chest injuries. Here, doctors face everyday challenges, choosing appropriate treatment techniques to fight for the life and health of their patients.

According to data from the Central Statistical Office, up to 3.8 million people were treated in hospital emergency departments (EDs) and admission rooms (ARs) in Poland in 2022 [1]. At that time, 2.8 thousand patients were admitted to 17 active trauma centres in Poland.

It is estimated that chest injuries account for 61% of all bodily injuries resulting from traffic accidents [2]. Traffic accidents and falls from heights are the most common causes [3–5].

Many therapeutic approaches have been developed for chest conditions. Known conventional procedures, such as thoracotomy, are not routinely used despite the fact that high-energy trauma most often requires urgent surgical intervention already in the ED setting. Other, minimally invasive techniques are available. Appropriately trained medical team will be able to use an adequate minimally invasive approach, previously known from the thoracic surgery setting for elective treatment of cancer. Minimally invasive methods such as pleural drainage, video-assisted thoracoscopic surgery (VATS), and thoracoscopy are increasingly utilised, even in those with extensive injuries. Titanium plates similar to orthopaedic sets are successfully used in special cases requiring chest wall reconstruction.

Aim

The aim of the study was to present the profile of patients admitted for chest injuries, as well as to analyse the choice of treatment methods.

Materials and methods

The descriptive data and images were obtained in the second half of 2024 in a group of patients with chest

injuries transported to the Trauma Centre at the Military Institute of Medicine – National Research Institute (WIM-PIB) in Warsaw. The patients were admitted as emergency cases and underwent further specialist treatment in the Department of General, Oncological, Metabolic and Thoracic Surgery and the Department of Anaesthesiology and Intensive Care. Data such as age, gender, type and mechanism of injury, diagnostic and therapeutic methods used, the length of hospital stay, and treatment outcomes were included in the analysis. Selected cases were described.

Case 1

A 47-year-old female patient was admitted with symptoms of respiratory failure as a result of a traffic accident with crashing into a concrete column. Extended focused assessment with sonography for trauma (eFAST) showed pneumothorax and right pleural fluid, as well as a small volume of abdominal fluid. Drainage of the right pleural cavity was performed in the Emergency Department, which collected 1800 mL of blood. The patient was qualified for video-assisted thoracic surgery (right-sided VATS) and a wedge resection of the lower lobe of the right lung within the fragmented and lacerated lung parenchyma, with evacuation of haematoma, followed by drainage of the right pleural cavity. The patient is currently under the care of the thoracic surgery clinic. (Pre- and postoperative status is shown in Figure 1).

Case 2

A 51-year-old man was admitted with symptoms of chest pain after being hit by an electric scooter. An X-ray and computed tomography (CT) of the chest revealed multiple fractures of left ribs 4–11, including comminuted fractures. The fractures of ribs 4 and 9 were stable and wedged; additionally, a pleural haematoma and a parenchymal tear in the lower lobe due to fragments of ribs 5–8 displaced into the chest and penetrating the lung were detected. The patient was qualified for haematoma evacuation, with suturing of the lung parenchyma, and chest wall stabilisation by means of conventional posterolateral thoracotomy using the Matrix system. Blood was sucked out, the parenchyma was sutured in

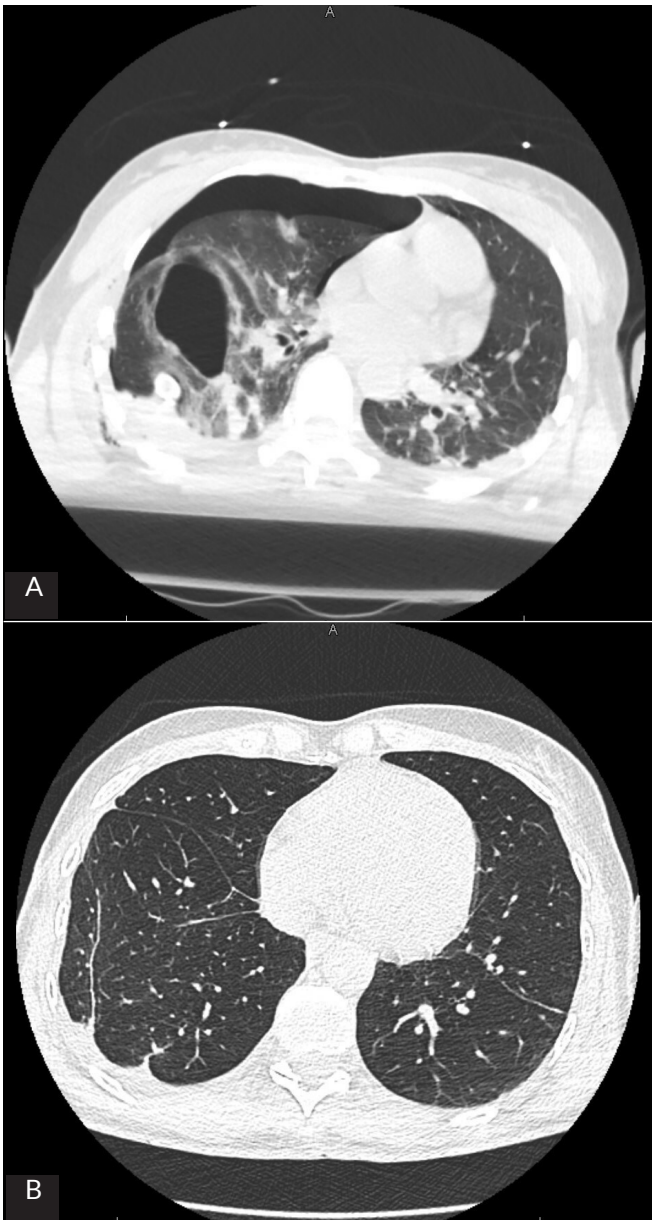


Figure 1. Case 1. Computed tomography findings. **A.** Preoperatively. **B.** Postoperatively

