

Neuro question of the month

Is there an optimal dose for Mannitol for intracranial surgery and what are the advantages and disadvantages of different doses?

Mannitol is used routinely in neurosurgical cases to reduce intracranial pressure (ICP) when there is a concern for cerebral edema. Mannitol is an osmotic diuretic that works by reducing intracranial volume thereby reducing pressure in the cranial vault [1]. The dose ranges vary widely in the anesthesia and neurosurgical literature, ranging from 0.25 g/kg to 2 g/kg, and often the dose given to the patient is dependent on the surgeon's preference [2].

Although mannitol is a widely utilized drug in neurosurgical procedures, there is currently no strong evidence to guide the optimal dose and duration of treatment. Recent literature suggests there may be a dose-related correlation with reductions in ICP both acutely and in terms of duration of effect. Seo et al. randomized a group of 124 patients to 0.25 g/kg, 0.5 g/kg, 1 g/kg, and 1.5 g/kg, and they saw optimal brain relaxation at a higher dose, however, at the cost of higher risks of adverse effects. They suggest the optimal mannitol dose is 1 g/kg for satisfactory brain relaxation while minimizing side effects. Limitations in this study include the subjectivity of the neurosurgeon's interpretation of adequate brain relaxation, and the fact that the anesthesiologists were not blinded to the mannitol doses [3]. Additionally, the data available on optimal mannitol dosing is limited, and further research is necessary.

As with most drugs we give in the operating room, there is a risk of adverse effects. Specific risks include electrolyte balances (hypo/hyponatremia, hypo/hyperkalemia), nephrotoxicity, and worsening of ICP when mannitol is administered rapidly. Most patients are able to tolerate the adverse effects of mannitol, but those with pre-existing renal failure are at higher risk for developing complications. These patients have a higher chance for developing heart failure, pulmonary edema, CNS depression, and severe electrolyte issues necessitating urgent hemodialysis. The risks associated with mannitol appear to be dose dependent, and even healthy patients are at increased risk of developing a reversible AKI at high doses [4,5,6].

The limited evidence available unfortunately means we still don't have an optimal dose of mannitol for brain relaxation in intracranial procedures, but we do know there is an increased risk of adverse effects at the higher doses, and ineffectiveness at the lower end. As such, using a dose between 0.5g/kg to 1 g/kg may provide effective neurosurgical conditions while minimizing adverse effects. This appears to be in keeping with the requests of neurosurgeons at Vancouver General Hospital.

Resources

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