Hypertonic Versus Isotonic Crystalloid for Fluid Resuscitation in Critically Ill Patients


**SYSTEMATIC REVIEW SOURCE**

This is a systematic review abstract, a regular feature of the *Annals’ Evidence-Based Emergency Medicine* (EBEM) series. Each features an abstract of a systematic review from the Cochrane Database of Systematic Reviews and a commentary by an emergency physician knowledgeable in the subject area.


The *Annals’*EBEM editors prepared the abstract of this Cochrane systematic review as well as the Evidence-Based Medicine Teaching Points.

**OBJECTIVE**

To determine if hypertonic crystalloid replacement therapy is more effective than isotonic crystalloid in the resuscitation of patients with trauma or burns or in those undergoing surgery.

**DATA SOURCES**

This systematic review was published in the software version of the Cochrane Review. Studies included in the meta-analysis were identified by searching MEDLINE, EMBASE, the Cochrane Controlled Trials Register, the Cochrane Injuries Group Specialized Register, and the National Research Register. The reviewers checked reference lists of all articles identified for additional trials. The review is updated to November 2001.

**STUDY SELECTION**

Studies were included if they were randomized controlled trials (RCTs) that compared hypertonic to isotonic crystalloid in patients with trauma or burns or in those undergoing surgery. Trials in both the out-of-hospital and hospital setting were included. Crossover trials were excluded. Trials of hypertonic crystalloid with an add-on colloid (e.g., hypertonic saline solution and dextran) were not included. This comparison has been dealt with in a previous systematic review.

**DATA EXTRACTION**

Two authors independently extracted the data and assessed the quality of the trials. The principal outcome measures were mortality from all causes and disability assessed at follow-up using the Glasgow Outcome Scale. For each trial, the relative risk (RR) of death and 95% confidence intervals (CIs) were calculated. Subgroup analyses were conducted of trials using comparable volumes and trials using comparable resuscitation endpoints.

**MAIN RESULTS**

Seventeen trials with a total of 869 participants (6 trauma, 4 burns, 7 pre-
Hypertonic saline (HTS) solution is thought to restore hemodynamics by causing an osmotic fluid shift from the intracellular to the extracellular compartment. Animal studies using a controlled hemorrhage model have demonstrated an increase in blood pressure and circulating volume with HTS solution resuscitation.1 However, studies using an uncontrolled hemorrhage model have shown higher mortality rates with HTS solution compared with isotonic saline solution.1 It is hypothesized that by rapidly increasing the blood pressure, HTS solution resuscitation results in increased hemorrhage volume. The uncontrolled hemorrhage model is thought to best represent the trauma victim with continued bleeding, such as those in the out-of-hospital setting.

The main hypothesis of this systematic review was clearly stated: HTS solution decreases mortality in patients with hypovolemia with and without head injuries. The authors performed a comprehensive search for published RCTs. However, no attempt was made to identify unpublished studies. The selection criteria were well defined, and subgroups were specified a priori. The reviewers were unable to adequately assess the effects of HTS resuscitation in head-injured patients because only one small study focused on this patient population.

One of the most interesting aspects of this systematic review for emergency medicine is the subgroup analysis based on those studies providing fluids in the out-of-hospital phase. The 2 studies in this subgroup were given the highest methodologic quality rating.

Although not reaching statistical significance, examination of the 95% CI reveals a trend toward benefit. The CI could be expected to narrow with larger clinical trials. Until such trials are completed, there is insufficient evidence to support the use of HTS solution in the trauma or burn victim. A future meta-analysis will attempt to address the controversy in regard to fluids versus no fluids in hypovolemic shock.2

T AKE H O ME M E S S A G E

There are insufficient data to conclude hypertonic crystalloid is better than isotonic crystalloid for the resuscitation of patients with trauma or burns or in those undergoing surgery.

C O N C L U S I O N S

The authors conclude that there are insufficient data to conclude that hypertonic crystalloid is better than isotonic crystalloid for the resuscitation of patients with trauma or burns or in those undergoing surgery. However, the CIs are very wide, which means that clinically important differences may exist. Further large trials that compare hypertonic to isotonic crystalloid to detect a clinically important difference are needed.

C o m m e n t a r y: C L I N I C A L IMPLICATION

Hypertonic saline (HTS) solution is thought to restore hemodynamics by increasing blood pressure and circulating volume. However, further large trials are needed to confirm these findings.