two layers with a 3/0 monofilament suture. Each suture line was sealed with haemostatic and aerostatic TachoSil sponge. The intermediate bone fragments of rib 5 in the anterior and posterior axillary line were intraoperatively fixed with two titanium plates (Matrix 10 cm universal). Ribs 6 and 7, fractured in three places, were stabilised with dedicated 15 cm rib plates adjusted to “rib left” body side, and rib 8 was fixed the same way, using a 10 cm universal plate from the set. Double pleural drainage was used, as well as continuous epidural anaesthesia was administered pre- and postoperatively until day 10. The patient continues follow-up at the outpatient thoracic surgery clinic. (Pre- and postoperative status is shown in Figure 2).

Case 3

A 67-year-old woman was admitted with symptoms of chest pain after a fall from her own height. X-ray

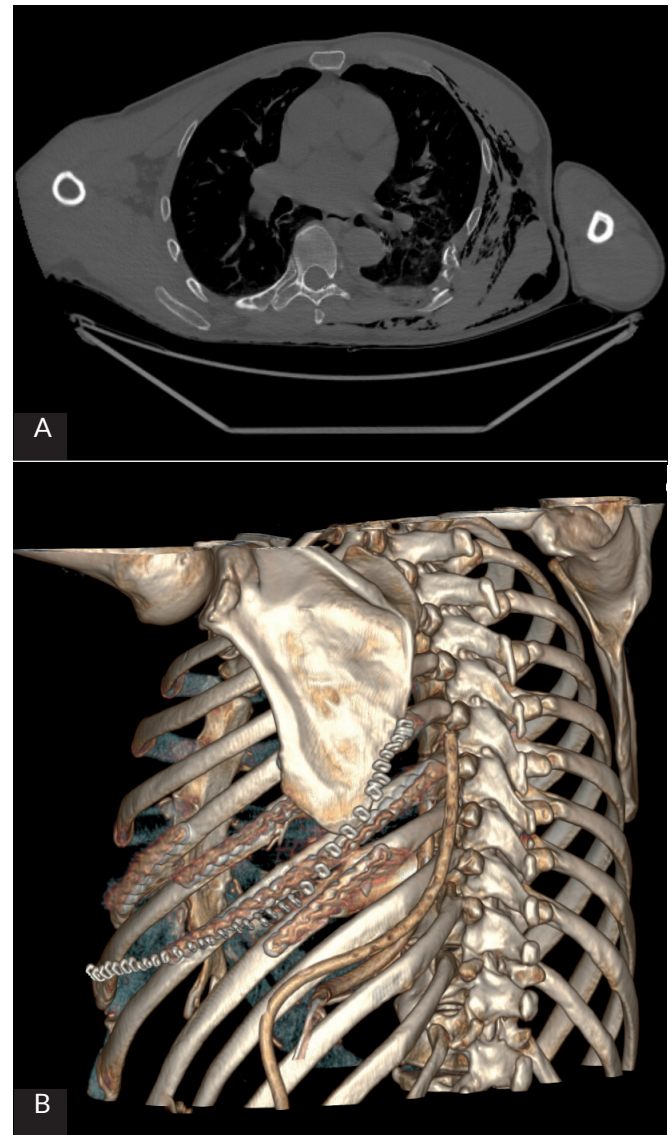


Figure 2. Case 2. Computed tomography findings. **A.** Preoperatively. **B.** Postoperatively

revealed fractured right clavicle and ribs 2–4 on the right side and pneumothorax with pleural haematoma. A drainage tube was inserted into the pleural cavity in the emergency room. Due to the symptoms of a flail chest and an onset of respiratory failure, as well as the risk of inflammatory lung disease, the patient was qualified for surgical treatment. Simultaneously, after stabilisation of the right clavicle fracture using the VariAx plate (Stryker) at the Traumatology Clinic of the Military Institute of Medicine–National Research Institute using minimally invasive techniques with access through right VATS and minithoracotomy above the fifth rib, decortication of the right lung was performed, adhesions were released, the pleural haematoma was aspirated, and the fractures of ribs 2, 3, 4 were reconstructed using the Stratos system, achieving stabilisation of the chest wall. Additionally, a double drainage of the right pleural cavity was placed. The patient underwent respiratory rehabilitation and was mobilised. Sustained aeration of the lung tissue was achieved and a significant improvement in the clinical

