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for neonatal and paediatric healthcare professionals

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How quickly should we aim for full milk feeds?

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Every year in the UK around 8,000 infants are born so prematurely that they cannot initially be fed nutritional volumes of milk and require intravenous nutrition. Milk feeding is then gradually increased as the immature gut begins to tolerate milk, and intravenous nutrition is correspondingly reduced. There is, however, little evidence to guide clinicians on how quickly this is best achieved[1].

One of the most serious complications of intravenous feeding is late onset sepsis, which occurs in 27% of babies born weighing less than 1,500g at birth or under 29 weeks' gestation[2]. It is also known to cause poor long-term cognitive outcomes, liver damage and sudden death from cardiac problems resulting from misplaced catheters[3-5]. One of the commonest late onset infections is 'catheter-related bloodstream infection'; the risk of which is directly related to the time the catheter is present in the blood stream[6-8]. While infection-control and catheter-management bundles have successfully reduced rates, they have not yet eliminated such infections[9-11]. In order to further reduce infection rates, there is a need to identify methods to reduce exposure to parenteral nutrition (PN).

It can be anticipated that more rapid advancement of enteral feeds will, in principle, cause infants to reach full milk feeds (tolerating 150mL/kg/day) a few days earlier than slower advancement. In the Speed of Increasing milk Feeds Trial (SIFT), the intention is to reduce exposure to parenteral nutrition and catheters by an estimated four days per infant, equating to 1,000 catheter days in 250 infants. This is possibly an underestimate of the reduction, since infection risk increases with the length of time a catheter is in place[12,13].

Potential benefits must, however, be confirmed in a clinical trial as faster increases in milk feed volumes may be countered by an increase in the likelihood of a serious bowel infection known as necrotising enterocolitis (NEC). This condition, aside from being potentially fatal, may provoke gut intolerance resulting in *longer* times to achieve full feeds rather than shorter.

The Cochrane review of studies examining rates of feed increase was updated in March 2011[1]. It included 496 infants from four trials, which all showed a reduction in time to full feeds of between two and five days in the faster increase groups, clearly demonstrating that this intervention could feasibly affect late onset sepsis. Unfortunately, none of the studies reported the effect on infection or long-term outcomes, nor were they powered to assess any effects on NEC. This proposed study will use survival without serious disability at two years of age as the primary outcome and will also evaluate the effect on key short-term outcomes including sepsis, NEC, growth and resource utilisation.

The 'SIFT' trial will be a multi-centre randomised controlled trial to assess whether the speed of increasing milk feed volumes, fast increase (30mL/kg/day) vs slow increase (18mL/kg/day), in very low birthweight infants (under 1,500g at birth) or significantly preterm infants (born before 32 weeks' gestation) has any

Trial design	Multicentre, randomised controlled trial, 2500 participants, duration 72 months
Trial participants	Infants who are either (i) very preterm (<32 weeks) or (ii) very low birth weight (<1500g)
Inclusion criteria	Infants will be eligible to participate if: ■ Gestational age at birth <32 weeks, or <1,500g birthweight ■ The infant is receiving <24mL/kg/day of milk at randomisation ■ Written informed consent is obtained To ensure the widest applicability to preterm infants across the UK we will include those exclusively breast milk fed, formula milk fed, or receiving mixed feeds.
Exclusion criteria	■ Infants with severe congenital anomalies ■ Infants who, in the opinion of the treating clinician, have no realistic chance of survival ■ Infants who are unlikely to be traceable for follow-up at 24 months of age (eg infants of non-UK residents)
Follow-up duration	Participants will be followed up at two years of age via a parent report questionnaire.
Objectives	To assess and compare the effects of a fast (30mL/kg/day) and a slow (18mL/kg/day) increase in milk feed volumes in very low birthweight (<1,500g at birth) or significantly preterm (born before 32 weeks) infants with respect to: 1. survival without serious disability at 24 months of age corrected for prematurity 2. the incidence of invasive nosocomial infection before hospital discharge 3. the time taken to reach full milk feeds (tolerating 150mL/kg/day) 4. growth (weight and head circumference) 5. duration of parenteral feeding 6. length of time in intensive care 7. length of hospital stay 8. the incidence of necrotising enterocolitis

FIGURE 1 Summary of the SIFT trial.

