[Intervention Review]

Colloids versus crystalloids for fluid resuscitation in critically ill people

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ABSTRACT

Background

Critically ill people may lose fluid because of serious conditions, infections (e.g. sepsis), trauma, or burns, and need additional fluids urgently to prevent dehydration or kidney failure. Colloid or crystalloid solutions may be used for this purpose. Crystalloids have small molecules, are cheap, easy to use, and provide immediate fluid resuscitation, but may increase oedema. Colloids have larger molecules, cost more, and may provide swifter volume expansion in the intravascular space, but may induce allergic reactions, blood clotting disorders, and kidney failure. This is an update of a Cochrane Review last published in 2013.

Objectives

To assess the effect of using colloids versus crystalloids in critically ill people requiring fluid volume replacement on mortality, need for blood transfusion or renal replacement therapy (RRT), and adverse events (specifically: allergic reactions, itching, rashes).

Search methods

We searched CENTRAL, MEDLINE, Embase and two other databases on 23 February 2018. We also searched clinical trials registers.

Selection criteria

We included randomised controlled trials (RCTs) and quasi-RCTs of critically ill people who required fluid volume replacement in hospital or emergency out-of-hospital settings. Participants had trauma, burns, or medical conditions such as sepsis. We excluded neonates, elective surgery and caesarean section. We compared a colloid (suspended in any crystalloid solution) versus a crystalloid (isotonic or hypertonic).

Data collection and analysis

Independently, two review authors assessed studies for inclusion, extracted data, assessed risk of bias, and synthesised findings. We assessed the certainty of evidence with GRADE.

Main results

We included 69 studies (65 RCTs, 4 quasi-RCTs) with 30,020 participants. Twenty-eight studied starch solutions, 20 dextrans, seven gelatins, and 22 albumin or fresh frozen plasma (FFP); each type of colloid was compared to crystalloids.

Participants had a range of conditions typical of critical illness. Ten studies were in out-of-hospital settings. We noted risk of selection bias in some studies, and, as most studies were not prospectively registered, risk of selective outcome reporting. Fourteen studies included participants in the crystalloid group who received or may have received colloids, which might have influenced results.

We compared four types of colloid (i.e. starches; dextrans; gelatins; and albumin or FFP) versus crystalloids.

Starches versus crystalloids

We found moderate-certainty evidence that there is probably little or no difference between using starches or crystalloids in mortality at: end of follow-up (risk ratio (RR) 0.97, 95% confidence interval (CI) 0.86 to 1.09; 11,177 participants; 24 studies); within 90 days (RR 1.01, 95% CI 0.90 to 1.14; 10,415 participants; 15 studies); or within 30 days (RR 0.99, 95% CI 0.90 to 1.09; 10,135 participants; 11 studies).

We found moderate-certainty evidence that starches probably slightly increase the need for blood transfusion (RR 1.19, 95% CI 1.02 to 1.39; 1917 participants; 8 studies), and RRT (RR 1.30, 95% CI 1.14 to 1.48; 8527 participants; 9 studies). Very low-certainty evidence means we are uncertain whether either fluid affected adverse events: we found little or no difference in allergic reactions (RR 2.59, 95% CI 0.27 to 24.91; 7757 participants; 3 studies), fewer incidences of itching with crystalloids (RR 1.38, 95% CI 1.05 to 1.82; 6946 participants; 2 studies), and fewer incidences of rashes with crystalloids (RR 1.61, 95% CI 0.90 to 2.89; 7007 participants; 2 studies).

Dextrans versus crystalloids

We found moderate-certainty evidence that there is probably little or no difference between using dextrans or crystalloids in mortality at: end of follow-up (RR 0.99, 95% CI 0.88 to 1.11; 4736 participants; 19 studies); or within 90 days or 30 days (RR 0.99, 95% CI 0.87 to 1.12; 3353 participants; 10 studies). We are uncertain whether dextrans or crystalloids reduce the need for blood transfusion, as we found little or no difference in blood transfusions (RR 0.92, 95% CI 0.77 to 1.10; 1272 participants, 3 studies; very low-certainty evidence). We found little or no difference in allergic reactions (RR 6.00, 95% CI 0.25 to 144.93; 739 participants; 4 studies; very low-certainty evidence). No studies measured RRT.

Gelatins versus crystalloids

We found low-certainty evidence that there may be little or no difference between gelatins or crystalloids in mortality: at end of follow-up (RR 0.89, 95% CI 0.74 to 1.08; 1698 participants; 6 studies); within 90 days (RR 0.89, 95% CI 0.73 to 1.09; 1388 participants; 1 study); or within 30 days (RR 0.92, 95% CI 0.74 to 1.16; 1388 participants; 1 study). Evidence for blood transfusion was very low certainty (3 studies), with a low event rate or data not reported by intervention. Data for RRT were not reported separately for gelatins (1 study). We found little or no difference between groups in allergic reactions (very low-certainty evidence).