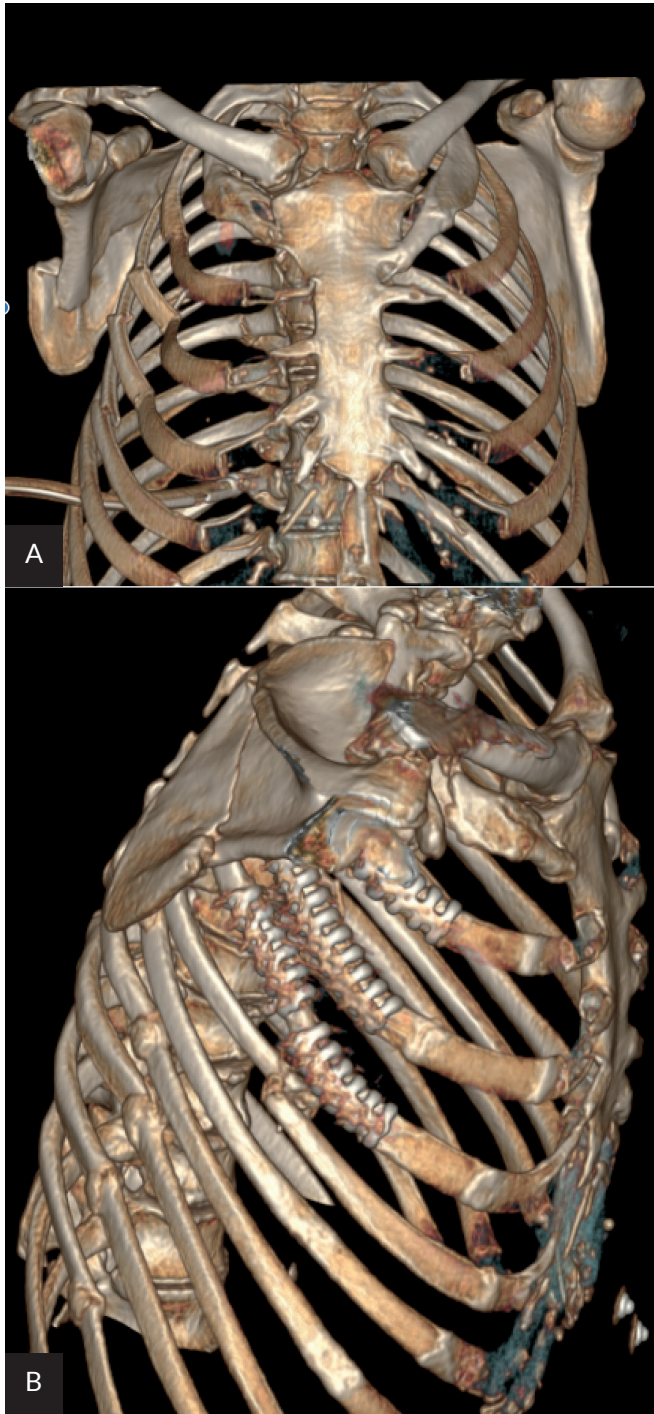


Figure 3. Case 3. Computed tomography findings. **A.** Preoperatively. **B.** Postoperatively

status and physical capacity was achieved. The treatment was completed after a check-up at the thoracic surgery clinic. A visit to the orthopaedic clinic was recommended, and the patient continued further primary care. (Pre- and postoperative status is shown in Figure 3).

Case 4

A 53-year-old man was admitted after a traffic accident with symptoms of dyspnoea and left-sided chest pain. Several years earlier, the patient received two Matrix

