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The importance of physical examination in chest injury following stabbing

Znaczenie badania fizykalnego w urazie klatki piersiowej w następstwie ugodzenia nożem

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Keywords

trauma, first aid, pneumothorax

Słowa kluczowe

uraz, pierwsza pomoc, odma płučna

Conflict of interest

Konflikt interesów

None

Brak konfliktu interesów

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Summary

Injuries that penetrate the chest are relatively rare but pose a direct threat to the injured. Correct injury assessment in emergency pre-hospital treatment is important for the subsequent outcome of the treatment of the victim. Pre-hospital procedures based on accepted standards, such as ABCDE (airway, breathing, circulation, disability, exposure/fractures) and the "golden hour" principle according to the guidelines in advanced trauma – ATLS, allow to quickly identify life-threatening complications. The paper describes the case of a 44-year-old man with a stab wound in the chest as a result of stabbing with a knife and an analysis of the emergency team's treatment with the patient. The operation of the ambulance service team in accordance with the developed standards ensured a quick and correct diagnosis of injury, stabilization and adequate protection of basic vital functions and transfer of the patient to the hospital.

Streszczenie

Urazy przenikające klatkę piersiową występują stosunkowo rzadko, ale stanowią bezpośrednie zagrożenie życia dla poszkodowanego. Prawidłowa ocena urazu w ratowniczym postępowaniu przedszpitalnym ma istotne znaczenie dla późniejszego wyniku leczenia poszkodowanego. Postępowanie przedszpitalne oparte na przyjętych standardach, takich jak: ABCDE (*airway, breathing, circulation, disability, exposure/fractures*) i zasada „złotej godziny” zgodnie z wytycznymi w zaawansowanych urazach – ATLS, pozwalają szybko rozpoznać powikłania zagrażające życiu. W pracy opisano przypadek 44-letniego mężczyzny z raną kłutą klatki piersiowej w wyniku ugodzenia nożem oraz dokonano analizy postępowania zespołu pogotowia ratunkowego z pacjentem. Postępowanie zespołu pogotowia ratunkowego zgodnie z wypracowanymi standardami pozwoliło na szybkie i prawidłowe rozpoznanie urazu, stabilizację i odpowiednie zabezpieczenie podstawowych funkcji życiowych oraz przekazanie pacjenta do szpitala.

INTRODUCTION

The chest sustains numerous serious injuries. In most cases, they are caused by traffic accidents, accidents at work, as well as falls from a height, and are dull and non-penetrating. Penetrating chest wounds are less frequent but pose a direct life threat to the injured. The main causes of penetrating chest wounds in Poland are stab wounds resulting from a knife or another sharp object; gunshot wounds and impalement injuries are sporadic (1, 2).

Chest stab wounds are related to a high risk of damage to critical internal structures of the body and, therefore, require prompt and efficient actions. Medical care in the case of patients with penetrating wounds can be divided into three stages: prehospital care to deal with the injury, hospital care at the hospital emergency department or admission desk, and postoperative care at the surgery department. Nevertheless, a proper assessment of the injury in prehospital emergency treatment has a significant impact on the further outcome of treatment.

Prehospital procedures based on the ABCDE (airway, breathing, circulation, disability, exposure/fractures) standards and the "golden rule" principle (according to the ATLS guidelines for serious injuries) enable the diagnosis of life-threatening complications: airway obstruction, open pneumothorax, tension pneumothorax, and hemorrhage of the damaged mediastinal vessels to the pleural cavity (3-7).

The aim of this paper is to analyze emergency medical procedures in the case of a patient with chest injury following stabbing.

This is a retrospective analysis. The study was conducted at the Ambulance Services in Gdansk with the consent of the head of this unit. The research involved a case study of a patient with chest injury following stabbing. The team of the specialized ambulance was interviewed and the documentation was reviewed to collect data. The interview was related to the circumstances of the incident and the procedures taken as far as the intervention was concerned.

CASE REPORT

At 6.40 p.m., a medical dispatcher of the emergency response center was informed about a domestic fight with a 44-year-old male injured. The patient was stabbed with a knife in his chest. The medical dispatcher dispatched the closest available specialized ambulance (with a doctor, a nurse, a paramedic, and a driver) and a police unit to ensure safety on the crime scene. The emergency team arrived at the place of incident within 6 minutes. The police officers had already been there, checked and emptied the flat, and had been hearing witnesses. Upon arrival, the emergency team also evaluated the situation to ensure safety of the rescuers and the injured.