Albumin or FFP versus crystalloids

We found moderate-certainty evidence that there is probably little or no difference between using albumin or FFP or using crystalloids in mortality at: end of follow-up (RR 0.98, 95% CI 0.92 to 1.06; 13,047 participants; 20 studies); within 90 days (RR 0.98, 95% CI 0.92 to 1.04; 12,492 participants; 10 studies); or within 30 days (RR 0.99, 95% CI 0.93 to 1.06; 12,506 participants; 10 studies). We are uncertain whether either fluid type reduces need for blood transfusion (RR 1.31, 95% CI 0.95 to 1.80; 290 participants; 3 studies; very low-certainty evidence). Using albumin or FFP versus crystalloids may make little or no difference to the need for RRT (RR 1.11, 95% CI 0.96 to 1.27; 3028 participants; 2 studies; very low-certainty evidence), or in allergic reactions (RR 0.75, 95% CI 0.17 to 3.33; 2097 participants, 1 study; very low-certainty evidence).

Authors' conclusions

Using starches, dextrans, albumin or FFP (moderate-certainty evidence), or gelatins (low-certainty evidence), versus crystalloids probably makes little or no difference to mortality. Starches probably slightly increase the need for blood transfusion and RRT (moderate-certainty evidence), and albumin or FFP may make little or no difference to the need for renal replacement therapy (low-certainty evidence). Evidence for blood transfusions for dextrans, and albumin or FFP, is uncertain. Similarly, evidence for adverse events is uncertain. Certainty of evidence may improve with inclusion of three ongoing studies and seven studies awaiting classification, in future updates.

PLAIN LANGUAGE SUMMARY

Colloids or crystalloids for fluid replacement in critically people

Background

Critically ill people may lose large amounts of blood (because of trauma or burns), or have serious conditions or infections (e.g. sepsis); they require additional fluids urgently to prevent dehydration or kidney failure. Colloids and crystalloids are types of fluids that are used for fluid replacement, often intravenously (via a tube straight into the blood).

Crystalloids are low-cost salt solutions (e.g. saline) with small molecules, which can move around easily when injected into the body.

Colloids can be man-made (e.g. starches, dextrans, or gelatins), or naturally occurring (e.g. albumin or fresh frozen plasma (FFP)), and have bigger molecules, so stay in the blood for longer before passing to other parts of the body. Colloids are more expensive than crystalloids. We are uncertain whether they are better than crystalloids at reducing death, need for blood transfusion or need for renal replacement therapy (filtering the blood, with or without dialysis machines, if kidneys fail) when given to critically ill people who need fluid replacement.

Study characteristics

The evidence is current to February 2018. We searched the medical literature and identified 69 relevant studies with 30,020 critically ill participants who were given fluid replacement in hospital or in an emergency out-of-hospital setting. Studies compared colloids (starches; dextrans; gelatins; or albumin or FFP) with crystalloids.

Key results

We found moderate-certainty evidence that using colloids (starches; dextrans; or albumin or FFP) compared to crystalloids for fluid replacement probably makes little or no difference to the number of critically ill people who die within 30 or 90 days, or by the end of study follow-up. We also found low-certainty evidence that using gelatins or crystalloids may make little or no difference to the number of deaths within each of these time points.

We found moderate-certainty evidence that using starches probably slightly increases the need for blood transfusion. However, we are uncertain whether using other types of colloids, compared to crystalloids, makes a difference to whether people need a blood transfusion because the certainty of the evidence is very low.

We found moderate-certainty evidence that using starches for fluid replacement probably slightly increases the need for renal replacement therapy. Using albumin or FFP compared to crystalloids may make little or no difference to the need for renal replacement therapy. One study comparing gelatins did not report results for renal replacement therapy according to the type of fluid given, and no studies comparing dextrans assessed renal replacement therapy.

Few studies reported adverse events (specifically, allergic reactions, itching, or rashes), so we are uncertain whether either fluid type causes fewer adverse events (very low-certainty evidence). We found little or no difference between starches or crystalloids in allergic reactions, but fewer participants given crystalloids reported itching or rashes. We found little or no difference in allergic reactions for the use of dextrans (four studies), gelatins (one study), and albumin or FFP (one study).

Certainty of the evidence

Some study authors did not report study methods clearly and many did not register their studies before they started, so we could not be certain whether the study outcomes were decided before or after they saw the results. Also, we found that some people who were given crystalloids may also have had colloids, which might have affected the results. For some outcomes, we had very few studies, which reduced our confidence in the evidence.

Conclusions

Using colloids (starches; dextrans; or albumin or FFP) compared to crystalloids for fluid replacement probably makes little or no difference to the number of critically ill people who die. It may make little or no difference to the number of people who die if gelatins or crystalloids are used for fluid replacement.

Starches probably increase the need for blood transfusion and renal replacement therapy slightly. Using albumin or FFP may make little or no difference to the need for renal replacement therapy. We are uncertain whether using dextrans, albumin or FFP, or crystalloids affects the need for blood transfusion. Similarly, we are uncertain if colloids or crystalloids increase the number of adverse events. Results from ongoing studies may increase our confidence in the evidence in future.