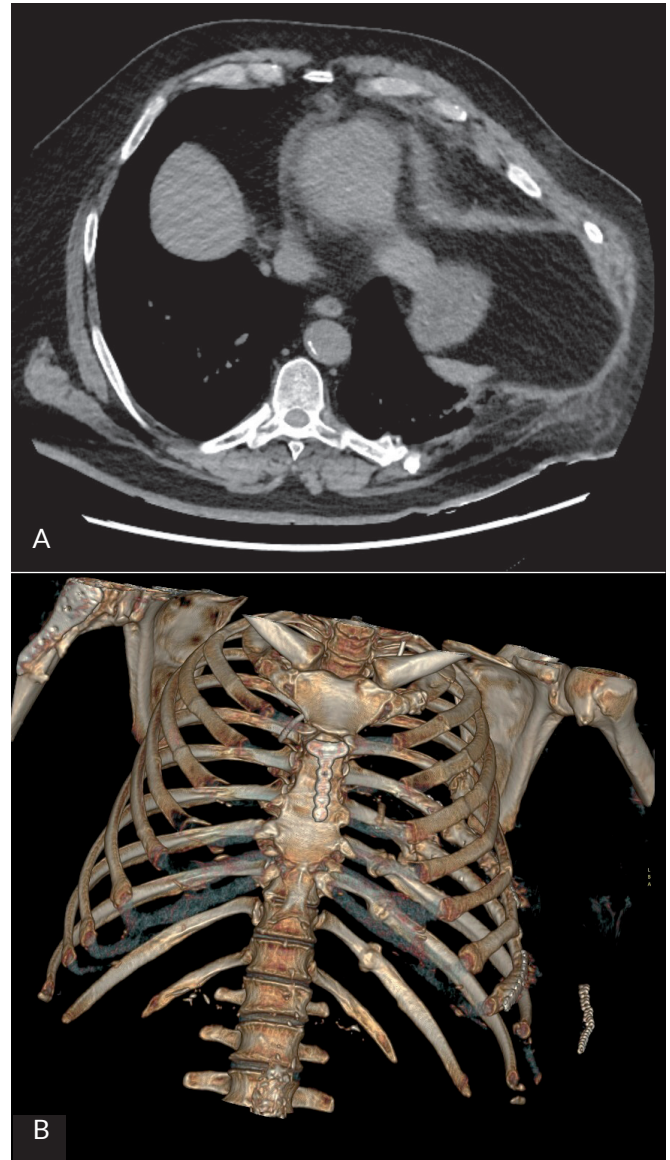


Figure 4. Case 4. Computed tomography findings. **A.** preoperatively. **B.** postoperatively

chest plates in Germany due to fractures of the lower left ribs 7 and 8 in the posterior sections in a traffic accident. A CT scan was taken and showed fractured sternal body with dislocation and haematoma near the fracture gap, fractures of the left ribs 1–8, surgically treated fractures of ribs 7 and 8, and a dislocated sternal fracture with post-traumatic chest wall hernia involving the stomach and adipose tissue. After appropriate preparation of the patient, surgical stabilisation of the chest was performed and the fracture of rib 8 was treated with a universal Matrix 10 cm plate, achieving reinforcement of the replaced rib. Then, the hernia was treated by reducing the viscera into the abdominal cavity. The hernial orifice between ribs 8 and 9 was secured with ZipFix tapes and sutured in layers. Additionally, the dislocated sternum was repositioned and fixed with a T-plate. In the postoperative period, the patient was gradually mobilised, and after the improvement of his health condition, he was transferred to outpatient care. (Pre- and postoperative status is shown in Figure 4).

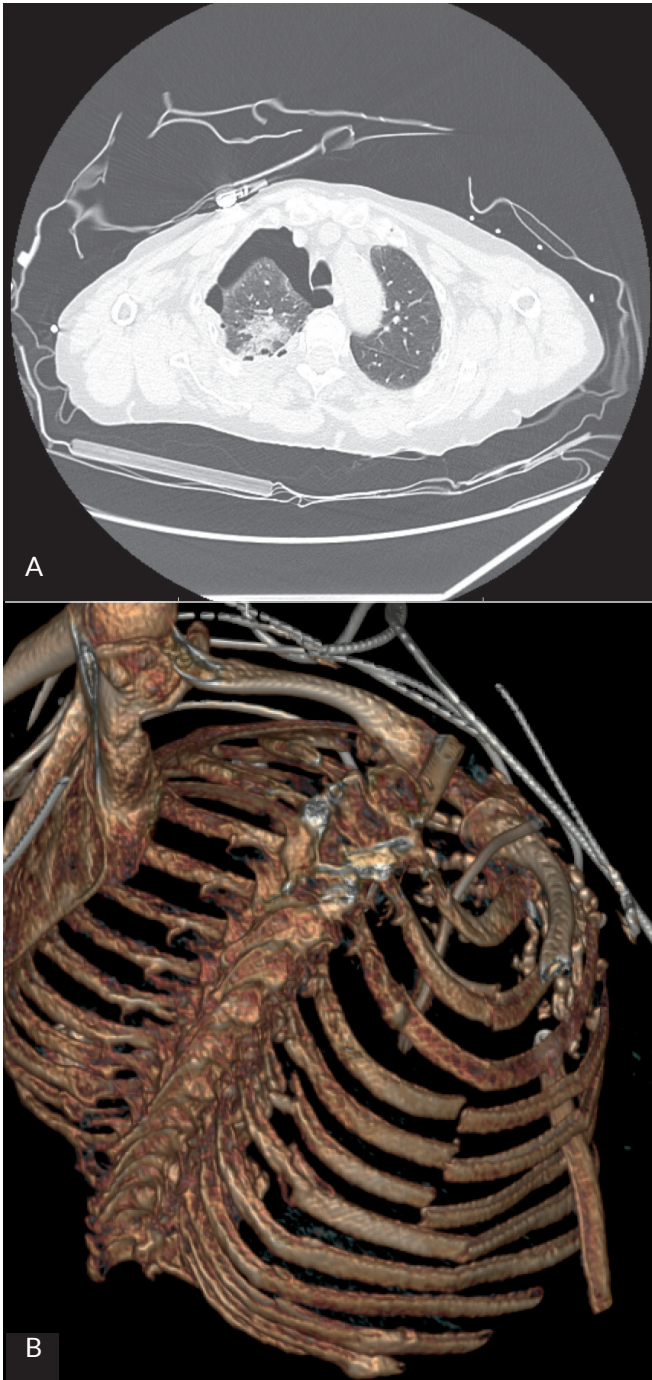


Figure 5. Case 5. Computed tomography findings. **A.** preoperatively. **B.** postoperatively

Case 5

A 71-year-old woman was admitted with symptoms of respiratory failure after being hit by a car. As a result of the incident, she suffered a head and chest injury. A CT scan revealed multiple fractures of ribs 3–9 on the right side, a right-sided pneumothorax with haematoma, as well as pelvic and limb injuries. After orthopaedic care at the Traumatology Clinic, further treatment was continued in the Department of Intensive Care due to the extremely serious general condition, where effective thoracic drainage was performed. Given the high risk of complications, surgical stabilisation of the