The patient was sitting in an armchair, leaning forwards, unable to maintain logical verbal contact. According to the witnesses, the man had been stabbed by his female partner during an argument. The emergency medical team evaluates the situation as safe and recognizes the injury mechanism as localized (a stab wound). The doctor, who was the team lead, initiates a preliminary diagnosis. The patient was unconscious, unable to maintain logical verbal contact, with a shallow respiration (respiratory rate: 10/min) and a visible wound of the left part of the chest at the level of the 3-4 intercostal space. The paramedics and the nurse measured the basic life parameters and reported an indeterminable blood pressure, muffled heart tones (65/min), and an indeterminable saturation. The patient's skin was pale, covered with sweat, and maintaining a normal temperature. The SAMPLE interview was impossible to apply. The doctor requests oxygen administration (flow rate: 9 l/min) and, due to the injury mechanism, initiates a local examination. Chest auscultation resulted in no respiratory sounds reported on the left side and chest percussion resulted in a tympanic sound reported on the left side of the chest. The team lead diagnosed dilation of jugular veins, the placement

of trachea along the central line, a proper pupil reaction to light, with a proper width. The patient was assigned 3 points of the Glasgow scale (eye 1, verbal 1, motor 1). The abdomen was soft with no pain and no further injuries. The doctor diagnosed tension pneumothorax and initiates an emergency decompression of the direct life-threatening tension pneumothorax. After having confirmed the location of tension pneumothorax on the left side, he identified the other intercostal space in the clavicle central line. After the disinfection of the decompressed part, the doctor introduced a 14 G catheter, removes the needle, and fastens the catheter to the chest wall. The paramedic secured the catheter by means of a gauze with a one-way valve, the Asherman Chest Seal in this case. The doctor repeated chest auscultation and reported increased respiratory sounds. Two iv access ways were ensured by the nurse as a result of doctor's request. HEAS 6% 500 ml of a rapid flow and 0.9% NaCl 500 ml were administered. The total amount of iv fluids provided to the patient was 2000 ml. Simultaneously, the paramedic passed the endotracheal intubation equipment and the patient was intubated by means of a 9 mm intubation tube and an AMBU-bag assisted respiration. After the above-mentioned procedures, a hemodynamic improvement was reported (blood pressure 130/80 mmHg, heart rate 130/min). A preparatory action was taken to immediately transport the patient to hospital in order to replace the chest decompression catheter by a pneumothorax drainage. For the time of transfer, the injured was placed on a stretcher, monitored by an ECG device and a pulse oximeter. Moreover, the team monitored all procedures that had been performed and used the radio equipment to inform one of the nearby hospitals about the expected arrival of an unconscious, intubated patient with maintained independent breathing function and tension pneumothorax decompression performed. The personnel of the hospital emergency department had enough time to prepare the unit for the admission of a critical case patient. The information exchanged between the emergency team and the hospital department enabled the implementation of further specialized procedures to treat the patient.

DISCUSSION

Penetrating chest injuries are always life-threatening cases as it is difficult to predict the scope of damage of deep structures and because such injuries have a tendency to dynamically develop. The injured person whose life is threatened requires prompt actions based on verified standards and procedures (4).

The priorities in prehospital emergency procedures are rescuers' and patient's safety, a detailed interview and a precise examination of basic life functions of the injured. A preliminary assessment of the event is initiated as soon as the emergency response center dispatcher is informed about the incident. The reported fact that the injured was involved in a fight (as in the case described in this paper) leads to the preliminary

assumption that the place of incident may not be safe enough and that a police unit is required.

The assessment of the place of incident is a significant part of the assessment of injury. Neglecting safety may lead to fatal consequences regarding the emergency team and the patient. When rescuers become victims, they are unable to assist other individuals, which leads to an increased number of the injured. Medical care must wait until the place of incident is secured (8).

A proper treatment of the injured is based on an adequately performed initial examination of trauma according to the ABCDE procedures. In the case of a patient with a penetrating chest wound, the most important element of assessment is maintaining airway patency, respiration, circulation, and an overall examination of the injured to exclude external bleeding. The knowledge of injury mechanisms supports the prediction of potential internal injuries. The individual responsible for physical examination (as a part of the prehospital emergency examination) should follow the International Trauma Life Support – ITLS guidelines and ensure a complete examination in order not to overlook anything.

A prompt assessment of airway patency, respiration quality and volume, and circulatory stability (with an examination of pulse involving both radial artery and carotid artery, and peripheral perfusion monitoring) is crucial to diagnose any complications that pose a direct life threat to the injured. Examples of such complications are as follows: open pneumothorax, tension pneumothorax, hemorrhage of the damaged mediastinal vessels to the pleural cavity, pliable chest, and pericardial tamponade (3, 9).

