

Don't stop now? How long should resuscitation continue at birth in the absence of a detectable heartbeat?

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In this issue, Shah and colleagues from Western Australia present the latest in a series of papers suggesting that outcomes for infants who have received prolonged resuscitation in the delivery room are more favourable than before.[1] They report 13 near-term infants who had an Apgar score of zero at 10 minutes and were admitted to intensive care. Five of the thirteen infants survived and four of the five appeared to have normal development at one to two years of age (one of the infants had hearing impairment). One of the five survivors developed severe spastic quadriplegia.[1]

Similar findings were reported recently in the journal by Kasdorf et al.[2] They reported nine infants managed in a New York hospital, and combined their results with data from three of the therapeutic hypothermia trials and one other previously published report.[3] In total, Kasdorf et al analysed a cohort of 90 infants with an Apgar score of zero at 10 minutes who were admitted to intensive care. Fifty percent of the infants survived to discharge from hospital, and 49% of the survivors were developmentally normal at follow-up at 1-2 years.[2] Longer-term developmental outcome data are available for a subgroup of these infants who were enrolled in the US NICHD cooling trial.[4] Twenty-four infants in that trial had an Apgar score of zero at 10 minutes. Eleven (46%) survived to age 6-7 years, and 5/11 (46%) had mild or no disability at follow-up.[4]

Considered together, these results are in striking contrast to earlier studies and should cause us to question current recommendations in consensus resuscitation guidelines. A systematic review in 2007 identified 94 infants from 8 reports.[5] Seventy-eight infants (83%) died, while 10/13 (76%) of survivors with available long-term follow-up were severely impaired. The authors concluded that the outcome for infants with an Apgar score of zero at 10 minutes was “almost universally poor”. On the basis of this earlier report and other information, the 2010 ILCOR guidelines stated: “It is appropriate to consider discontinuing resuscitation if there has been no detectable heart rate for 10 minutes.”[6] It is important to recognise that this statement is not a recommendation that resuscitation *should* always be discontinued and was qualified by factors that might be taken into consideration if resuscitation were

to be continued. However, the inference is that discontinuing resuscitation at 10 minutes would be the usual approach.

Are current guidelines appropriate?

The recent data have some important limitations. The reports only include infants who were admitted to intensive care. Infants in whom prolonged resuscitation did not achieve a sustained return of the circulation are excluded. The cooling trials also excluded infants who were moribund or who died within the first hours after birth. The overall survival rate for infants who respond to resuscitation after having an Apgar score of zero at 10 minutes is likely to be somewhat lower than the rate reported here. The newer data were gathered in the context of a practice guided by the historically reported outcomes. If resuscitation and intensive care were continued in more infants with Apgar score of zero at 10 minutes, resulting in more survivors, it is possible that the rate of severe disability amongst survivors might be greater. Death in infants with hypoxic-ischaemic encephalopathy usually follows a decision to limit life-sustaining treatment on the basis of poor neurological prognosis.[7] Longer-term outcomes would be likely to vary in practice settings where decision-making is different.

What are the ethical justifications for stopping resuscitation?

Is a normal outcome impossible?

One reason for limiting resuscitation at birth to 10 minutes may be a belief that further resuscitation is futile because it is inevitable that the infant will either die or be profoundly impaired [8]. However, the recent papers indicate clearly that in the current era the outcome is not universally poor. Focusing just on the 66 infants in published series who have received therapeutic hypothermia, discontinuing resuscitation at 10 minutes would have led to the death of 18 infants who do not have severe disability, many of whom are developmentally normal.

Is a 'poor' outcome highly likely?

An alternative justification for discontinuing resuscitation at 10 minutes is because the chance of a poor outcome, although not 100%, is felt to be too high. Here we need to be clear about the reason *why* it is considered too high. This should not be influenced by a high mortality risk because in the absence of further resuscitation mortality will be universal. The reason here would therefore be a fear of generating additional survivors with severe disability.[9] From the point of view of parents, the outcomes of death or severe disability may have quite different significance. Some parents may fear the possibility of their child surviving in a state of severe impairment whilst, others may be much more afraid of their child dying even if there is a likelihood of survival with disability. There may be an unwelcome trade-off with increasing duration of resuscitation between avoiding death in a child who could survive with a favourable outcome and avoiding survival in a child who will have profound neuro-disability. Even if the risk of disability can be estimated, identifying a level of disability that is so severe that it is contrary to the child's best interests to provide treatment is extremely challenging.[10]

What should resuscitation guidelines recommend?

1. Providing treatment in the best interests of the child

As with all medical treatment for newborn infants, clinicians should be guided by the best interests of the child.[11] It is ethical to withhold life-sustaining treatment where a child's life would be limited in quantity or quality, and treatment would therefore do more harm than good.[11] The evidence summarized above shows that it is far from clear that continued resuscitation beyond 10 minutes would be harmful. It is, therefore highly questionable whether medical professionals should make a unilateral decision to cease resuscitation at 10 minutes in the absence of additional information.

