

Management of neonatal hypotension – a national questionnaire survey

This article is about a national survey looking at the policies for management of neonatal hypotension across the neonatal units in the UK. The survey shows a wide variation across the country in the management practice for neonatal hypotension and highlights the need for national guidelines.

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Normal blood pressure (BP) is defined as the pressure which ensures adequate organ perfusion¹. Early postnatal adaptation to transitional circulation, in low birthweight and preterm infants is often associated with low BP and decreased blood flow to various organs². This can be associated with multiorgan injury and adverse long-term outcome¹. The immature brain is highly vulnerable to hypoperfusion, which is a risk factor for periventricular haemorrhage³. It is therefore crucial to manage neonatal hypotension appropriately.

Although hypotension is one of the most common diagnoses made in extremely preterm infants, the normal physiologic BP range ensuring appropriate organ perfusion in the neonate is unknown^{4,5}. BP for infants depends on the gestational age (GA) and postnatal age¹. Cut-off values are based more on statistically defined gestational and postnatal age-dependent normative BP values rather than on data bearing physiological reference⁵. Various reference charts are available defining normal BP values for different GAs⁵.

Different therapeutic strategies including volume expansion, corticosteroids and inotropic agents are used to treat systemic hypotension in preterm neonates. Inotropes help by enhancing myocardial contractility, thereby increasing cardiac output and/or systemic BP. Peripheral systemic vasculature changes also have an influence on the haemodynamic response to inotropic therapy⁶.

Aim

The aim of the survey was to look at the current practice for the management of neonatal hypotension, across the neonatal units in the UK.

Methodology

An online search was carried out to identify all level two (secondary) and level three (tertiary care) neonatal units in the country, which led to the identification of 95 units. The units where it was not possible to determine the levels of care (Level 1, 2 or 3) were excluded. A postal questionnaire was sent to the neonatal lead clinician of all the identified neonatal units across the country. The structured questionnaire included multiple choice questions with tick boxes and free text answer options. The questionnaire along with a self addressed envelope was sent in February 2009 with a reminder a month later. All replies received until the end of April 2009 were considered for the survey. Letters were sent and tracked by the audit department at Southend Hospital. The investigators were blinded to the details of the respondents. The results were manually analysed using MS Excel spreadsheets. This project was approved by the Southend Hospital Audit Department under the local clinical governance policy. Ethics approval was not obtained as there were no human subjects involved.

The questionnaire enquired whether the unit had written guidelines for the management of hypotension, the reference/standards that were used and whether echocardiography was used as a diagnostic tool in the unit. Questions were asked about the choice of inotropes and the order of preference in using various treatment regimes and the reasons for their choice, as well as if it would be preferable to have integrated national guidelines for the management of neonatal hypotension. Results were analysed separately from the responses by two investigators, working manually.

Keywords

neonatal hypotension; management of hypotension; national survey

Key points

Bhojani S., Banerjee J., Rahman M.M.
Management of neonatal hypotension – a national questionnaire survey. *Infant* 2010; 6(5): 152-54.

1. Neonatal hypotension is a common problem on the neonatal unit.
2. Studies have shown that treating hypotension in neonates does not necessarily improve the outcome.
3. There is a wide variation across the country in the management of neonatal hypotension.
4. A national consensus is required to enable national guidelines to be formulated.

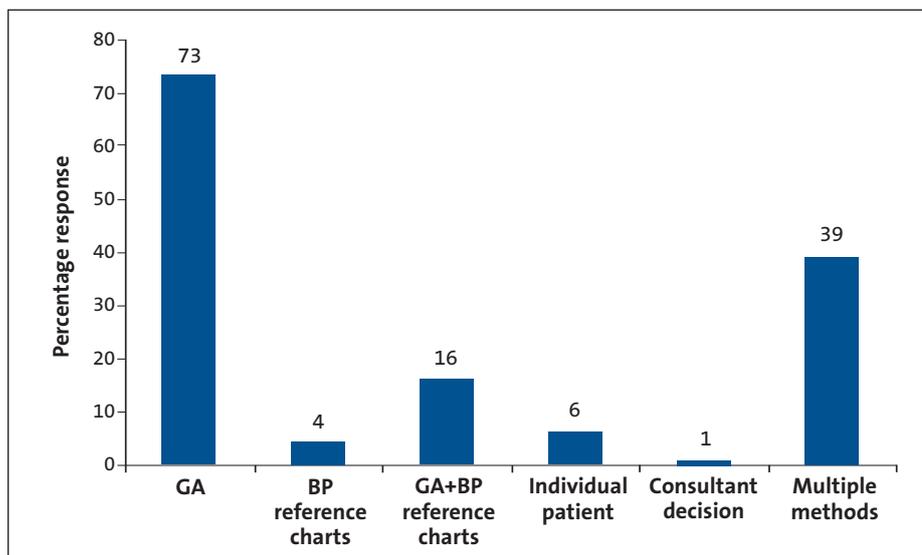


FIGURE 1 Reference standards for management of hypotension. BP = blood pressure, GA = gestational age.

