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The Current Trends in Pain Management of Patients with Traumatic Injuries at the Early Hospital Stage (Literature Review)

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Abstract The literature review of current trends in pain management of patients with traumatic injuries at the stage of care in the Emergency department has been presented in the article. Narcotic analgesics are the first-line treatment for pain management in trauma patients, but they have a number of side effects associated with serious cardiovascular events, acute dyspeptic syndrome with nausea, vomiting, and an increased risk of respiratory failure. Paracetamol and/or nonsteroidal anti-inflammatory drugs are often used as first-line treatment for mild to moderate pain. Nonsteroidal anti-inflammatory drugs have a risk of gastrointestinal bleeding, acute kidney injury, and cardiovascular complications, so their use in trauma is limited by cases of mild trauma with a low risk of complications. Regional pain management methods are becoming increasingly popular in the treatment of trauma pain. The use of modern methods of pain management at an early hospital stage, such as regional analgesia under the control of ultrasound navigation, will eliminate professional barriers to pain management and improve the quality of care provided to patients with traumatic injuries.

Keywords Pain, Analgesia, Trauma, Early hospital stage

According to the literature, 38 million people in Europe visit emergency departments due to traumatic injuries annually, more than 5 million of whom are hospitalized [1]. Acute musculoskeletal pain is an important factor, but it is most often underestimated at the prehospital stage, as all efforts of emergency physicians are aimed to stabilize vital systems (cardiovascular system, respiratory system). The same situation is observed in emergency departments where doctors' efforts are also aimed towards stabilizing the function of vital organs [2]. The hemodynamically unstable patients are less likely to receive anesthesia than hemodynamically stable ones. It is not surprising as opioids are the most used medications for pain management in patients with isolated and combined injuries in emergency departments and in some cases they can affect hemodynamics, consciousness, and impair oxygenation [3]. Besides, in patients with prevalent head injury and unstable hemodynamics, opioid-dependent arterial hypotension is accompanied by low cardiac output, which may lead to cerebral hypoperfusion, especially in the admission departments in the early hospital phase [4]. Pain is known to impair respiratory function, immune response, and wound healing, and worsen treatment outcome by increasing metabolic demands in patients with severe trauma. Inadequate treatment of acute pain after injury impairs quality of life and increases the risk of complications such as post-traumatic stress disorder [5]. Poor pain control is a major risk factor for the development of chronic pain syndrome leading to patient disability.

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The primary goal in pain management is to achieve a tolerable level of pain, i.e., a level of pain that is acceptable to the patient and allows him or her to function [6].

A key role in the anesthesia of patients with trauma is played by an anesthesiologist-resuscitator who, along with removing the patient from shock and carrying out anti-shock measures, must think through and implement anesthesia for a patient with a musculoskeletal injury. There is uncertainty about when to initiate pain management, because patients may be clinically unstable (as a result of traumatic shock) and unable to describe the degree of pain, due to impaired consciousness (e.g., head injury, alcohol intoxication), or as a result of pain management, delayed or absent pain evaluation, unwillingness to use opioid analgesia and delayed administration of it [7].

To date, the drug of choice for pain relief in patients with traumatic injuries of the musculoskeletal system is primarily narcotic analgesics [8].

In Europe, prehospital and early hospital treatment of traumatic pain in emergency departments is largely similar and consists mainly of paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs), nitrous oxide (N2O) and opioids [9]. The current use of these analgesics can be considered inadequate. For example, prospective data from Norway and Italy indicate that only 14% and 32% of patients

with moderate to severe pain received appropriate analgesia in emergency departments [10,11].

Early in-hospital pain relief in trauma patients, i.e., in the emergency department, Italian clinical guidelines suggest to minimize the use of narcotic analgesics with the recommendation to replace them with non-opioid analgesics [12]. However, on the other hand, non-opioid analgesics (non-steroidal anti-inflammatory drugs) may expose the patient to other risks, such as bleeding [13,14]. Paracetamol and/or NSAIDs are often used as first-line therapy for mild and moderate pain severity, the route of administration is usually oral or intravenous (IV), depending on the patient's condition, care setting and circumstances. The prescription of NSAIDs such as ibuprofen, diclofenac and naproxen is common in Europe. In a double-blind study, paracetamol was found to be non-inferior to diclofenac as an analgesic for acute mild musculoskeletal injury [15]. NSAIDs have a risk of gastrointestinal bleeding, acute kidney injury, and cardiovascular complications, so their use in trauma is limited by cases of mild trauma with a low risk of complications. Besides the risk of gastrointestinal bleeding, all NSAIDs have antiaggregant activity, which contributes to an increased risk of bleeding at any site, so they should be used with caution in patients with trauma and traumatic coagulopathies [16].

Metamizole (Dipyrone, Analgin) is a non-opioid analgesic the use of which in emergency care varies widely throughout Europe [17]. Methamizole is banned in some countries (UK, Sweden and some non-European countries), including the USA, due to concerns about myelotoxicity, but its use is widespread in other countries, e.g. Spain and Germany [18].

The systematic review showed that further large-scale studies are needed to improve the understanding of the risks and benefits of methamisole in comparison with other analgesics [19].

Weak opioids such as codeine and tramadol are also used to treat injuries with moderate pain severity [20]. Tramadol acts on L-opioid receptors and inhibits the reuptake of serotonin and norepinephrine [21]. Tramadol is not indicated in patients taking serotonergic drugs or in individuals with concomitant seizure disorders [22]. It results to an atypical analgesic effect compared to conventional analgesics of this class and with a less severe side effect profile. Typical opioid side effects with tramadol are rare, making this analgesic a useful option for pain relief [23].