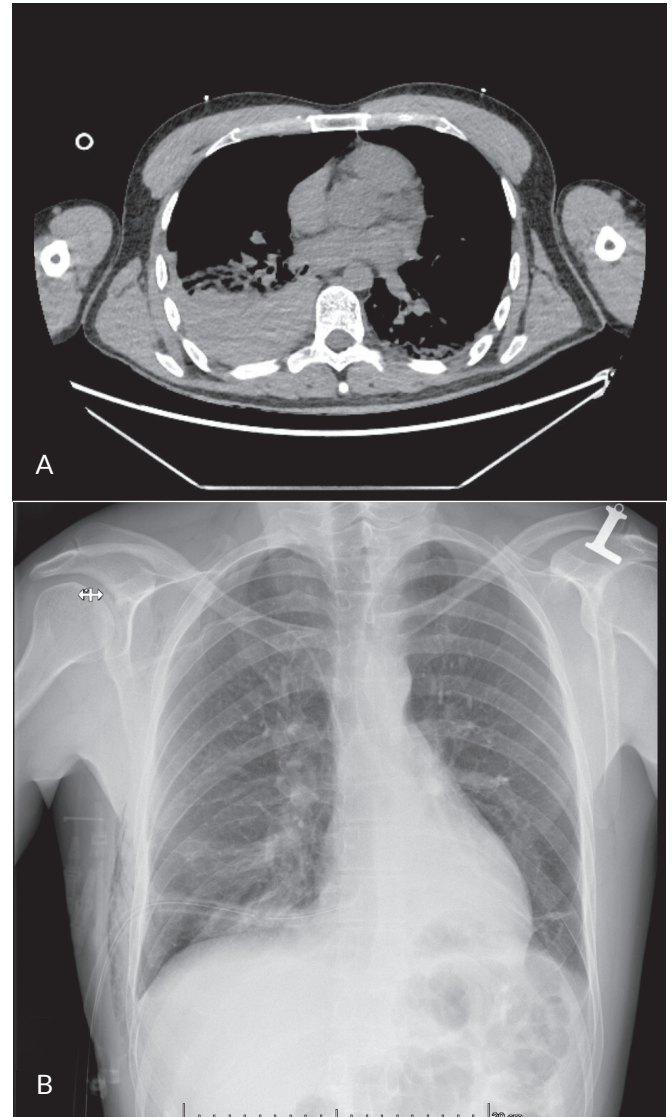


Figure 6. Case 6. **A.** Preoperative computed tomography. **B.** Postoperative x-ray

chest wall was temporarily abandoned. Once her clinical condition stabilised, the patient was transferred to the Traumatology Clinic for surgical treatment of pelvic fractures with possible simultaneous chest wall stabilisation. The patient remains under the care of the Traumatology Clinic. (Pre- and postoperative status is shown in Figure 5).

Case 6

A 32-year-old man was admitted with symptoms of dyspnoea after receiving a stab chest wound (knife) in the lower part of the sternum. Drainage of the right pleural cavity in the Emergency Department, collected 250 mL of blood and the patient was transported for an urgent trauma scan. The results of the examination and the patient's clinical condition did not indicate the need for additional emergency interventions. Once the acute stab wound was managed, the patient's condition improved significantly, with spontaneous healing of the wound. The man was discharged home to continue outpatient follow-up. (Pre- and postoperative status is shown in Figure 6).

