

Automation of Intraoperative Analysis of the Indicators of the Inflammatory Response of Neurosurgical Patients Undergoing Brain Tumor Removal: Information Processing, Analysis, Prognosis

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ABSTRACT

The data of the study of indicators of the inflammatory response, hormonal status, biochemical blood parameters in the perioperative period in neurosurgical patients undergoing surgery for tumors of the posterior cranial fossa are presented. The study included 65 patients. The operations were performed under anaesthesia using fentanyl (3-5 µg/kg-hour), clonidine (1-2 µg/kg-hour), and propofol (3-5 mg/kg-hour). A significant increase in the level of Interleukin 10 was noted at the stage of hemostasis. The next day after the operation, the level of Interleukin 6 was significantly increased. At the stage of hemostasis, a transient increase in the levels of ACTH, Cortisol, Prolactin was noted. Their rates returned to the initial levels on the next day after the operation. Under conditions of neurovegetative stabilization, a sufficient humoral response to surgical trauma was noted.

KEYWORDS

Inflammatory Response, Information, Modeling, Neurovegetative, Operations, Posterior Cranial Fossa, Stabilization, Systemic

INTRODUCTION

Describe the general perspective of the article. End by specifically stating the objectives of the article.

The digitalization of the medical sector in the Russian Federation is currently of a systemic nature, mainly at the level of federal documents, not being comprehensive, often focusing on specific local areas. At the same time, part of the processes that are not included in the priority list require phased automation in order to ensure timeliness and control the completeness of operations with information, as well as to optimize time costs and minimize the human factor. An example of such an area is the

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intraoperative control of neurosurgical patients. In the Almazov National Medical Research Center, the area of research for the designated subject area is the control of the inflammatory response in the perioperative period when brain tumors are removed.

Significant research and practical testing of the developed approaches for working with patients allowed creating a sufficient data sample, on the basis of which, following the basic principles of building distributed information systems, with the prospect of developing to the big data level, specialists of information departments of Admiral Makarov State University of Maritime and Inland Shipping developed the information system called “Automated system of intraoperative monitoring of homeostasis index of neurosurgical patients” (Sokolov, Lesteva & Musin, 2014).

Information technology is now widely used. It is clear that such an important area of human life as health care cannot be left out. The latest digital developments have a positive effect on the development of the most promising methods of organizing the provision of medical care to the population around the world. At the same time, the effective construction of IT infrastructure is becoming increasingly important. Many states have long been active in innovating in the medical field.

SUBJECT OF THE STUDY

There is a certain set of body reactions in which the functional state called the “surgical stage of anesthesia” is reflected and to which the anesthesiologist most often draws attention and tries to correct. These are indicators of systemic hemodynamics, changes in spontaneous and induced bioelectric activity of the brain, deviations in the level of various hormones and other biologically active substances in the blood.

In neurosurgery, the concept of the adequacy of anesthesia is interpreted more broadly. So, the criteria of adequacy in neuroanesthesiology, depending on the stage of the operation, can be: before decompression of the brain - maintaining perfusion pressure; after decompression - preservation of elasticity, suppleness of the brain, assessment and the maximum possible limitation of centrogenic reactions; at the stage of removal of the tumor and hemostasis - normal indicators of vascular-platelet and coagulation hemostasis in the wound. In addition, an adequate anesthetic benefit is the key to a smooth, harmonious exit of the patient from the anesthetized state. In the postoperative period after surgery on the brain, the clinical manifestations of inadequacy of anesthesia can be: excessive inhibition of central nervous system functions, multiple organ dysfunction. Apparently, an overly expressed systemic inflammatory response may be the background, and in some cases, the main cause of this symptomatology. For cognitive impairment, this relationship is well established (Sokolov, Lesteva & Musin, 2014).

Inflammation is both a pathological and adaptive process caused by the reaction of the body's defense mechanisms to local damage. Inflammation triggers - tissue degradation products, immune complexes - activate several basic components of the inflammation program at once. Moreover, the initial activation of even one link can “turn on” the entire system of inflammatory reactivity as a whole. The regulatory intermediaries for this mutual activation are cytokines, hemostatic activation products, biogenic amines, and many other inflammatory mediators. A key role in coordinating the mechanisms of inflammation belongs to cytokines. The main producers of cytokines are T cells and activated macrophages, as well as other types of leukocytes, postcapillary venule endotheliocytes, platelets and various types of stromal cells. Initially, a local inflammatory response is controlled by proinflammatory cytokines such as IL-1, IL-6, IL-8, IL-12, TNF, interferons, as well as their endogenous antagonists, especially IL-10. Subsequently, with the prevalence of the inflammatory component over the anti-inflammatory one and damage to the primary barrier structures in the area of inflammation, a “breakthrough” of inflammatory mediators into the systemic circulation occurs. At the same time, the main function of pro-inflammatory mediators in the circulating blood is to attract white blood cells, coagulation and complement factors, acute phase proteins to the area of

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