Opioids provide efficient pain relief for severe pain in trauma and have options for different routes of administration, including intravenous, intranasal, intraosseous, subcutaneous, and oral. Although morphine is most commonly used in emergencies for severe pain in Europe, other opioids such as fentanyl and oxycodone are also widely used [24].

It has been proven that opioids are very efficient but have a number of side effects associated with serious cardiovascular events, acute dyspeptic syndrome with nausea and vomiting, and ultimately an increased risk of respiratory failure [25]. The side effects associated with opioids are well described. In most patients, they are either transient or are resolved as the patient develops tolerance (e.g. nausea and vomiting), or they persist (e.g. constipation), i.e. the clinical response varies [26].

Nausea and vomiting were the main side effects of morphine in 4.8% of cases, fentanyl in 1.5% of cases, and ketamine in 0.5% of cases, with hypotension occurred in 1.6% of cases with fentanyl and 0.5% of cases with morphine [27].

Decreases in SpO2 were observed with fentanyl (mean 0.6%, maximum 16.1% [26], ketamine (mean 0.4%, maximum 11.5% [28], and morphine (mean 0.6%, maximum 4.8%) [29].

Today, regional methods of pain relief are becoming increasingly popular in the treatment of pain due to injuries [30,31]. Regional anesthesia (RA) is a safe method of pain relief. In modern practice, the method of regional anesthesia and analgesia is gaining popularity as a component of a multimodal approach to pain management in trauma patients, which is important in patients with musculoskeletal trauma [32].

In Germany, regional anesthesia procedures in emergency medicine in the early hospital stage are not yet standard, but are expected to be included in the guidelines for disaster medicine. At the European level, regional anesthesia procedures have already been described in guidelines [33] and are commonly used in some clinical situations (e.g., iliac fascia block for hip fractures in 60% of patients in the National Health Service). The same in the United States, where there are evidence-based recommendations on standards for the use of regional anesthesia techniques in pediatric practice [34] and have been proposed for use in pediatrics in the early hospital stage of emergency medicine.

Ultrasound-guided interscalene brachial plexus block provides adequate analgesia for reduction while reducing emergency response time, emergency department stay by 65% and reducing emergency department staff time by 90% [35,36].

Recent data demonstrate the superiority of interscalene block over analgesia/sedation with regard to block timing, duration of analgesia, comfort during reduction, and complication rates [37].

For pain relief of forearm fractures in emergency cases, it is recommended to use supraclavicular or subclavian regional anesthesia under ultrasound control, which allows for painless reposition of the limb, has a good quality of pain relief and has a low level of complications [38]. For forearm injury, analgesics are mainly prescribed orally; If hemarthrosis is present, it is evacuated [39,40,41].

Fractures of the lower limb are also accompanied by severe pain, traumatic shock and large blood loss. The benefits of regional anesthesia for acute lower extremity fracture pain have been well studied, particularly ultrasound-guided fascia iliaca blocks: Femoral nerve block (continuous or single), pericapsular nerve block (ultrasound-guided PENG block), intra-articular block are used for injuries of the hip joint.

Hany A. Zaki et al. conducted a meta-analysis of publications that used regional analgesia in comparison with opioid analgesia during the early hospitalization of patients in the emergency department and identified an earlier onset of analgesia, better analgesia effect and comfortable conditions for repositioning of the injured limb in the group using

ultrasound-guided regional analgesia [42].

There is a problem with the attitude of some medical professionals who consider pain to be a secondary factor to other vital signs abnormalities in emergency situations. For example, a patient with trauma may arrive with the phenomena of traumatic shock, accompanied by instability of hemodynamic parameters, respiration. The emergency department physician will certainly be involved in the care of the trauma patient and his or her actions will be aimed at stabilizing vital signs - this is a critical factor in the timely treatment of traumatic pain with analgesics, as pain is not considered as important an element as blood pressure, respiratory rate, or state of consciousness [43]. Besides, the early hospital care provider will prefer the use of a systemically administered analgesic (opioid or non-narcotic analgesic) as the use of regional blockade requires time and skill. There is a need to train anesthesiologists-resuscitators in the skills of regional analgesia under the control of ultrasound technology.

Lee J. S. et al believe that there are important barriers to training emergency physicians, namely the early hospital level in regional blockade skills under ultrasound navigation. The emergency department is a time-limited environment where stabilization of vital organs and systems is a priority. In this environment, it can be difficult to learn new procedural pain relief skills. The time to perform regional blockade takes from 10 to 20 min, and it takes 5 min to perform systemic analgesia with narcotic analgesics [44]

High patient flow, overcrowding in emergency hospitals is also a crucial factor in delaying the treatment of traumatic pain in the early hospital stage, as medical staff in this context is under tremendous pressure. Excessive numbers of patients requiring treatment in emergency departments may inevitably lead to increased patient assessment times and therefore lengthen treatment times [45].

Taking into account the published literature, the management of moderate and severe traumatic pain in emergency departments can be improved by increasing the use of analgesics and by implementing modern pain relief techniques. The use of pain rating scales, the development of pain management protocols, and the introduction of ultrasound navigation with regional blockades, especially when using a multimodal approach to pain management, will reduce healthcare costs for the treatment of patients with traumatic injuries. The use of modern methods of anesthesia at the early hospital stage, such as regional analgesia under the control of ultrasound navigation will eliminate professional barriers in anesthesia and improve the quality of care provided to patients with various traumatic injuries.

Conflict of interests' statement

The authors declare no conflict of interest.

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