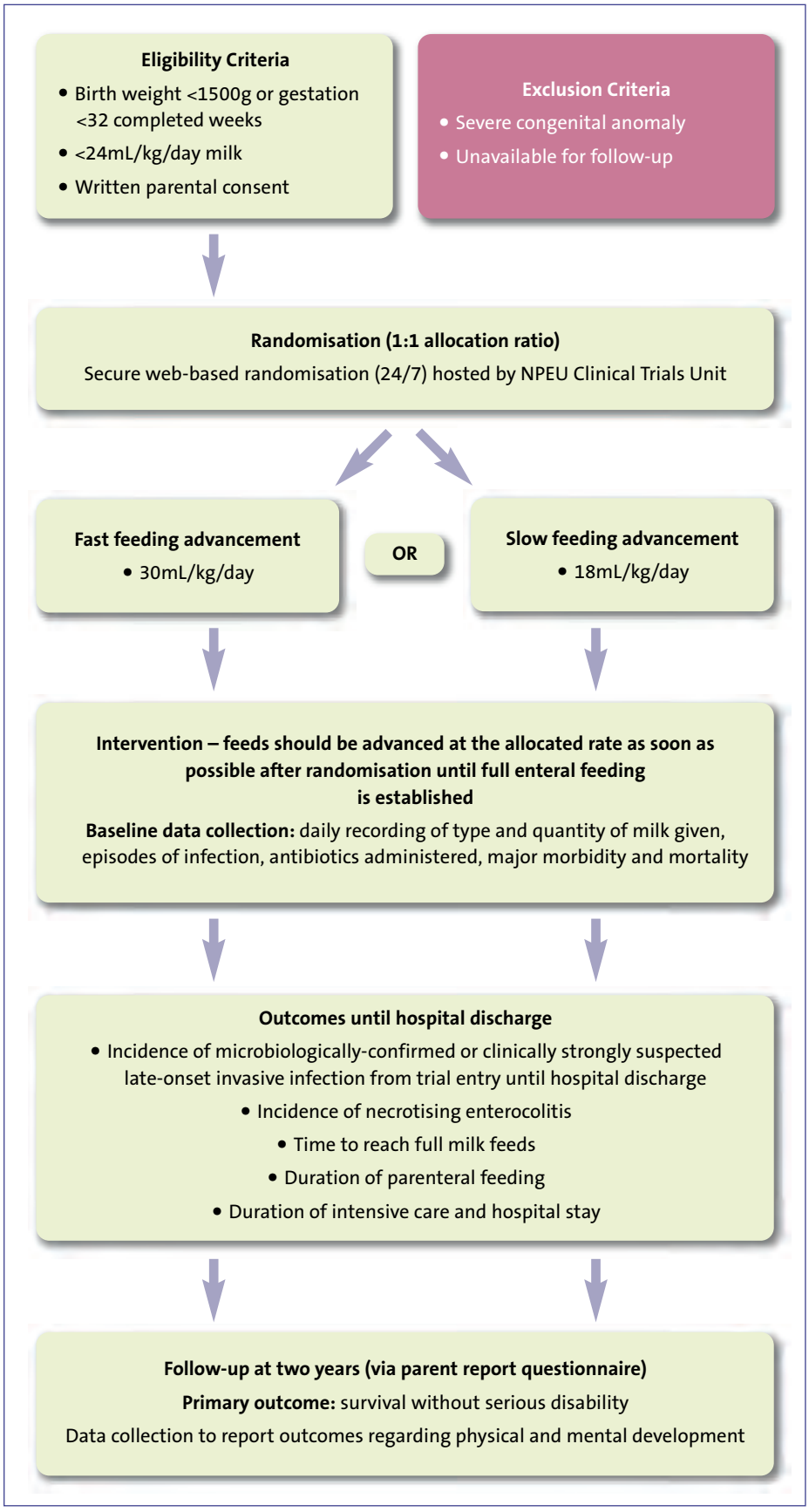

FIGURE 2 Study flow diagram: the 'SIFT' trial for very preterm or VLBW infants.

effect on survival without serious disability at 24 months of age (corrected for prematurity). Further information is provided in the summary and flow diagram (**FIGURES 1 and 2**).

The trial (subject to a contract being agreed between NIHR HTA and University of Oxford) will recruit 2,500 infants from approximately 30 neonatal units within the UK and Ireland over three years commencing in the first few months of 2013.

