

Clinical effectiveness and cost-effectiveness of prehospital intravenous fluids in trauma patients

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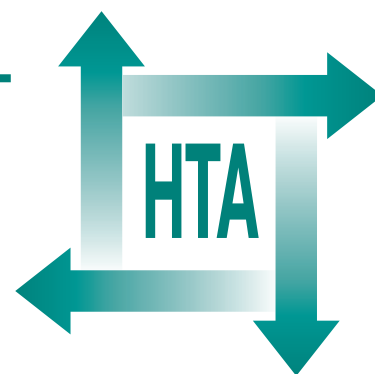
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Executive summary

Health Technology Assessment 2004; Vol. 8: No. 23

Health Technology Assessment
NHS R&D HTA Programme





Executive summary

Background

Trauma is an important cause of death and disability in the UK, with road traffic accidents causing a substantial number of injuries. There are no comprehensive audit data on the use of prehospital intravenous (IV) fluids available. Figures from previous research and some audit data suggest that between 5 and 18% of trauma patients receive fluids (generally crystalloids), representing 9–65 patients/year/100,000 population.

The term ‘shock’ is used to describe circulatory failure leading to inadequate perfusion and oxygenation of the tissues. This can cause permanent damage to essential organs and may result in multiple organ failure and death. One cause of shock is bleeding (hypovolaemic shock). Traditionally, the management of bleeding trauma patients has included early rapid fluid replacement by paramedics at the scene, on the basis that increasing the circulating volume and blood pressure will help to maintain vital organ perfusion (supported by early animal studies). In the 1980s, however, it was increasingly suggested (partly on the basis of observational studies) that delaying definitive treatment may be harmful and there was a new emphasis on the prevention of on-scene delays. Newer animal models of uncontrolled haemorrhage indicated that fluid replacement itself may be harmful and it was argued that, by restoring blood pressure with fluids, the risk of blood loss was increased through the dilution of clotting factors and the mechanical disruption of clots. Although a policy of transferring trauma patients to hospital as quickly as possible with minimal on-scene delay is now widely supported in the UK, there is still a lack of consensus about whether fluid resuscitation per se is beneficial or harmful.

Current service provision

Ambulance crews consist of one driver and one attendant. They can be emergency medical technicians (trained in basic life support) or paramedics (who have additional skills in advanced life support skills). Only paramedics can administer IV fluids. Current policy is for ambulance crews to include one paramedic.

Current ambulance service policies for IV fluid resuscitation are set out in the 2002 Joint Royal Colleges Ambulance Liaison Committee (JRCALC) guidelines. These are consistent with the Consensus Statement Guidelines of the Royal College of Surgeons of Edinburgh (except that for hypovolaemia they recommend an initial rapid infusion of 500 ml of crystalloid to achieve a peripheral or carotid pulse rather than 250 ml). Both recommend avoidance of on-scene delay and represent a shift to a more cautious (hypotensive) fluid resuscitation policy than previously advocated. The extent to which current guidelines are being followed is unclear, but there are suggestions that there may still be avoidable on-scene delay.

Objectives

The focus of this report was to determine whether prehospital IV fluid replacement, compared with no IV fluid replacement or delayed fluid replacement, should be undertaken in trauma patients who have haemorrhage-induced hypotension due to trauma. The evidence surrounding the effects of a potential delay in definitive treatment and the choice of fluid was also considered. Trauma patients with head injuries were not included.

Methods and results

Number of studies

Evidence was available in the form of four randomised controlled trials (RCTs) investigating aspects of fluid resuscitation protocols (delay, volume, speed) and a previous Cochrane systematic review reporting on the timing and volume of fluid resuscitation. Observational studies listed in the Consensus Statement were also critically appraised.

Two systematic reviews were found on advanced versus basic life support and ten systematic reviews comparing different types of fluids. Systematic reviews specifically addressing the following questions were searched for, but not found: effect of fluid replacement for different types of injuries (e.g. blunt versus penetrating), effect of fluid replacement in paediatric trauma patients, ability of paramedics to diagnose hypovolaemia

accurately at the scene, effects of naturally occurring physiological shock mechanisms and interaction with fluid resuscitation.

Quality of studies and direction of evidence

The observational studies were particularly inconclusive as regards use of fluids because of extensive uncontrolled confounding due to their design and analysis. Three of the four RCTs were poorly designed and/or conducted. One good-quality RCT suggested that IV fluids may be harmful in patients with penetrating injuries. No pathophysiological reasons or empirical evidence were found that would suggest that the intervention is likely to be more or less harmful in blunt than in penetrating trauma.

There was some, potentially confounded, evidence from observational studies to suggest that a delay in definitive treatment may be harmful. No reliable evidence was found from systematic reviews to suggest that a particular type of fluid is more beneficial over another type of fluid in trauma patients, although there was a trend favouring crystalloids over colloids.

Costs

The relative cost of using IV fluids versus not using them is very similar: the giving sets and fluids currently used are extremely cheap; not using fluids for certain categories of patients would not obviate the need for ambulances to carry fluids or for personnel to be trained with the skills required to administer them; on-scene times represent a small proportion of total time, so that changes in these would have no cost consequences for the service.

A more detailed cost-effectiveness analysis was not undertaken because there is insufficient reliable information available about the relative consequences of different strategies, particularly with respect to blunt trauma (the predominant type trauma in UK) and long-term morbidity and mortality. Given the similarity in costs between different policies, what is needed to populate a decision analytic model is better empirical evidence about the relative consequences in terms of morbidity, mortality and hospital utilisation of different strategies.

Conclusions

This review found no evidence to suggest that prehospital IV fluid resuscitation is beneficial. There is some evidence that it may be harmful and that patients do comparatively well when fluids are withheld. However, this evidence is not conclusive (particularly for blunt trauma) and is not sufficient to contradict the Consensus Statement and JRCALC guidelines, which recommend hypotensive resuscitation.

The Consensus Statement, and to a lesser extent the JRCALC guidelines, represent a more cautious approach to fluid management than previously advocated, and are therefore in line with the findings of the limited evidence base, which has been systematically reviewed.

Recommendations for research

Further research is needed to establish whether hypotensive (i.e. cautious) resuscitation is more effective than delayed or no fluid replacement, and whether IV fluid resuscitation in blunt trauma should be more aggressive than in penetrating injury, as implied by current guidelines.

New fluids should not be adopted for use without being shown to be superior to alternative treatments in high-quality clinical trials, which, in the light of the current lack of evidence for the benefits of fluids, should include an arm with a very cautious fluid resuscitation protocol.

Routinely collected data for ambulance call-outs should be analysed and reported, and the quality of data collection and analysis improved.

Publication

Dretzke J, Sandercock J, Bayliss S, Burls A. Clinical effectiveness and cost-effectiveness of prehospital intravenous fluids in trauma patients. *Health Technol Assess* 2004;**8**(23).

NHS R&D HTA Programme

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The research reported in this monograph was commissioned and funded by the HTA Programme on behalf of NICE as project number 02/21/01. The authors have been wholly responsible for all data collection, analysis and interpretation and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the referees for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

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ISSN 1366-5278

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Published by Gray Publishing, Tunbridge Wells, Kent, on behalf of NCCHTA.

Printed on acid-free paper in the UK by St Edmundsbury Press Ltd, Bury St Edmunds, Suffolk.