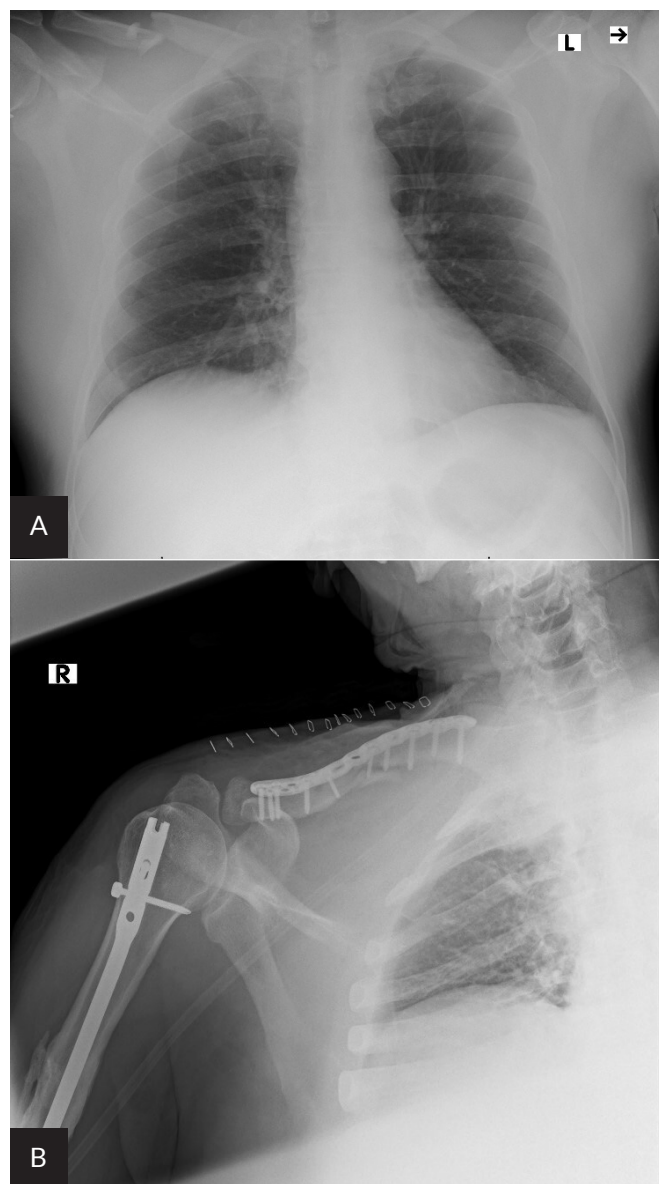


Figure 7. Case 7. X-ray. **A.** After conservative treatment. **B.** After surgery

Case 7

A 49-year-old patient was admitted with a crush chest injury after being buried under a pile of earth. Diagnostic imaging on admission revealed a fracture of the right clavicle with the presence of free bone fragments, paravertebral and parasternal fracture of the first rib, fractured ribs 2–4 in the anterior axillary line, a dislocation of the first sternocostal joints, gas collections in the soft tissues along the cervical blood vessels, at the clavicular and sternocostal joints of ribs 1–3 on the right side and along the first right rib, and suspected damage to the right subclavicular vein. After consulting a vascular surgeon, the patient did not require additional interventions and continued conservative treatment. Once the patient's health improved, he was qualified by a traumatologist for surgical treatment of the right clavicular fracture. During his stay at the Department of Surgery, conservative treatment

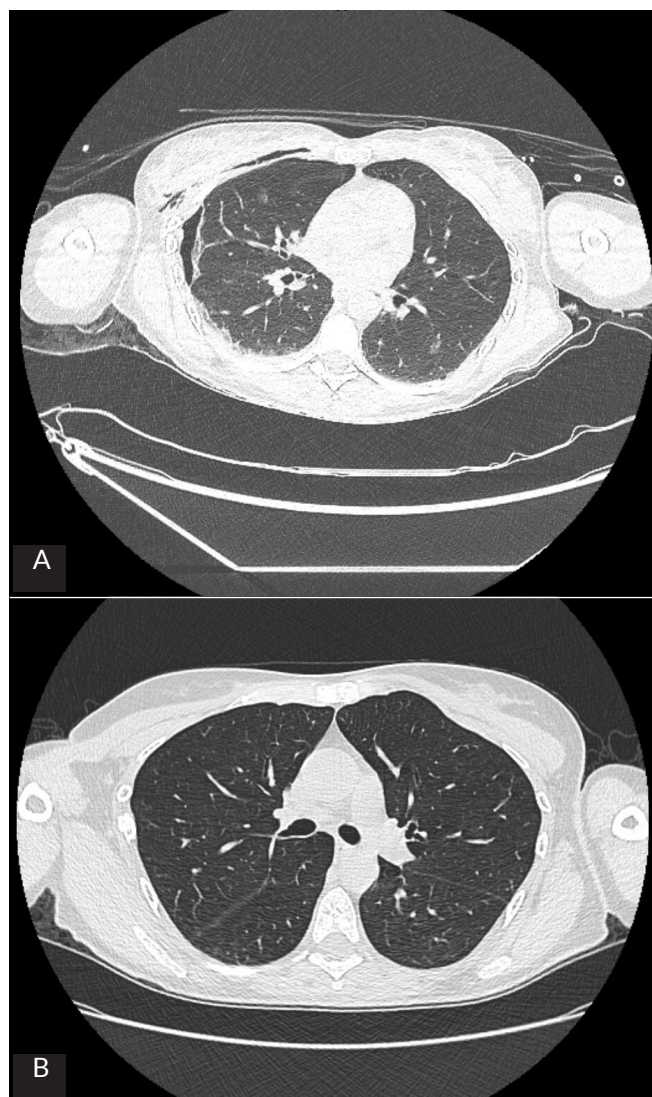


Figure 8. Case 8. Computed tomography findings. **A.** On admission. **B.** At discharge

was used and the patient's health condition was monitored. Diagnostic workup, including echocardiography, was done and pericardial sac fluid was excluded. Ultimately, no surgical interventions were needed, and the patient was transferred to the Traumatology Clinic, where an open reduction with internal stabilisation of the fractured clavicular shaft was performed using the VariAx Clavicle plate (Stryker). The patient was discharged home in good general and local condition, with instructions for further outpatient care. (After conservative treatment and postoperative status is shown in Figure 7).