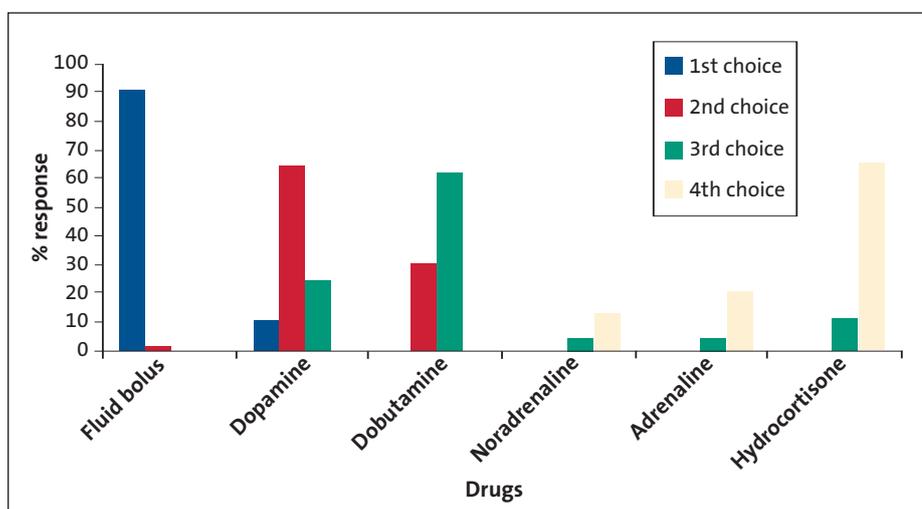


FIGURE 2 Treatment choices.

Results

Eighty-six percent (82/95) of the units responded to the survey. Two of the responses were incomplete and therefore were discarded. Written guidelines for the management of neonatal hypotension were available in 69% (55/80) of units. Seventy-three percent (58/80) of the respondents used GA as a reference guide for the management of hypotension, 4% (3/80) used BP reference charts and 16% (13/80) used both. Management was decided according to individual patients in 6% (5/80) of units and by consultant decision in 1% (1/80). Thirty-nine percent (31/80) used multiple methods to decide the management (**FIGURE 1**).

For BP monitoring, 92% (74/80) of the units used both invasive (umbilical or peripheral arterial line) and non-invasive (cuff BP) methods for measurement of BP and 8% (6/80) used only invasive methods.

Echocardiography was felt to be a useful tool for the management of BP by 75% (60/80). It was used to look at the cardiac contractility and to see if myocardial dysfunction and patent ductus arteriosus (PDA) were the cause of hypotension. Twenty-five percent of respondents (20/80) did not use echocardiography as an aid in management of hypotension, half of whom said it was because the facility was not readily available on the unit.

Regarding the choice of inotropes for the management of hypotension, the respondents were asked to rank the inotropes in the order of preference. The choices included fluid bolus, dopamine, dobutamine, adrenaline, noradrenaline, albumin and hydrocortisone (**FIGURE 2**). Free text was available for additional comments. Ninety percent (72/80) used fluid bolus as their first choice whereas 10% (8/80) used dopamine. Dopamine

was used by 64% (51/80) as second and 24% (19/80) as third choice respectively, whereas 30% (24/80) and 61% (49/80) used dobutamine as their second and third choices respectively. Sixty-five percent (52/80) used hydrocortisone and 20% (16/80) used adrenaline as their fourth choice.

Half of the respondents mentioned that their choice of treatment would differ for a preterm as compared to term baby. They felt that the aetiology for hypotension is different in a preterm baby and therefore their management should differ accordingly. In preterm babies, some were more likely to start dopamine or dobutamine before giving fluid bolus due to the risk of PDA and fluid overload, whereas in term babies, hypovolaemia was thought to be the common cause and therefore fluid bolus was preferred over inotropes. Eighty-one per cent (65/80) of the units preferred to correct parameters like metabolic acidosis, anaemia, hypovolaemia and electrolyte imbalance before starting inotropes.

