

Editor's note: This is a summary of a nursing care–related systematic review from the Cochrane Library.

# Mannitol vs. Hypertonic Saline for Brain Relaxation in Patients Undergoing Craniotomy

## REVIEW QUESTION

Is mannitol or hypertonic saline more effective in promoting intraoperative brain relaxation in patients undergoing craniotomy?

## TYPE OF REVIEW

This is a review of six randomized controlled trials (RCTs) comparing the effectiveness of mannitol and hypertonic saline in inducing intraoperative brain relaxation in patients undergoing craniotomy.

## RELEVANCE FOR NURSING

In patients undergoing craniotomy for removal of a brain tumor, it is important to ensure that the brain is relaxed, minimizing the likelihood of damage to healthy brain tissue and improving the neurologic outcomes of the patient. Increased intracranial pressure contributes to a tense brain during the intraoperative period. The osmotic agent mannitol is considered the gold standard in reducing intraoperative intracranial pressure, or relaxing the brain; however, hypertonic saline, another osmotic agent, is also effective.

Mannitol facilitates the movement of water from the brain into the vasculature. It is available as a 20% or 25% solution and is administered via rapid intravenous infusion in doses of 0.25 to 1 g/kg. Hypertonic saline is the hyperosmolar solution of normal saline and is available in concentrations of 3%, 5%, 7.5%, and 23%. It does not cross the blood–brain barrier, remaining in the intravascular compartment. Hypertonic saline maintains better cerebral perfusion pressure than mannitol, as it has less diuretic properties.

## CHARACTERISTICS OF THE EVIDENCE

Six RCTs with 527 participants were included in the review. Of these, five were of an unclear or high risk of bias, with only one at a low risk of bias. Primary outcomes included longest follow-up mortality, Glasgow Outcome Scale score at three months, and adverse events related to the administration of mannitol and/or hypertonic saline—however, none of these outcomes were investigated by the six studies in the review. Secondary outcomes included intraoperative brain relaxation, length of ICU stay, length of hospital

stay, and quality of life—this last outcome was not investigated by any of the six RCTs.

Brain relaxation was assessed by three of the included studies ( $n = 387$ ); 21% (42/197) of participants in the hypertonic saline group and 36% (68/190) of those in the mannitol group demonstrated inadequate brain relaxation (risk ratio for brain bulge = 0.60, 95% confidence interval, 0.44–0.83,  $P = 0.002$ ). Only a single study ( $n = 238$ ) included data on lengths of hospital and ICU stay, and no difference was found between patients treated with mannitol or those treated with hypertonic saline in the mean number of days spent in the hospital (5.7 for both) or in the ICU (1.28 versus 1.25, respectively).

## BEST PRACTICE RECOMMENDATIONS

While the review concluded that hypertonic saline was more effective in inducing brain relaxation than mannitol, because of the limited number of studies in the review and an unclear or high risk of bias in the majority of these, no recommendations for practice can be made.

## RESEARCH RECOMMENDATIONS

Additional RCTs of high methodological quality that compare mannitol, hypertonic saline, and other methods for intraoperative brain relaxation in patients undergoing craniotomy are needed. The dosages of mannitol and hypertonic saline and the intraoperative time at which these are administered should be important considerations for future RCTs, which should consider a range of patient outcomes, including but not limited to mortality, quality of life, long-term postoperative outcomes, and length of hospital stay. ▼

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## SOURCE DOCUMENT

Prabhakar H, et al. Mannitol versus hypertonic saline for brain relaxation in patients undergoing craniotomy. *Cochrane Database Syst Rev* 2014;7:CD010026.