Place of birth- why we need to improve: a review article

Catherine M Harrison

Department of Neonatal Medicine

Leeds Children's Hospital

Great George Street

Leeds

LS3 1EX

West Yorkshire

Elizabeth A Bonney

Department of Obstetrics and Gynaecology

St James's University Hospital

Beckett Street

Leeds

LS9 7TF

West Yorkshire

Corresponding author:

Dr C Harrison

Tel: 0113 3928301

Catherine.harrison10@nhs.net

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Introduction

In England and Wales, 7.9% of babies are born preterm.[1] Survival of preterm infants has improved with advances in both maternal and neonatal care, but prematurity remains the leading cause for deaths under 5 years of age, with survivors at risk of major long-term morbidity.[2,3,4]
Evidence supporting the "right place of birth" was first described nearly 40 years ago by Kitchen, with higher survival rates in babies born in hospitals with both tertiary obstetric and neonatal facilities.[5] EPICure 2 data showed the same but additionally looked at level of activity in tertiary centres, showing improved survival in high activity units.[6]

More recently much work has been done to increase the number of babies born in tertiary centres, recognising that postnatal transfers have been associated with increased morbidity and mortality.[7,8] This paper describes the challenges we face, both from a neonatal, and obstetric perspective to resolve this problem.

In utero transfers

It is recognised that in utero transfer (IUT) of the high risk fetus improves the outcome for the baby if delivered in a tertiary centre. Data from the UK Neonatal Transport Group, however, showed that in 2019 nearly 400 babies born at less than 27 weeks, required an uplift in care transfer to a tertiary centre within the first three days of life, suggesting wrong place of birth.[9] Other countries are better at achieving the right place of birth for preterm babies; 95% babies born at less than 28 weeks deliver in tertiary centres in Finland.[10] The National Neonatal Audit project reported that in 2018, only 74.3% babies were born "in the right place", with only three networks managing 85% or above - the target recommended by Better Births.[11,12] The range across the UK was 58-91%.[11] Sadly data from 2019 (unpublished currently) only shows a slight improvement.

In the UK it seems that predicting which women will deliver after an IUT remains difficult, with recent data showing that approximately a half of women transferred, will deliver within 48 hours of their transfer.[13,14] The lack of a perinatal database linking maternal NHS numbers with babies, means that outcome data is difficult to ascertain.

Other challenging aspects of in utero transfers are the length of time taken to find appropriate beds due to the capacity challenges many units face, and the significant distances that women are moved to access care away from their families and support structure.[13,14] Munthali et al showed the average distance travelled was 42.3 miles (68 km) to an appropriate centre. [14]

There is wide variation across the UK maternity centres regarding acceptance of in utero transfers, with some able to take all referrals, irrespective of capacity, and others only accepting if there is both availability of a maternal bed and a neonatal cot. With the knowledge that less than half the women transferred deliver within 48 hours of transfer, is bed availability on the NICU really that important? What is certain for in utero transfers, is that we need to think differently about capacity, prediction of birth and the challenging perceptions that tertiary NICU cots will be "blocked" if centres accept these women with suspected preterm labour.

Postnatal transfers

Concerns have been raised about postnatal transfers and the effect on the newborn brain from historical data. The Epicure study showed more severe cranial ultrasound scan abnormalities in preterm babies who were transferred within 24 hours of birth, leading to higher morbidity. In Australia, Boland et al found significant mortality in babies who were transferred.

Within the UK, there are 15 dedicated and specialised neonatal transport teams with regionalisation of care pathways. It is uncertain whether the concerns about brain injury and transport persist with specialised teams.

To answer this question, a recent article by Helenius on behalf of Neonatal Data Analysis Unit concluded that infants born in a non tertiary setting and who were transferred within 48 hours had a higher risk of death and severe brain injury.[16] They carried out a retrospective cohort study of all infants born before 28 weeks between 2008 and 2015 using data from National Neonatal Research Database. Babies were split into four groups based on hospital of birth and transfer status within 48 hours of birth. The control group were babies born in a tertiary centre and not transferred within the time scale. Babies under 28 weeks who were born in a level 1 or level 2 unit and transferred to a tertiary centre were described as the "upward transfer" group; babies born in a hospital with a local neonatal unit (level 2) and not transferred were described as the "non- tertiary care" group, and then a group of babies born in tertiary units but transferred to a different tertiary centre with 48 hours for example, capacity issues, the "horizontal transfer" group.