Respondents were also asked if they would like to have national guidelines for the management of neonatal hypotension. Thirty-one per cent (25/80) felt it would be useful to have national guidelines while 54% (43/80) said they already had local guidelines and therefore did not feel the need for national guidelines. Nineteen per cent (15/80) denied the need of national guidelines despite absence of local guidelines.

Discussion

The survey showed a wide variation across neonatal units throughout the country in the identification and management of neonatal hypotension. Studies have shown that treating hypotension in neonates doesn't necessarily improve the outcome⁷. The range of BP needed to maintain adequate tissue perfusion and prevent cell injury is unknown in preterm infants⁴. The reference range for normal BP has been derived from readings of infants who did not require treatment for hypotension, based on their GA and birth weights⁴. In this study, the majority of the respondents, 89%, used GA for the management of hypotension, whereas some just used reference charts. Studies have shown that systemic BP is not a good reference for cerebral blood flow and perfusion⁸. Therefore it is questionable whether systemic BP in preterm neonates

should be used as a determinant of cerebral perfusion⁹ and whether systemic hypotension should be treated. If systemic hypotension is to be treated then consensus needs to be reached as to when treatment should be initiated and what treatment regimes should be used.

Direct intra-arterial recording is the gold standard method of measuring BP, mainly used in critically ill neonates and neonates with arterial access¹⁰. Among the non-invasive methods, oscillometry is the most accepted technique¹¹ (FIGURE 3). Eight per cent of the respondents used only invasive methods of BP measurement, whereas 92% used both invasive and non-invasive methods.

Myocardial dysfunction can be a cause of hypotension¹². Studies have shown left ventricular cardiac output is not a very good determinant of organ perfusion, whereas, superior vena cava (SVC) flow and Doppler studies give better information about cerebral perfusion¹³. A correlation between SVC flow and cerebral perfusion has been demonstrated using near infrared spectroscopy (NIRS). In adults right ventricular cardiac output has been shown to be correlated with organ perfusion and has been used routinely in managing hypotension in intensive care units¹⁴. In the present study 74% felt that echocardiography was a useful tool for diagnosing hypotension as it helped in assessing the cardiac contractility and diagnosing PDA. Unfortunately, not all units had an echocardiogram facility available at all times and therefore had to rely on clinical grounds. Having echocardiography facilities and trained staff on the neonatal unit may help to manage hypotension more efficiently.

Studies have shown that absolute hypovolaemia is less likely to be the primary cause of hypotension in preterm infants⁵ and inotropes like dopamine are more likely to normalise BP than volume expansion^{15,16}. However, nearly 50% of respondents treated preterm and term neonates identically and 90% used fluid bolus as their first choice for the management of hypotension in all neonates.

When comparing dopamine and dobutamine, the Cochrane review showed that dopamine was more effective than dobutamine in the short term treatment of hypotension in preterm infants, although there is no evidence regarding its safety



FIGURE 3
A neonate with non-invasive BP monitoring.

and long term effectiveness⁶. In the present study dopamine was used by 10% as their first choice and by 64% as their second choice (with IV fluid bolus as the first choice) for the management of low BP, whereas 30% used dobutamine as their second choice. Other studies have also shown that low to moderate dose adrenaline is as effective as dopamine in low birthweight infants although there can be transitory adverse effects with adrenaline². In this study adrenaline was mainly used fourth or fifth choice of treatment. Hydrocortisone was used as third choice by 1% and as fourth choice by 65% of the respondents. Some of the units were more likely to use hydrocortisone earlier in preterm than in term infants. Studies have shown that hydrocortisone is useful in refractory hypotension in very low birthweight babies, although it is not recommended for routine use due to its potential adverse effects¹⁷.

Conclusion and recommendations

This survey revealed a wide variation across the country, in the management of neonatal hypotension. Currently there is not sufficient evidence in the literature to suggest that treating systemic hypotension improves cerebral perfusion. Further systematic reviews are needed to establish the correlation between neonatal hypotension and cerebral blood flow and the management of hypotension. Randomised controlled trials are required aimed at identifying, interpreting and managing hypotension in preterm babies, looking at their short- and longer-term clinical outcome and benefits. There is a need for a national consensus for the management of hypotension and guidelines for uniformity of practice. Questions need to be asked about how to diagnose hypotension in neonates, how to

identify neonates who require treatment and what treatment they need.

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