Pneumothorax is one of the most frequent complications of chest injuries. The initial ITLS examination enables a diagnosis of open pneumothorax and tension pneumothorax. In order to diagnose this complication, comparative auscultation and chest percussion are crucial. These types of examination are characterized by a high sensitivity (90%). The symptoms that characterize pneumothorax are tachycardia as well as (on the side of pneumothorax) less audible or no respiratory sounds and excessively clear percussion sounds (tab. 1) (4, 10). In the case in question, the auscultation and percussion performed by the doctor led to a diagnosis of symptoms that indicated tension pneumothorax. As soon as the diagnosis was made,

pneumothorax decompression was initiated by means of a catheter puncture of the second intercostal space and the catheter was secured with an Asherman Chest Seal. After the intervention, there was a reviewed examination to assess the influence of the procedures performed on the patient's condition.

The available literature emphasizes the importance of chest decompression in tension pneumothorax. Pneumothorax decompression may be performed by means of an iv catheter puncture or a pleural cavity drainage. In spite of the fact that pleural cavity drainage ensures a maximum evacuation of air from the pleural cavity and lung decompression, catheters are more frequently applied to decompress pneumothorax as they are a time-saving procedure usually performed in prehospital emergency procedures. In their research, Kaserer et al. emphasize, however, that the use of a catheter in pneumothorax decompression is related to a high risk of failure. The main reason of a low effectiveness of decompression is insufficient catheter length in the context of chest thickness. The standard catheter sizes are 14-16 G catheters of 45-50 mm length (that was also used in the reported case), which is often not enough especially in the case of obese people and individuals with subcutaneous emphysema. A 64 mm-long catheter should be applied in such patients (11). According to the current legal regulations in Poland, pleural cavity drainage can be performed only by doctors; qualified nurses and paramedics can decompress tension pneumothorax with a puncture.

ITLS (International Trauma Life Support) is searching for the most effective methods to achieve the best results during the few minutes required to save a patient's life. ITLS is a recognized prehospital emergency training standard preventing dealing with the prevention of fatal cases and disabilities resulting from injuries (9). Transportation should be initiated as soon as the patient is secure and stabilized. The injured ought to be transferred to the nearest hospital emergency department as soon as possible. Radio equipment should be used to inform the department about the transferred of an injured. An emergency team member reports the patient's condition, the emergency medical procedures performed and the expected arrival time of the ambulance. Any actions maintaining patient's life functions and ensuring their security should be continued during the transfer and can be performed following a further sequence of letters (12-14).

Tab. 1. Physical examination – clinical symptoms reported in patients with chest injury

Clinical condition	Respiratory sound	Percussion sound	Hemodynamic condition
Airway obstruction	Less audible on both sides	Proper sound	Unstable
Open pneumothorax	Less audible on the side of pneumothorax	Excessively clear	Unstable
Tension pneumothorax	Less audible or no sound on the side of pneumothorax	Excessively clear	Unstable
Massive hemothorax	Less audible	Muffled sound	Unstable
Pericardial tamponade	Proper sound	Proper sound	Unstable
Pliable chest	Proper or less audible sound	Proper sound	Stable

Source: based on (7)

CONCLUSIONS

Maintaining life functions in the case of a patient with a chest injury following stabbing depends on a prompt implementation of adequate procedures. Knowledge and team cooperation were crucial here. The emergency medical team included fully qualified members: an emergency doctor, a nurse specialized in anesthesiology and intensive care, a paramedic with a Bachelor's degree of paramedic practice, and an experienced driver. The qualified emergency personnel was significant in the life-saving procedures. A crucial aspect of the proper treatment of the patient with chest injury was an efficient emergency medical system:

- the decision made by the medical dispatcher to dispatch the nearest available ambulance to the place of incident,

- a short time from ambulance dispatch to arrival (less than 8 min),
- dispatching a police unit to secure the place of crime,
- diagnosis and implementation of proper treatment in the case of tension pneumothorax is very difficult in prehospital conditions,
- transfer to the adequate medical unit.

Proper qualifications and relevant experience of the personnel ensured a prompt diagnosis of symptoms and life-threatening injuries. In the case under study, the right diagnosis was made quickly and proper procedures were implemented. Owing to the professional cooperation of all elements of the emergency medical system (emergency response center, ambulance, hospital emergency department), the patient was properly treated in the prehospital care period, which certainly had an impact on a further therapeutic benefit.

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received/otrzymano: 22.05.2018
accepted/zaakceptowano: 12.06.2018