20.3% of extremely preterm infants were transferred within 48 hours of birth. Disappointingly when comparing numbers from 2008 to 2015, this figure was higher in 2015, highlighting that we have not made progress with the right place of birth for this vulnerable population. Babies born in a level 1 or 2 unit who required an upward transfer, had no significant difference in mortality before discharge (1.22, 95% CI 0.92-1.61) compared to the control group, but had significantly higher chances of severe brain injury (2.32, 1.78 to 3.06) and less chance of surviving with severe brain injury (0.60, 0.47 to 0.76). Compared to the control group, babies born and staying in a non-tertiary centre had a significantly higher chance of dying (1.34, 1.02-1.77) but no significant difference in the incidence of severe brain injury (0.95, 0.70-1.30). When compared to the upward transfer group, the babies who were born in non-tertiary centres and not transported had no significant difference in mortality (95% CI 1.1.0, 084 to 1.44) but significantly lower chances of severe brain injury (0.41, 0.31 to 0.53). Further matched pair analysis comparing against controls was done for

upward transfers and for babies who remained in their local unit (non-tertiary care).The authors found that infants who had an upward transfer had no significant difference in mortality but a higher incidence of severe brain injury. Babies who remained in non tertiary centres had higher odds of death before discharge (1.33, 1.19 to 1.49) but no difference in severe brain injury.

The authors concluded that extremely preterm infants born in a hospital without tertiary neonatal care had a higher risk of adverse outcomes which was seen in both infants who underwent early post natal transfer and those who remained in a non-tertiary neonatal hospital. They recognised limitations in the study as the exclusion of babies who died in the delivery room, and the lack of data about in utero transfers.

The difference in outcome for babies born in non-tertiary centres compared to those transferred (less severe brain injury), may well be due to the approach and management by local teams of these babies during resuscitation and stabilisation. Potentially only the sickest of this group, surviving to outside the delivery room, required a postnatal transfer for uplift of care.The data from this study therefore has to be used appropriately and in the correct context. It cannot detract from the need to move babies from non-tertiary centres to tertiary units for specialised care, using dedicated neonatal transport teams. There is ongoing debate with regard to postnatal transfer to determine if the transfer process itself is detrimental to the baby or whether the condition prior to transfer is the determining factor with regard to brain injury.

Recent data from the Canadian Neonatal Transport Network showed that postnatal transfer was not associated with severe brain injury.[17] 781 babies, less than 33 weeks gestation who were transferred in the first three days of life were included in their study, with an incidence of 14.7% of severe brain injury, classed as grade 3 or 4 intraventricular haemorrhage or parenchymal echogenicity. The infant's condition at birth and immediate postnatal management were found to be risk factors for severe brain injury with receipt of chest compressions and/or epinephrine at delivery (1.81, 1.08 to 3.05) and need for fluid boluses (1.61, 1.00 to 2.58) being significant.

Whilst considering whether it is the transport process or quality of initial resuscitation, and the cohort of babies who survive to be transferred, we need to remember that Epicure 2 reported 72% babies born in level 1 neonatal units died compared to 53% born with tertiary NICU facilities ($p<0.0001$), with only 56% of babies being inborn in tertiary centres.[6]

What remains vital is that despite good facilitation and infrastructure to support in utero transfers, there will always be women who despite all good intentions, deliver in a local neonatal unit. Clinicians need to be competent and confident in effective resuscitation and stabilisation until babies are transferred to a tertiary NICU by a specialised transfer service.

Obstetric issues

A significant dilemma for obstetricians is that more than 50% of women who deliver preterm have no identifiable risk factors.[18] Often the first opportunity to identify a woman at risk is when she presents with threatened preterm labour (TPTL) symptoms. This occurs in 9% of pregnancies but only 3-5% of women will deliver within 7 days.[19-21]

If a woman is thought to be in preterm labour, a cascade of interventions is recommended including antenatal corticosteroid (ACS) administration, tocolysis, magnesium sulphate infusion and in utero transfer, if appropriate neonatal facilities are not available. Current NICE guidelines advise a treat-all policy for women presenting with symptoms of preterm labour before 30 weeks.[22] As the majority of women will not deliver within the 7 days, a large number will receive unnecessary interventions.

