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AB or ABC: pre-hospital fluid management in major trauma

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SUMMARY

Pre-hospital trauma care in the United Kingdom is a neglected field with little consideration being given to this phase. Of the 14 500 annual fatalities from road traffic accidents in this country,[1] 60% die before reaching hospital and it has been estimated that one-third of these fatalities are due to hypovolaemia.[2] The pre-hospital fluid resuscitation of trauma patients is a controversial area and although it would seem sensible to commence intravenous (IV) fluids at the roadside, several large studies have failed to show any benefit from this intervention. By delaying departure to hospital, initiation of IV fluid replacement may actually worsen outcome. This paper reviews recent studies and discusses current thought on pre-hospital fluid replacement in major trauma.

Key words: hypovolaemia, pre-hospital care, trauma

INTRODUCTION

Trauma is now the most common cause of death in the Western world and exceeds the combined deaths from cancer and cardiovascular disease in those aged under 40. It has been justly described as 'the last great plague of the young' and 'the neglected epidemic'.[3] In 1985 the cost of trauma to society in the United Kingdom was estimated at £2.8 billion.[4]

In an attempt to improve care for the 545 000 annual trauma admissions,[1] regionalization of trauma services has been proposed along similar lines to the trauma centres that have evolved in the USA.[5] Although trauma centres in this country may have an important role to play in reducing morbidity and mortality from trauma, little attention has been given to the pre-hospital treatment of trauma patients.

Greater potential to save lives exists by improving pre-hospital rather than hospital care because of both the larger numbers of patients involved and the poorer standards of pre-hospital care. This has been confirmed by a recent survey of trauma deaths in the South West Thames Region, in which 58% of the 434 trauma deaths occurred prior to arrival at hospital.[2] Some initial deaths were a result of non-survivable injuries but about 80% occurred in patients who survived long enough for medical assistance to be given, only to die before reaching hospital. Even if the in-hospital death rate could be reduced by 36%, as suggested by a retrospective study of 1000 UK trauma deaths,[6] the overall death rate would be reduced by only 15%. This study recognized that attention must also be given to improving pre-hospital care, which may have more potential to reduce trauma mortality above any benefits from improved in-hospital care.

The Airway, Breathing and Circulation or ABC approach forms the basis of both basic and advanced life support procedures. Opinion is currently divided between those who advocate field stabilization prior to hospital transfer and those who believe 'scoop and run' offers the best chance of patient survival. It is generally agreed that the airway (A), together with cervical spine control and problems with breathing (B) are best managed on-scene. Correct treatment of circulatory abnormalities (C) may involve the use of pressure dressings, splintage of fractures or relief of cardiac tamponade. The most common therapeutic action however is fluid replacement, especially in blunt trauma, but most patients who exsanguinate or become dangerously hypovolaemic do so from internal bleeding which is not controllable without surgical intervention. The benefit of on-scene fluid replacement is thus less clear.

Fluid replacement

As pre-hospital trauma care evolved, it seemed reasonable to commence IV fluid replacement

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at the scene of injury in order to establish some degree of cardiovascular stability prior to hospital transfer. However, commencing an IV infusion in the field takes time and any subsequent delay in departure for hospital may be detrimental to the patient. Aware of this dilemma, several studies failed to show any advantage of pre-hospital fluid administration in multiple trauma.[7,8] Some studies actually suggested that any advantage of early fluid replacement was outweighed by the resultant on-scene delay from initiating an infusion.[9,10] Many trauma centres in the USA subsequently changed their policies to one of scoop and run for multiple trauma.[10] A clear answer has yet to evolve with strong advocates of both field stabilization and scoop and run continuing to fuel the debate.

IV fluid replacement has two controversial issues. Firstly, the on-scene delay resulting from initiating an IV infusion and secondly the advantage of the apparently small volumes of fluid infused during transit.

IV cannula insertion

Estimates of time to initiate intravenous infusions by paramedics in the USA vary widely from 1.5 to 12 min.[7] Some reports show the delay in transport to trauma centres may result in an increased mortality.[9,11] Claims that there is no difference with on-scene times in patients with or without IV infusion started in the field[7] are surprising and may reflect a poorly designed study. Unfortunately, there are no studies from the UK paramedic system that examine the time to initiate IV infusions, perhaps because of the relatively recent evolution of the paramedic in this country. Much depends upon the skills of the paramedics involved but it is likely that the short 6-week training course for UK paramedics results in at least a few additional minutes on-scene to commence an IV infusion. A study from the University of California analysed the time taken for establishment of an intravenous cannula versus the time taken for transport to hospital. They concluded that seriously injured hypovolaemic patients should not have resuscitative efforts at the scene but should be subjected to immediate evacuation.[12] Intravenous cannulation *en route* in a moving ambulance has been shown to be as successful as when attempted at the scene and under these circumstances there is no delay in arriving at hospital.[13]

Hypovolaemic patients are a group in whom IV insertion is likely to be more difficult than usual because of vasoconstriction or hypotension. It is likely that a higher failure rate for cannula insertion occurs in these patients and further on-scene delay results. Where time to initiate IV infusion exceeds the transit time to hospital, it is clearly deleterious to delay departure in order to gain IV access. The Boston Emergency Medical Service has shown that MAST suit inflation and rapid transport to the hospital is the best plan in situations where insertion of IV lines is difficult because of shock.[14] The pneumatic antishock garment is rarely used in the UK and in view of recent studies showing that it may actually increase mortality when used inappropriately[15,16] together with the unfamiliarity of medical staff with the equipment, it probably has little role in the pre-hospital management of most trauma patients in this country.

