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Cool and transfer — The way forward

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Abstract *Objective:* Evaluation of servo-controlled cooling by a Neonatal Transport Service and comparison to patients where active cooling was initiated by a pilot Local Neonatal Unit (LNU).
Design: Service evaluation of 3 groups of babies referred to a single Neonatal Transport Service between 2009 and 2013. Age of initiation of active cooling, achievement of the target temperature and temperature stability in a group of patients where active cooling was commenced by the transport team was compared to cases where passive cooling only was possible. In addition, we evaluated the effectiveness and safety of active cooling initiation in a single LNU.
Results: Active cooling initiation by the transport service at the local hospital led to earlier commencement of cooling compared to passive cooling transfers. However, one fifth of this cohort failed to start active cooling by 6 h of age. In a series of 7 cases where active cooling was commenced by the referring LNU prior to transfer, the target temperature was achieved around 2 h earlier and all infants were cooled within 6 h of age. No adverse incidents occurred within this group.
Conclusion: Active servo-controlled cooling during transfer is an effective and safe treatment that should now be considered the "Gold Standard" for Neonatal

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Transport Services. Even with this ability, a significant number of neonates will not be cooled in a timely manner. Initiation of servo-controlled, active cooling by the local referring unit prior to transfer to a recognised cooling centre, may ensure that infants receive this neuro-protective treatment at an earlier stage.

Introduction

Perinatal asphyxia is known to be a major cause of morbidity and mortality, affecting 1–2 per 1000 near-term infants (Pierrat et al., 2005). In the last two decades it has been established that the cellular injury that follows a hypoxic insult occurs in a biphasic way and it is the secondary neuronal damage following the primary insult that has been the centre of interest for intervention (Lorek et al., 1994). The initiation of therapeutic hypothermia before the secondary damage has taken place has been shown to improve survival and the rate of disability in survivors (Edwards et al., 2010).

In addition to defining the pattern of neuronal injury, research has also been instrumental in defining a therapeutic window for the commencement of therapeutic hypothermia following the hypoxic insult; this is currently believed to be up to 6 h after the initial insult, although evidence from magnetic resonance studies suggests that it might be less than that as the time-period between primary and secondary energy failure has been shown to be inversely proportional to the initial asphyxia insult (Kendall et al., 2010). Animal studies suggest that the earlier cooling is commenced, the better the outcome (Gunn and Gunn, 1998; Kendall et al., 2010). Further, in the TOBY trial there was a trend towards improved outcomes in those treated earlier (Azzopardi et al., 2009).

Infants with Hypoxic Ischaemic Encephalopathy (HIE) often have complex medical needs due to multiorgan involvement. For this reason they have traditionally been transferred to specialist Newborn Intensive Care Units (NICUs) to initiate cooling whilst managing other complications. In 2010 a NICE report endorsed the use of therapeutic hypothermia, stating that "this procedure should only be carried out in units experienced in the care of severely ill neonates, by staff who have been specifically trained in the use of therapeutic hypothermia" (NICE, 2010). Many neonatal networks have taken this to suggest that active cooling should not be performed in any unit other than a Level 3 NICU. However, this may not be in the infant's best interests as there could be a delay in reaching the target rectal temperature if the infant requires transfer to a level 3 unit before treatment is commenced. Further, as with any time-critical intervention, it places logistical pressure on neonatal transport teams to stabilise and prepare infants safely for a quick transfer to a tertiary centre (Robertson et al., 2010).

Initiation of passive cooling measures at the referring hospital does offer a degree of cooling for some infants. However, there is a risk of over-cooling (which might increase the risk of bradycardia, hypotension, abnormal clotting and even death (Eicher et al., 2005; Hallberg et al., 2009)) or of not achieving an adequate degree of cooling (Hallberg et al., 2009). A more logical and potentially safer model could be the initiation of active cooling at the referring centre, after consultation with a cooling centre, followed by the continuation and completion of the treatment during transfer and at the cooling centre. This could also alleviate some of the pressure on transport teams.

In recent years automated servo-controlled active cooling machines have become available within the UK. These systems have alleviated some of the technical challenges for medical and nursing staff in achieving a rapid and controlled reduction in core temperature to the target range. This prompted our neonatal network to consider the potential value of initiation of active cooling within a local neonatal unit (LNU) setting, followed by continuation of active cooling during transfer to the NICU cooling centre.

Within the Greater Manchester Neonatal Network there are three NICUs offering cooling treatment and five LNUs with a total birth rate of around 40,000. One of these LNUs (Royal Albert Edward Infirmary (RAEI)) was considered as a pilot site to initiate active cooling measures for babies with HIE. RAEI has a delivery rate of about 3000 per year, has facilities to provide short term intensive care combined with senior clinicians who have an interest and previous experience in interpreting cerebral function monitoring (CFM) traces and providing cooling within a NICU setting.