The Cochrane 2017 update confirmed the reduced risk of respiratory distress syndrome (RDS) (average RR 0.66 CI 0.56- 0.77) with the use of antenatal corticosteroids.[23] ACS also significantly reduced the occurrence of necrotising enterocolitis and intraventricular hemorrhage in infants born preterm. [23,24] However, the reductions in RDS and intraventricular haemorrhage have only been found to be significant if delivery occurs between 1 and 7 days from administration. [23,25] If treated

outside the 7-day window, even with a single course, infants demonstrate lower birth weight (mean difference -147 g, 95% CI -291 to -2 g), head circumference, and length. Of greater concern, the 2006 Cochrane Review described a worrying trend towards an increased risk of death for babies who received ACS and went on to deliver at full term (relative risk 3.25; 95% CI 0.99– 10.66). [26] Norman et al. confirmed that benefits from ACS are temporary, and do not exceed seven days.[27]

If based on symptoms alone, more than 90% of women transferred for PTL will not deliver imminently, therefore accurate prediction is also key to prevention of unnecessary transfers for preterm labour.[21,28] Transferring everyone (as suggested by NICE) puts additional strain on an already stretched system and increases the emotional and financial burden upon women and their families.[29]

Accurate prediction of preterm labour has the benefits of appropriately admitting women to hospital, whilst safely discharging home those at lowest risk; only administering treatments to those at highest risk; and avoiding unnecessary in utero transfers. The QUiPP app is a decision assist tool which combines risk factors, fetal fibronectin and/or cervical length to give a probability of the risk of a woman having a preterm birth at the time of her presentation with symptoms. [30] The QUiPP app's ability to guide management relative to a "treat-all" strategy (NICE 2015) for women less than 30 weeks' gestation demonstrated improved prediction of women destined to give birth preterm. If a 5% threshold of delivery within 7 days is used to decide when to intervene, 89% of admissions could have been safely avoided compared to none with a treat-all strategy. No true cases would have been missed as no women delivered within 7 days who were given a risk less than 10% which is essential in women less than 30 weeks' gestation.[31]

Clinicians regularly face complex clinical dilemmas where they have to balance the risks and benefits of preterm birth interventions with fetal and maternal side-effects and their costs.The QUiPP app is a new way of improving the diagnosis and gaining an individualised score for the risk of having a spontaneous preterm delivery.

System challenges

Despite many clinicians having awareness of outcome data, there are still barriers that need to be overcome for us to move forward and improve the rates of babies being born in the right place. Capacity issues need to be addressed and systems need to be introduced to allow facilitation of in utero transfers to be led by non clinicians enabling clinical time to be spent with patients. Currently only 7 out of 15 regions in the UK have a regional cot bureau hosted by the regional transport team allowing regional overview of cot availability.

Triaging which women have the highest risk of birth needs to be improved so accepting units do not think that cots will be "blocked". Improved engagement and joint working between obstetricians and neonatologists developing perinatal teams to prioritise in utero transfers is critical if we are going to address this important issue. In utero transfers that do not occur and babies who are born in the "wrong place" need to have a post natal perinatal review via systems such as exception reporting, so outcomes are visible to all involved in the process. There needs to be recognition that the whole team is responsible for change and failures are not seen as system failures.

Summary

Babies being born in the right place is vitally important in terms of neonatal outcome. [4] Globally, there is recognition that improvements need to be made. The 2010 Healthy People Goals Initiative in the USA aims to achieve a target of 90% of preterm and high risk births to deliver in NICUs. The UK's Better Birth project suggested a target of 85% .[12,32] It is recognised that in utero transfers can be difficult and time consuming to facilitate, with the mother often moving significant distances to find appropriate bed/cot pair. In the UK, there is disparity between regions about how in utero transfers are facilitated; some are organised by the local obstetric unit phoning other hospitals to see if there is bed availability, other regions use their neonatal transport service who host a cot bureau. If we are to achieve this national target for appropriate place of birth, there is need for established regional pathways for transfer of pregnant women between centres, and coordination

between obstetrics and neonatology to ensure the appropriate maternal bed/neonatal cot pair is identified.

Obstetricians and neonatologists need to work together to optimise their own local and regional systems to prioritise accepting women at high risk of preterm delivery. Combined guidelines should be written and audited for compliance to improve. Following on from the publication of the national toolkit regarding antenatal optimisation at birth, establishing regional working groups will enable teams to deliver and promote best practice.[33] Effective assessment of women presenting with symptoms of preterm labour is essential to determine which women will require appropriate transfer for a neonatal cot. Perinatal teams can then ensure preparatory strategies such as neuroprotection, lung maturation and thermoregulation are delivered to optimise both short and long term outcomes.

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