Fluid volume

Even when there is apparently no delay on-scene from initiation of IV therapy, the pre-hospital administration of fluids may be of little benefit. In a study of 131 trauma patients in Washington, the volume of pre-hospital fluid infused had no correlation with patient survival and there was no significant difference in the transport time of the two groups.[8] The same was found in a large study of 6855 trauma patients from San Diego.[7] On-scene times were identical in both groups but the volume of fluid administered was not significantly different in the group who survived compared with those who did not.

Several reasons have been suggested as to why pre-hospital administration of IV fluids has such little effect on mortality but the answer remains unclear. A computer model of patients with major haemorrhage predicated that pre-hospital fluids would only be of benefit if three criteria were met. These were a bleeding rate between 25 and 100 $ml\,min^{-1}$, a fluid infusion rate at least equal to the bleeding rate and a pre-hospital time greater than 30 min.[17] In patients for whom IV infusions are commenced, actual bleeding rates are thought to be in the higher end of the range of this computer model but infusion rates inadequate. A review of the volumes infused during transit showed that the mean infusion rates varied between only 17 and 47 $ml\,min^{-1}$.[10] Lewis showed that, on average, a patient will receive just 700 ml of fluid prior to arrival in hospital.[17] Therefore, the limited volume infused may not justify the time spent initiating fluid resuscitation. The third criteria of a pre-hospital time greater than 30 min is unusual in this country except

in the case of road traffic accident entrapments. Thus, computer modelling of fluid replacement in bleeding patients suggests a limited role for IV therapy in pre-hospital trauma care because inadequate volumes are infused during transit and pre-hospital time is usually less than 30 min.

DISCUSSION

The benefit of IV fluid replacement seems limited by on-scene delays while setting up the infusion and the subsequent small volumes of fluid that are infused during short transit times.

Although recent papers have shown that IV fluid replacement can be performed more rapidly than reported in earlier investigations,[18,19] this has been dependent on greater numbers of trained paramedics at the scene. The common scenario in the UK is a trained paramedic working alone with a colleague trained in basic life support only. Thus, there may be similar problems in this country to those encountered in the USA with insufficient advanced life support trained staff. A single paramedic may slow advanced life support and prolong on-scene time, resulting in a worse outcome than basic life support and rapid evacuation, as has already been demonstrated in some USA systems.[20].

The optimum pre-hospital management of penetrating thoracic and cardiac trauma seems to be immediate transportation without attempting field stabilization. Delays of just 15 min in transport of patients with penetrating cardiac injuries are associated with increased morbidity and mortality and rapid transport with basic life support may be more appropriate.[21] Studies from South Carolina also showed that reduction in field times through adoption of a scoop and run policy for unstable and penetrating trauma patients reduced the number of patients who deteriorated *en route* to hospital and doubled survival rates.[10] In another study of 13 potentially salvageable patients with penetrating heart wounds, seven subjected to IV fluid resuscitation at the scene incurred a 100% mortality. The six patients who were promptly evacuated to hospital without attempts at field resuscitation had a survival rate of 80%.[21] The approach to blunt trauma is less clear but a scoop and run policy with this group of patients has certainly not been shown to be detrimental when compared with field stabilization. The greater the field time and the longer the transportation distances the more appropriate field measures become and initiation of IV infusions in rural areas has been shown to be of benefit.[22] In the UK, however, where most areas are within 30 min of a hospital, prolonged on-scene resuscitation is less appropriate.

It would appear that intravenous therapy has little to offer the extricated hypovlaemic patient[11] although pressure dressings and splintage will help reduce blood loss and shock. Whilst the benefit of pre-hospital fluids remains unproven, rapid transportation to hopital should remain paramount.[20] Pre-hospital management in the UK must place greater emphasis on the need for rapid evacuation to hospital of all trauma patients and further studies are urgently required to assess the benefits of pre-hospital intervention.

CONCLUSION

In the UK more than 8000 people die each year from trauma before reaching hospital, the majority of whom are under 40 years of age. One-third of these die from hypovolaemia but there is little evidence that pre-hospital initiation of IV fluid replacement is anything but detrimental for most of these patients. Even with longer transit times in the USA, evidence points to a scoop and run approach and the urban environment of most areas in Britain must make this approach even more applicable than the USA where most studies were conducted. Rapid evacuation from the scene of injury to surgical care would currently appear to offer the hypovolaemic trauma patient the best chance of survival. This needs to be stressed to those working in the field of immediate care and studies are needed to further evaluate pre-hospital management of the trauma patient.

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