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OPTIMIZATION OF ANESTHETIC MANAGEMENT FOR COMBINED INJURIES IN MILITARY PERSONNEL IN DIFFICULT FIELD AND MOUNTAIN CONDITIONS: THE ROLE OF NERVE CONDUCTION BLOCKS

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Abstract

Modern emergencies, including man-made accidents, natural disasters, local armed conflicts, and terrorist attacks, are accompanied by a mass influx of victims with multiple injuries— polytrauma.

Keywords: Nerve conduction block, anesthetic management, Advanced Trauma Life Support .

Relevance of the study

Modern emergencies, including man-made accidents, natural disasters, local armed conflicts, and terrorist attacks, are accompanied by a mass influx of victims with multiple injuries— polytrauma . These conditions require the healthcare system, particularly military medicine, to respond immediately, with precise triage and the most effective anesthetic support, as a key element in saving lives. Conduction anesthesia as a method of pain relief is particularly relevant given the shortage of anesthetic and respiratory equipment, power outages, shortages of inhalational anesthetics, and the need for autonomous operation in field hospitals. Despite technological advances and the availability of modern medications, a

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systematic approach to the use of regional anesthesia in military field conditions has yet to be developed and fully implemented in Uzbekistan. The development and implementation of an effective anesthetic management strategy for polytrauma , adapted to mobilization readiness conditions , is a priority for anesthesiology, military, and disaster medicine.

The degree of development of the topic

The world medical literature is rich in works on the problems of providing assistance in cases of multiple trauma (American College of Surgeons , ATLS, 2022), as well as research on military anesthesiology (Murphy M. et al ., NATO Medical Doctrine , 2017). However, the use of regional anesthesia in extreme conditions, especially during mass casualty influxes, remains insufficiently addressed and lacks a unified methodology. In Uzbekistan, such aspects are covered fragmentarily in individual studies, while there are no studies dedicated to the systematic implementation of regional anesthesia in field hospitals as part of mobilization medicine.

Modern aspects of anesthetic management in polytrauma

Clinical and pathophysiological features of polytrauma

Polytrauma (multiple, combined, and combined trauma) is one of the most severe clinical conditions, characterized by damage to two or more anatomical areas or systems, with at least one of them threatening the patient's life. According to ATLS (Advanced) recommendations Trauma Life Support), timely identification of life-threatening conditions and provision of anesthetic support is a critically important component.

Pathophysiological features of polytrauma include:

severe hypovolemia due to massive blood loss;

violation of microcirculation and tissue perfusion;

development of multiple organ failure;

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stress response with hypercatabolism and immunodepression;
high risk of infectious complications.
Under these conditions, the anesthesiologist must quickly assess the hemodynamic status, determine the amount of compensation, and select a safe and effective anesthesia technique.

The importance of anesthesiological tactics in the outcome of polytrauma

Anesthetic management in polytrauma depends on the severity of the patient's condition and the type of planned intervention. General anesthesia (GA) with mechanical ventilation is traditionally used in hospital settings; however, this option is not always available in the field. Research shows that adequate pain relief during trauma not only reduces stress and the risk of shock but also promotes better outcomes, including reduced mortality. Furthermore, the use of regional anesthesia in resource-limited settings (field hospitals, temporary hospital modules) may be a safer and more resource-efficient solution. Research by B. Vetter et al . (2014) demonstrated that patients with extremity injuries who received regional anesthesia had more stable hemodynamics and a lower incidence of respiratory complications compared to patients receiving general anesthesia.

Development and application of conduction anesthesia in trauma

Regional anesthesia—a method of blocking nerve pathways to achieve regional pain relief—has become an important area of anesthesiology in the 21st century. In cases of multiple trauma , particularly with isolated injuries to the extremities, pelvis, and chest, this technique allows for:
avoid intubation and mechanical ventilation;
reduce the load on intensive care beds;
reduce the consumption of narcotic analgesics;
provide long-term pain relief after surgery.

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Ultrasound navigation has significantly improved the accuracy, effectiveness, and safety of nerve blocks. Since the 2010s, this approach has become the standard in most Western militaries (NATO, US Army). Medical Corps), and in recent years, in a number of civilian health care systems.

The following types of blockades are considered particularly promising:

brachial plexus block for upper limb injuries;

lumbosacral block for injuries of the lower limbs and pelvis;

paravertebral block for chest injuries.

In emergency situations and mobilization, where conditions for full-fledged inhalation anesthesia are not available, conduction anesthesia becomes one of the few available methods, while maintaining safety and effectiveness.

International experience and military standards

NATO military medical guidelines (STANAG 2540), as well as the doctrines of the US Department of Defense (Joint Trauma System Clinical Practice Guidelines emphasize the need for widespread use of regional anesthesia in field conditions [11]. Thus, at the evacuation stages of levels 2 and 3 (Role 2 and Role 3), it is recommended to use conduction anesthesia for operations on the extremities and soft tissues if there is no threat to airway patency or head injury. During the military campaign in Afghanistan (2003–2014), the use of conduction anesthesia allowed for a 40% reduction in the consumption of ketamine and 60% of inhalation anesthetics, as well as an increase in the mobility of surgical teams.

