Mannitol for intraoperative brain relaxation

The risk of brain edema after dural opening is high in patients with midline shift undergoing supratentorial tumor surgery. Brain swelling may result in intracranial hypertension, impeded tumor exposure, and adverse outcomes. Mannitol is recommended as a first-line dehydration treatment to reduce brain edema and enable brain relaxation during neurosurgery. Research has indicated that mannitol enhanced brain relaxation in patients undergoing supratentorial tumor surgery; however, these results need further confirmation, and the optimal mannitol dose has not yet been established [1].

Although mannitol is widely used to facilitate brain retraction in cases of ruptured aneurysms, there is no consensus about the intraoperative administration of mannitol in the case of unruptured aneurysms. Accordingly, this study was conducted to identify an intraoperative mannitol administration strategy.

Mannitol was routinely administered to patients (n = 90) from January 2015 to April 2016, and not administered to patients (n = 97) from May 2016 to June 2017. The patient groups with and without mannitol administration were then compared based on the patient medical records, radiological data, and digital recordings of the intraoperative microscope.

The patient groups with and without mannitol administration were comparable as regards patient age, number of elderly patients, sex, and aneurysm locations. No between-group difference was identified in terms of the intradural procedural time, retraction-induced cortical injury, postoperative electrolyte imbalance, symptomatic infarction, and postoperative epidural hematomas (EDHs). However, the patient group without mannitol administration showed a significantly lower incidence of chronic subdural hematomas (CSDHs) >50 mL (13.3% vs 3.1%, P = 0.010). Moreover, a multivariate analysis revealed that an advanced age (p = 0.019), male gender (p <0.001), and mannitol administration (p = 0.040) were all statistically significant risk factors for a postoperative CSDH >50 mL following unruptured aneurysm surgery.

Withholding the administration of mannitol during a pterional or modified procedure for unruptured aneurysms was found to reduce the postoperative occurrence of a CSDH without increasing the operative difficulties or other postoperative complications [2].

Some clinicians [3] [4] advocate high doses (>1.0 g/kg) of mannitol to effectively reduce intracranial pressure, while others recommend lower doses (<1.0 g/kg) [5] [6].

Treatment guidelines for using mannitol in patients with traumatic brain injury and stroke have been published and provide recommendations regarding the dose and timing of mannitol. However, there is still controversy concerning dehydration treatment with mannitol in patients with preoperatively increased intracranial pressure during brain tumor surgery.

Seo et al. sought to determine the dose of mannitol that provides adequate brain relaxation with the fewest adverse effects.

A total of 124 patients were randomized to receive mannitol at 0.25 g/kg (Group A), 0.5 g/kg (Group B), 1.0 g/kg (Group C), and 1.5 g/kg (Group D). The degree of brain relaxation was classified according to a 4-point scale (1, bulging; 2, firm; 3, adequate; and 4, perfectly relaxed) by neurosurgeons; Classes 3 and 4 were considered to indicate satisfactory brain relaxation. The osmolality gap (OG) and serum electrolytes were measured before and after mannitol administration.

The brain relaxation score showed an increasing trend in patients receiving higher doses of mannitol ($p = 0.005$). The incidence of satisfactory brain relaxation was higher in Groups C and D than in Group A (67.7% and 64.5% vs 32.2%, $p = 0.011$ and 0.022, respectively). The incidence of OG greater than 10 mOsm/kg was also higher in Groups C and D than in Group A (100.0% in both groups vs 77.4%, $p = 0.011$ for both). The incidence of moderate hyponatremia ($125 \text{ mmol/L} \leq Na+ < 130 \text{ mmol/L}$) was significantly higher in Group D than in other groups (38.7% vs 0.0%, 9.7%, and 12.9% in Groups A, B, and C; $p < 0.001$, $p = 0.008$, and $p = 0.020$, respectively). Hyperkalemia ($K+ > 5.0 \text{ mmol/L}$) was observed in 12.9% of patients in Group D only.

The higher doses of mannitol provided better brain relaxation but were associated with more adverse effects. Considering the balance between the benefits and risks of mannitol, the authors suggest the use of 1.0 g/kg of intraoperative mannitol for satisfactory brain relaxation with the fewest adverse effects. Clinical trial registration no.: NCT02168075 (clinicaltrials.gov) [7].

References

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