Case 8

A 42-year-old woman was admitted due to multiple-site trauma sustained as a result of a fall from a horse and subsequent crushing. The patient complained of multi-site pain. Trauma scan showed right-sided pneumothorax and fractures of ribs 4–9 on the right side and ribs 6–11 on the left side, as well as pubic and sacral fractures. After consultation, it was decided to treat the patient con-

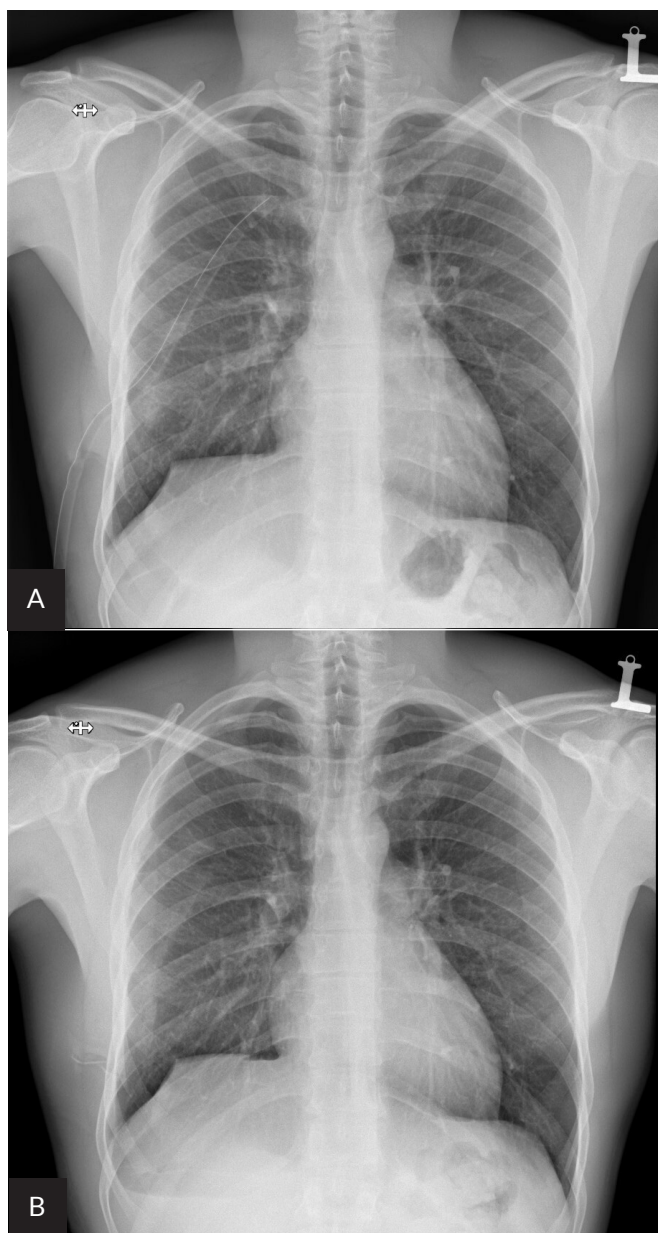


Figure 9. Case 9. X-ray. **A.** After drain. **B.** At discharge

servatively. Analgesic treatment and respiratory training led to spontaneous regression of pneumothorax. Further treatment of the pelvic fractures was continued by the team of the Traumatology Clinic. (Status on admission and at discharge is shown in Figure 8).

Case 9

A 36-year-old soldier was admitted with symptoms of dyspnoea after intensive physical exertion. X-ray revealed spontaneous right-sided pneumothorax. The patient was transported from the Polish Military Contingent with emergency pleural drainage. At WIM-PIB, he was first treated with chest drainage alone, followed by surgery using the right-sided VATS approach. A resection of the right lung apex, as well as pleuroctomy and pleurodesis were done. These were followed by intensive respiratory rehabilitation, which resulted

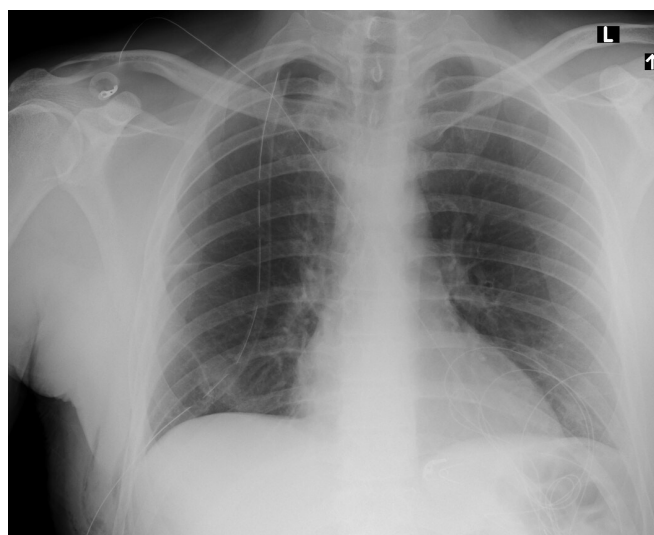


Figure 10. Case 10. X-ray after drain and VATS

in full sustained aeration of the lung, confirmed by imaging. The patient was discharged for outpatient follow-up. (Status post-drainage and on discharge is shown in Figure 9).

Case 10

A 36-year-old man was admitted due to sudden dyspnoea that occurred during a parachute jump. An X-ray showed spontaneous pneumothorax. The patient received a pleural drainage and was transported from the district hospital. Chest CT showed emphysematous bullae originating from the middle lobe and a residual pneumothorax. He was qualified and prepared for surgical treatment. A decision was made to perform decortication and marginal resection of middle lobe alveoli. The patient was discharged home on postoperative day 3 and continues outpatient care. (Status post-drainage and VATS is shown in Figure 10).