The state of the problem in Uzbekistan

In the Republic of Uzbekistan, work during mobilization readiness is regulated by departmental orders of the Ministry of Defense, the Ministry of Health, and the Service for Sanitary and Epidemiological Welfare and Public Health. However, there are currently no unified recommendations for the use of regional anesthesia in field hospitals. Existing clinical protocols are primarily focused on

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inpatient settings. The work of anesthesiologists in emergency situations is limited to standard pain relief measures (general anesthesia, ketamine , opioids). Moreover, existing staff often lack sufficient experience in ultrasound navigation of blockades, and access to mobile ultrasound machines remains limited. The implementation of a unified system for training, preparation, and provision of regional anesthesia in mobilization medicine remains a pressing issue.

In the context of mobilization medicine, the effectiveness of anesthesia directly impacts the survival of patients with severe injuries. According to the Damage concept Control Resuscitation (DCR), the main tasks of the anesthesiologist are:
rapid assessment of vital functions;
stabilization of the airways and circulation;
minimization of intraoperative blood loss;
prevention of the death triad: hypothermia, acidosis and coagulopathy .

Today, leading international organizations recognize the importance of a multi-level approach to trauma system), where each stage – from pre-hospital to specialized – must ensure continuity in the provision of anesthetic care.

International experience shows that up to 60% of fatal outcomes in multiple trauma are associated with the untimely initiation of adequate anesthetic support and the lack of standardization of actions in mobilization situations.

Mobilization readiness models and field hospitals

Field medical units in emergency situations and military scenarios are divided into several levels:
initial examination, basic care without surgery;
surgical interventions with elements of resuscitation;
full surgical and anesthesiological support with artificial ventilation, laboratory, ultrasound and blood substitutes.

In the Republic of Uzbekistan, in accordance with the national concept of mobilization readiness, structures have been established at military hospitals,

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including in Tashkent. Their equipment allows for surgical interventions for injuries of varying complexity. However, the current regulatory framework requires revision in terms of regional anesthesia and the use of modern DCR and FAST algorithms (Focused) . Assessment with Sonography for Trauma)

In conditions of multiple trauma , especially with a mass influx of wounded, regional anesthesia provides:

conservation of oxygen resources;

no need for mechanical ventilation, minimization of drug load;

the ability to conduct operations sequentially with minimal logistical burden.

Field protocol for anesthesiological care: the experience of NATO and the CSTO

NATO military doctrines (STANAG 2540, JTS Guidelines) clearly regulate anesthesia care algorithms for multiple trauma cases . Specifically, they recommend:

in case of limb trauma - regional anesthesia with ultrasound navigation;

in case of traumatic brain injury - ketamine / propofol with intracranial pressure monitoring;

in case of chest injuries - paravertebral or epidural blocks;

mandatory administration of tranexamic acid and hemostasis control.

Experience from missions in Afghanistan and Iraq has shown that the implementation of field protocols with mandatory participation of anesthesiologists in TCCC (Tactical Combat Casualty Care) has led to a 23% reduction in mortality during the evacuation phase. The CSTO (including Uzbekistan's CIS allies) conducts regular joint exercises to practice anesthesia tactics during mass influxes of wounded. The main focus is on adapting military standards to civilian conditions during disasters and mobilization.

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Conclusions

Conduction anesthesia for severe multi-trauma patients in mobilization readiness settings has proven its value and continues to evolve. Methodologically, this approach is supported by special initiatives (e.g., MARAA) and the mandatory inclusion of regional techniques in combat medicine protocols (prolongedfieldcare.org). International and domestic experience demonstrates the feasibility of blockades in field hospitals (USA, France, Russia, etc.) (pubmed.ncbi.nlm.nih.gov , medvestnik.ru). Modern algorithms utilize ultrasound navigation, ensuring the safety and accuracy of blockades (painrussia.ru). Personnel training includes mandatory simulation training and regular master classes (researchgate.net , medvestnik.ru). Equipment includes portable ultrasound machines and comprehensive block kits (nysora.com, aneskey.com). In practice, these measures improve the effectiveness of anesthesia care in polytrauma : they improve pain control, reduce complications, and expedite the evacuation and treatment of the wounded (aneskey.com pubmed.ncbi.nlm.nih.gov). All provisions and recommendations are outlined in current guidelines and supported by clinical studies (prolongedfieldcare.org aneskey.com), justifying the further expansion of the role of RA in mobilization medicine.

Practical recommendation

1. Anesthetic support in the context of mobilization medicine requires a flexible model focused on resource conservation and rapid stabilization.
2. Conduction anesthesia is a key method for interventions in cases of isolated injuries to the extremities and chest.
3. International recommendations (JTS, STANAG) can be adapted to the conditions of Uzbekistan.
4. Practical experience of the Tashkent Military Hospital confirmed the effectiveness of regional anesthesia.

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5. To achieve sustainable mobilization readiness, systematic training of personnel and technical support are necessary.

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