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Fluid therapy for acute bacterial meningitis.
Cochrane Database of Systematic Reviews 2014, Issue 5. Art. No.: CD004786.
DOI: 10.1002/14651858.CD004786.pub4.

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[Intervention Review]

Fluid therapy for acute bacterial meningitis

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Editorial group: Cochrane Acute Respiratory Infections Group.
Publication status and date: New search for studies and content updated (no change to conclusions), published in Issue 5, 2014.

Citation: Maconochie IK, Bhaumik S. Fluid therapy for acute bacterial meningitis. *Cochrane Database of Systematic Reviews* 2014, Issue 5. Art. No.: CD004786. DOI: 10.1002/14651858.CD004786.pub4.

ABSTRACT

Background

Acute bacterial meningitis remains a disease with high mortality and morbidity rates. However, with prompt and adequate antimicrobial and supportive treatment, the chances for survival have improved, especially among infants and children. Careful management of fluid and electrolyte balance is an important supportive therapy. Both over- and under-hydration are associated with adverse outcomes.

Objectives

To evaluate treatment of acute bacterial meningitis with differing volumes of initial fluid administration (up to 72 hours after first presentation) and the effects on death and neurological sequelae.

Search methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL) (2013, Issue 10), MEDLINE (1966 to October week 5, 2013), EMBASE (1980 to November 2013), CINAHL (1981 to November 2013), LILACS (1982 to November 2013) and Web of Science (2010 to 2013).

Selection criteria

Randomised controlled trials (RCTs) of differing volumes of fluid given in the initial management of bacterial meningitis were eligible for inclusion.

Data collection and analysis

For this update we identified two abstracts, but after obtaining full texts we excluded them. Previous searches had identified six trials; on careful inspection three trials (415 children) met the inclusion criteria. All four of the original review authors extracted data and assessed trials for quality (one author, ROW, has died since the original review; see Acknowledgements). We combined data for meta-analysis using risk ratios (RRs) for dichotomous data or mean difference (MD) for continuous data. We used a fixed-effect statistical model. We assessed overall evidence quality using the GRADE approach.

Main results

There were no trials in adult populations. All included trials were on paediatric patient groups. The largest of the three trials was conducted in settings with high mortality rates. The meta-analysis found no significant difference between the maintenance-fluid and restricted-fluid groups in number of deaths (RR 0.82, 95% confidence interval (CI) 0.53 to 1.27; 407 participants) (moderate trial quality); acute severe neurological sequelae (RR 0.67, 95% CI 0.41 to 1.08; 407 participants) (very low trial quality); or in mild to moderate sequelae (RR 1.24, 95% CI 0.58 to 2.65; 357 participants) (moderate trial quality). However, when neurological sequelae were defined further, there was a statistically significant difference in favour of the maintenance-fluid group for spasticity (RR 0.50, 95% CI 0.27 to 0.93; 357 participants);

seizures at both 72 hours (RR 0.59, 95% CI 0.42 to 0.83; 357 participants) and 14 days (RR 0.19, 95% CI 0.04 to 0.88; 357 participants); and chronic severe neurological sequelae at three months follow-up (RR 0.42, 95% CI 0.20 to 0.89; 351 participants).

Authors' conclusions

The quality of evidence regarding fluid therapy in children with acute bacterial meningitis is not high-grade and there is a need for further research. Some evidence supports maintaining intravenous fluids rather than restricting them in the first 48 hours in settings with high mortality rates and where children present late. However, where children present early and mortality rates are lower, there is insufficient evidence to guide practice.

PLAIN LANGUAGE SUMMARY

Fluids for people with acute bacterial meningitis

Review question

We reviewed the evidence about the effect of differing volumes of initial fluid administration (up to 72 hours) on death and various neurological sequelae in people with acute bacterial meningitis.

Background

Bacterial meningitis is an infection of the fluid in the spinal cord and surrounding the brain. Antibiotics are prescribed as treatment. Supportive care includes other drugs and the regulation of fluid intake. Despite treatment, there is a risk of death or long-term complications from the infection, especially in the youngest and oldest patients.

There has been disagreement as to whether fluids should be restricted (hormones secreted by very ill patients reduce normal fluid output by the body). There are potential risks from giving too much fluid (especially brain swelling) as well as too little fluid (especially shock).

Study characteristics

The evidence is current to November 2013. We did not find any trials in adult populations. We included three trials involving 415 children (over 350 of whom were in a single trial). All trials were set in countries where death rates are high and where patients seek help late.

In one study no funding source was mentioned. The remaining two studies were funded jointly by pharmaceutical concerns with government agencies and a charitable agency.

Key results

Analysis of available trials found no significant differences in death rates or overall effects on neurological function, either immediately or later. However, for acute neurological sequelae, one study found a significantly lower rate of seizures and spasticity (abnormal body tone) in children receiving normal amounts of fluid compared to those receiving restricted fluids. There was also some evidence favouring maintenance fluid therapy over restricted fluids for chronic severe neurological events at three months follow-up.

An adverse effect in children with restricted fluid intake was that they were less likely to have low levels of sodium in their blood and therefore they would experience greater reductions in body fluids.

An adverse effect of unrestricted fluid administration was reported in one study as short-term swelling of the face and low blood sodium levels one to two days after fluids were started, although the largest study found no difference in blood sodium levels.

No studies reported important healthcare outcomes like duration of hospital stay, raised intracranial pressure and status epilepticus. The review found limited evidence from these trials in support of not restricting fluids in settings with high mortality rates. As there were no trials in other settings, there is no evidence to guide clinicians when children with meningitis present early in settings with low mortality rates. There is no evidence to guide clinicians about fluid therapy in adult patients with acute bacterial meningitis.

Quality of the evidence

The quality of evidence was moderate for the outcomes of death, chronic severe neurological sequelae and mild to moderate neurological sequelae. The quality of evidence was very low for acute severe neurological sequelae.