Case 11

A 47-year-old woman was admitted after a traffic accident, during which she suffered multiple organ injuries. Trauma scan showed a fracture of the pelvis, left lower limb and left ribs; a tear along the entire length of the diaphragm, from the sternum to the spine; and a traumatic thoracic hernia involving the abdominal organs: the transverse colon, greater omentum and stomach. After preparation, the patient underwent surgery using the VATS approach and left anterolateral thoracotomy with laparoscopy. The abdominal organs were reduced and repositioned below the sutured diaphragm, the remaining abdominal organs were checked and this stage of the surgery was closed. Then, a wedge resection of the upper lobe was performed due to adhesions, a fragment of the torn lingula was removed, and the upper lobe parenchyma was sutured using haemostatic and aerostatic TachoSil sponge. After surgery, the patient was transferred to the intensive care unit and as of the date of writing this paper, she continues her care there. (Pre- and postoperative status is shown in Figure 11).

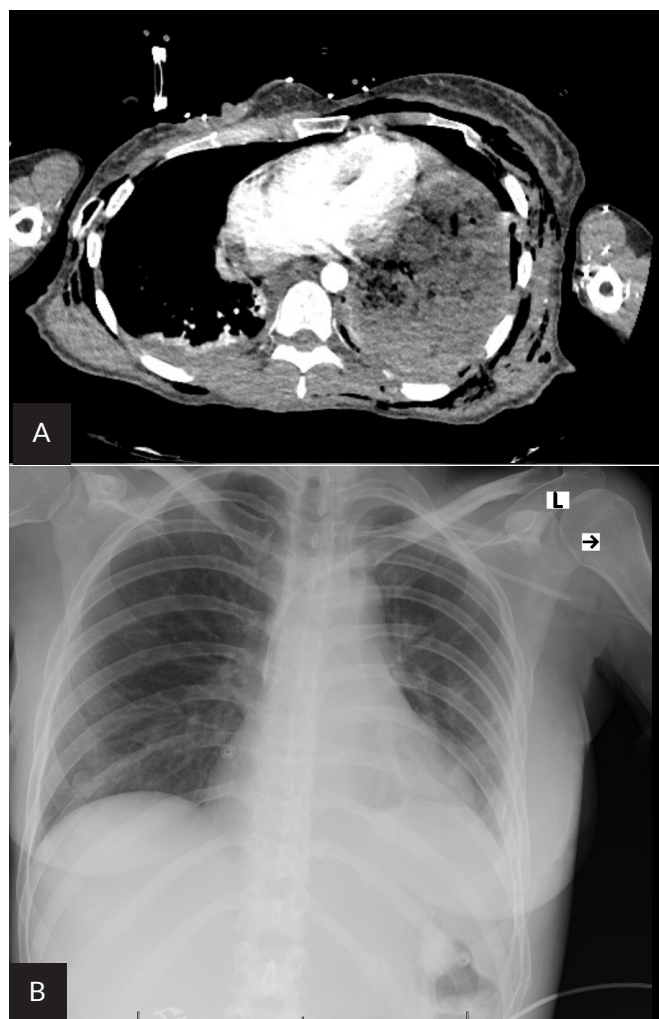


Figure 11. Case 11. A. Preoperative computed tomography. B. Postoperative x-ray

Discussion

Despite the decreasing number of fatal traffic accidents in Poland over the last twenty years [6], a total of 20,936 such incidents, with 24,125 people injured, were recorded in our country in 2023 [7]. The growing popularity of electric scooters, of which one of the described patients was a victim, also contributed to the increase in the frequency of accidents [8]. Currently, the Military Medical Institute - State Research Institute is the only military hospital with the Department of Thoracic Surgery, which supports the Trauma Centre. Since the procedures described above represent a standard known from European thoracic surgery centres, it seems justified to develop this field of surgery, especially in the military health service. The Extended Focused Assessment with Sonography in Trauma (E-FAST) [9, 10] should be a standard assessment and one of the first to be performed in a trauma setting. Chest drain for life-threatening pneumothorax is the first invasive procedure performed immediately after ultrasound if indicated [11]. The presented cases indicate that minimally invasive thoracic surgery is used in the treatment of patients with chest trauma [12–14]. The average length of stay in the Department of Surgery was 7 days in the presented cases, which

was 10 days shorter than the length of stay after multi-organ injuries reported by Pape et al. in their literature review [15]. Healthcare staff who are first to take charge of patient care in the hospital setting should receive basic training in thoracic surgery. Training and implementation of minimally invasive techniques is essential in modern and effective treatment in order to meet the needs of the Polish Armed Forces.

Conclusions

The study has shown that the extent of chest injuries has an impact on the direct threat to the patient's health and life. Immediate diagnosis and treatment already in the Emergency Department are often needed. Medical history, physical examination, and eFAST allow for rapid patient qualification for emergency chest drainage in order to stabilise their condition. After the initial treatment, further thoracic surgical management depends on CT findings.

Minimally invasive surgical techniques such as thoracoscopy/VATS can be successfully used in the treatment of chest trauma.

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