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THE IMPORTANCE OF DEXMEDETOMIDINE IN OPTIMIZING INTENSIVE THERAPY IN CHILDREN FOLLOWING NEURO-ONCOLOGICAL SURGERY

S.Sh. Joniev, I. Togayev, A.Fazilov, T.Yuldashev

[1] Samarkand State Medical University , Uzbekistan, Samarkand

Abstract: Intensive therapy in the postoperative period following neuro-oncological surgeries aims to reduce cerebral edema and protect cells from hypoxia and oxidative damage. This article provides a comprehensive analysis of the neuroprotective properties of dexmedetomidine, sodium oxybutyrate, and osmodiuretics, as well as their application and combined effectiveness. Dexmedetomidine, with its sympatholytic and anti-inflammatory effects, contributes to improved cerebral blood circulation. The efficacy of dexmedetomidine in lowering arterial pressure and providing neuronal protection further broadens its application. Considering its role in strengthening the blood-brain barrier, its use in neurosurgery marks a new dimension of its efficacy. The clinical advantages of dexmedetomidine in reducing postoperative complications are highly valued due to the aforementioned factors. This article presents a detailed analysis of the outcomes of using dexmedetomidine, sodium oxybutyrate, and osmodiuretics in intensive therapy following neuro-oncological surgery.

Keywords: dexmedetomidine, sodium oxybutyrate, osmodiuretics, cerebral edema, intracranial pressure, neuroprotection, neuro-oncological surgery.

Article Text:

Neuro-oncological surgeries, particularly those related to brain tumors, are critical for saving patients' lives. However, increased intracranial pressure and the development of cerebral edema during and after surgery can worsen the patient's condition and lead to mortality. Therefore, intensive therapy in the postoperative period

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must fulfill key objectives: reducing cerebral edema, managing hypoxia and oxidative stress, and ensuring neuroprotection. Choosing effective treatment methods for postoperative recovery and complication management is crucial. Drugs such as dexmedetomidine and mannitol, or combinations like sodium oxybutyrate and mannitol, are widely used for these purposes.

Dexmedetomidine's neuroprotective properties are highly effective due to its sedative and sympatholytic effects, improvement of cerebral blood circulation, and anti-inflammatory action (Kress et al., 2017, Journal of Clinical...). Furthermore, osmodiuretics (e.g., mannitol) are recognized as an effective means of rapidly reducing intracranial pressure and cerebral edema. These agents provide rapid and effective action in reducing cerebral edema, which is a crucial factor in preventing postoperative complications. Concurrently, numerous studies have shown the effectiveness of combined use of dexmedetomidine and mannitol in reducing cerebral edema and enhancing neuroprotective effects.

Study Objective:

The primary objective of this study is to enhance the effectiveness of intensive therapy following neuro-oncological surgeries by utilizing dexmedetomidine and sodium oxybutyrate.

Methods and Techniques:

This study was conducted at the multidisciplinary clinic of Samarkand State Medical University, in the neurosurgery and neuroreanimation departments, involving a total of 75 patients who underwent surgery for brain tumors. According to the study aims and objectives, patients were divided into two groups: Group 1 (main group), consisting of 33 patients, received dexmedetomidine and mannitol for postoperative intensive therapy and sedation. Group 2 (control group), consisting of 32 patients, received a combination of sodium oxybutyrate and mannitol in intensive therapy. In

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both groups, the described drug combinations were used during intensive therapy to reduce intracranial pressure and enhance neuroprotection. Infusion methods and dosages were precisely defined for each combination.

Dexmedetomidine, an alpha-2 adrenergic agonist, exerts sedative and sympatholytic effects. In this study, the dexmedetomidine infusion dosage was determined as follows:

- **Dexmedetomidine:** 0.5–1 µg/kg/patient body weight for infusion.
- **Infusion rate:** 0.1–0.2 µg/kg/hour.
- **Mannitol:** 0.25–0.5 g/kg/patient body weight for infusion.
- **Infusion rate:** 60–120 ml/hour.

Mannitol was used as an effective osmodiuretic to rapidly reduce intracranial pressure. During infusion, dexmedetomidine provided sedation, calming patients, and further reduced intracranial pressure with its sympatholytic properties.

For Group 2 patients, sodium oxybutyrate, a GABA A receptor activator primarily used in anesthesia, was administered at the following dosage:

- **Sodium oxybutyrate:** 1–2 mg/kg/patient body weight for infusion.
- **Infusion rate:** 0.05–0.1 mg/kg/hour.
- **Mannitol:** Infused at the same dosage as above (0.25–0.5 g/kg/patient body weight).

Sodium oxybutyrate helps to sedate patients and maintain an anesthetic state. Its effect on cerebral edema contributes to reducing intracranial pressure and enhancing neuroprotection.

The effectiveness of the infusions was assessed by measuring intracranial pressure (ICP) and mean arterial blood pressure (MAP). Additionally, neurosonography, blood oxygen saturation, central hemodynamic parameters (systolic arterial blood pressure

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(SBP), diastolic arterial blood pressure (DBP), mean arterial pressure (MAP)), and hourly urine output were used to evaluate the effectiveness of intensive therapy.

Results and Discussion:

In comparing the effectiveness of dexmedetomidine and sodium oxybutyrate in reducing cerebral edema, the sedative and sympatholytic effects of dexmedetomidine and the osmodiuretic effect of sodium oxybutyrate were studied to determine the efficacy of these combinations in reducing cerebral edema. It was found that osmodiuretics lower intracranial pressure by reducing cerebral edema. The combined use of dexmedetomidine and mannitol, along with its sedative and analgesic properties, confirmed its effectiveness in reducing cerebral edema in intensive therapy. Neuroprotective properties were identified by controlling intracranial pressure and edema during intensive therapy with agents like dexmedetomidine and sodium oxybutyrate.

The results of this study helped to compare the effectiveness of using dexmedetomidine and sodium oxybutyrate in optimizing intensive therapy methods. In Group 1, the combination of dexmedetomidine and mannitol effectively reduced intracranial pressure and enhanced neuroprotection in patients. Dexmedetomidine, as an alpha-2 adrenergic agonist with sedative and sympatholytic effects, demonstrated positive results in reducing cerebral edema and managing intracranial pressure. The combination of sodium oxybutyrate and mannitol was also effective for patients in Group 2, but its effectiveness in reducing cerebral edema was slightly lower compared to dexmedetomidine. Neurosonography further aided in the accurate measurement of cerebral edema and pressure, providing a modern and effective approach to monitoring patient health during intensive therapy.

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Conclusion:

The study results indicated the superior effectiveness of the dexmedetomidine and mannitol combination in reducing cerebral edema and enhancing neuroprotection. While the sodium oxybutyrate and mannitol combination can also be effective, the benefits of using dexmedetomidine in combination are more pronounced.

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