2. Erring on the side of providing treatment

Faced with uncertainty, it is usually preferable to err on the side of providing life-saving treatment.[11] The recently revised Royal College of Paediatrics and Child Health guidelines around limitation of treatment note that "Neonates should almost always be resuscitated in the labour ward, unless there is a clear

decision to do otherwise made with the consent of parents”.[11] Given the uncertainty about outcome and a likely inability to determine the parents’ wishes in a meaningfully informed manner, the default approach at 10 minutes should be to continue resuscitation, take the infant to intensive care if they have a return of circulation, and at that stage to involve parents in decision-making about ongoing treatment.

The statistics summarized above, with an estimated chance of survival of 50% and a risk of severe disability in survivors of around 50%, are similar to the outcome figures for infants born alive at 23 to 24 weeks gestation.[12] In that setting, there is widespread acceptance that parents views are crucial to decisions.[13] It would not be regarded as acceptable for clinicians to make decisions to limit treatment without knowing the parents’ views. Of course, the distinctive feature of decisions about the duration of resuscitation at birth for term infants is that it is extremely difficult to involve parents fully in decision-making. The acuity of the situation, its unpredictability, the intense time-pressure and the involvement of the clinical team in the ongoing resuscitation efforts combine to make it extremely challenging to counsel parents and gauge their views.

A risk of longer resuscitation and of taking infants to intensive care is that this potentially leaves some families facing a more difficult decision that they would have preferred not to have faced about whether or not to withdraw treatment. Some families may be unwilling to acquiesce to a decision to stop life support. This is a particular challenge for religious or cultural groups that traditionally do not accept withdrawal of treatment.[14] However, there is no *ethical* difference between withholding and withdrawing life-sustaining treatment.[15] Clinicians must be guided primarily by the best interests of the infant. As the paper by Shah indicates, in intensive care units with access to prognostic tests such as MRI and EEG, and for communities and cultures that accept withdrawal of treatment, such a policy is associated with a low rate of survival with severe impairment.[1]

If not 10 minutes, when?

On the basis of current evidence the outcome for infants with an Apgar score of zero at 10 minutes is not universally poor. In circumstances where neonatal intensive care (including therapeutic hypothermia) is available, resuscitation at birth should usually continue beyond 10 minutes. Infants should be supported with intensive care if their circulation is restored. Guidelines on resuscitation should be modified. The question then becomes *how long* resuscitation should continue beyond 10 minutes in the absence of a heart-beat. This is a much harder question because there is (to our knowledge) little published data on longer durations of resuscitation at birth and outcome. Kasdorf et al have called for a registry of all infants with an Apgar score of zero at 10 minutes, including infants for whom resuscitation is not successful.[2] However, long-term outcome from any such registry is not likely to be available soon.

Although the series is small, the paper by Shah et al provides some pointers. Their 5 surviving infants all had their first heart-beat documented by 20 minutes. Of these 5, 4 subsequently had a good outcome. No infant in their report who had their first heart beat after 20 minutes of resuscitation survived.[1] It may be possible to obtain information about the timing of the first detectable heart-beat and the final outcome for infants from the other reports. In individual cases other factors may already be known at the time of birth that should influence decision-making.

Conclusions

An Apgar score of zero at 10 minutes after birth is not a good enough predictor of outcome to be used as the main basis for decision making about ongoing resuscitation. There is no clear answer to the question of how long resuscitation should continue after birth. We propose that in most circumstances, resuscitation at birth should continue until 20 minutes in the absence of a clinically detectable heart-beat. In the face of uncertainty about whether resuscitation should be discontinued, clinicians should opt to provide longer resuscitation, with later consideration of withdrawal of life-sustaining treatment if the clinical course indicates that the prognosis is poor (box). If practice changes in this way it will be very important for clinicians to audit and report

their outcomes in order that the best possible information becomes available to inform future decision-making.

Summary box

1. In most circumstances, resuscitation at birth should continue until 20 minutes in the absence of a clinically detectable heart-beat.
2. In the face of uncertainty about whether resuscitation should be discontinued, clinicians should err on the side of providing longer resuscitation, with later consideration of withdrawal of treatment if the clinical course indicates that the prognosis is poor.

Competing Interests:

BS has been a member of the ILCOR neonatal group and is editor of the Fetal and Neonatal edition of Archives of Disease in Childhood. DW has contributed to recent RCPCH guidelines on decisions around life-sustaining treatment and is Associate Editor of the Journal of Medical Ethics. The views expressed in this article are solely those of the authors and do not represent the views of any other organisation.

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DW and BS conceived and planned this article. DW wrote the first draft and edited the manuscript. BS reviewed and edited the manuscript.

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