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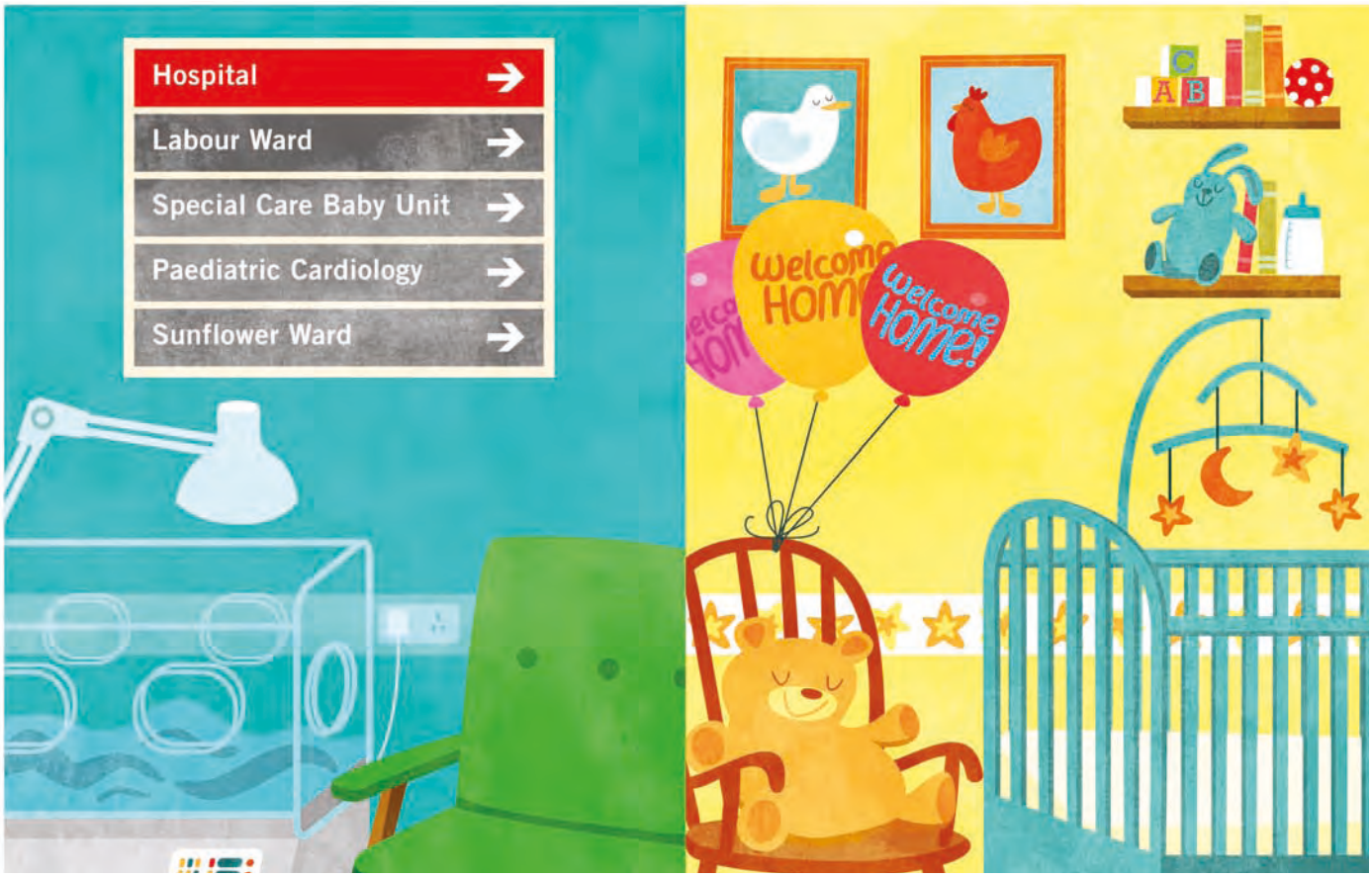

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The need for vigilance, effective communication and collaboration in medication management

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Medication-related activities are an integral part of the daily work of many nurses especially those working in neonatal care. Medication administration is becoming increasingly complex – technological advances are allowing larger numbers of physiologically vulnerable infants to survive on complex drug regimens. It is the responsibility of all nurses to ensure the safe and reliable administration and documentation of medicines, and to monitor and respond promptly to any adverse effects.

It is imperative that nurses are personally vigilant about medication management in the neonatal unit and that systems are in place to prevent, detect and deal appropriately with any errors that do occur. Nurses obviously do not work in isolation, their role in medication management occurs in the context of a partnership between the nurse, doctor and pharmacist as the process involves prescribing, dispensing, administering, receiving and recording. A range of skills is required for the safe administration of medicines including adequate knowledge of the medications, numerical competency, skills required for delivery and up-to-date knowledge on current literature on medicine use in infants. So a nurse must constantly reflect on personal learning needs and be proactive in seeking additional support when required.

While in-service training and updates to medication administration policy and procedures are an important recommendation for neonatal nurses[1], increasingly nurses are expected to be autonomous in their ongoing professional development.

Medication administration is one of the highest risk areas in nursing and medication administration errors are reported to occur in one in five medication dosages[2]. These medication errors include calculating the wrong dose of a medication, administering the wrong medication, administering a medication at the wrong time or via the wrong route and administering the medication to the wrong patient. The consequences of medication error are potentially greater in infants than adults and thus medication administration to infants requires caution and precision. Dosage miscalculation is compounded by[3]:

- complex calculations
- a need to calculate dose on an individual basis (based on age, weight and body surface area)
- limited availability of prescribing information for infants
- a need to use off-label medications
- administration of formulations designed for adults (thus requiring dosage manipulation).

Hospitals are usually very aware of the risk in this area and provide clear written guidelines for nursing staff to help them in their practice and to ensure the safe storage, preparation, administration and record keeping in all aspects of medication practices[1].

It is interruption, rather than lack of knowledge/policy matters, that is the most frequently cited reason for errors[1] and alarmingly, while medication administration is a known high-risk activity, it is among the most interrupted nursing care activity[4]. This factor is increasingly being addressed at clinical sites by the wearing of a high visibility vest/apron during drug administration which advises potential disturbers not to interrupt the nurse.

The medication format may also render it error prone. There can be confusion over trade names, medication packaging or drug names[1], thus nursing staff need to ensure that their specific knowledge of medications used in their units is at a very high level. This can be overcome by raising awareness of medications that look or sound like other medications, prescribing medications by their generic and trade names and placing eye-catching labels/warning stickers. It is also incumbent upon manufactures of medications to clearly label and package their products.

Alongside dosage miscalculation, prescribing errors are major causes of medication error[1,5,6]. Pharmacists play a key role in assuring safe use of medication by monitoring storage of high-alert/confusing medications and educating staff on changes to formulary or new drugs on the market[7]. Pharmacist support, while clearly fundamental in reducing medication risk in neonatal care, varies across establishments[1]. Studies have indicated that the presence of ward-based clinical pharmacists reduce medication errors[8]. A pharmacist is able to detect medication errors at the prescription stage and thus prevent potential harmful medication errors[9], however, nurses need to be aware of drug dosage and actions/interactions and not rely solely on prescriptions.

Other reasons for medication errors in infant nursing include lack of staff, poor knowledge of the drug, equipment failure and poor communication with the doctor/pharmacist[1,6,10]. Indeed medication errors are often caused by communication problems – nurses, conscious of their junior status compared with other staff need to be supported and empowered to speak up if they witness poor practice. In a survey, many junior nurses felt unable to challenge a more senior nurse about a medication error[1]. Thus professional confidence in this area is required. As the infant's advocate, a nurse is duty bound to ensure safe practice and concerns about interpersonal reactions should be less important.

Dialogue, feedback and support are very important factors in the prevention and detection of medication errors in the NICU. It has been suggested that a well-developed system for reporting medication errors allows for vital information to be collected for root cause analysis, which should include a process of feedback to staff who have reported a medication error[11]. It is suggested that risk profile analysis, where specific medications and specific errors are catalogued centrally in an organisation, can identify trends, which can lead to targeting of specific high-risk preparations or activities[6].

Local initiatives need to be in place to monitor, collate, report and feedback on potential and actual medication errors and this feedback loop needs to ensure good communication across the multi-disciplinary team. Additionally, hospital systems need to have high quality communication mechanisms both at practice level, where medications are being administered and at management level when incidents are being investigated.

Recording of incidents of error, or potential incidents is now a more frequent occurrence in the nursing domain[1]. Staff are encouraged to report errors and near-misses and many hospitals have non-punitive policies. However recent evidence suggests that not all medication errors can be dealt with by this light approach, as where severe harm and/or other factors exist a nurse may face disciplinary action and possibly suspension. Ensuring that effective management systems are in place is an essential and key factor in the management of medication errors – reporting and investigation of incidents permits an organisation to understand (and hopefully prevent) the contributing factors.

Although actual harm to infants is rare[5], the reality is that medication errors can and do occur in neonatal care[6]. Local organisations need to examine practical ways in which medication errors can be addressed, which is not always a case of adding additional checking initiatives[1] but rather use of systems that minimise interruptions (such as the visible apron), ensuring effective pharmacy support, labelling high-risk preparations and ensuring the use of legible or printed prescriptions. Interventions to reduce medication errors within the context of risk management programmes are very effective[5] and ought to be proactively used to ensure best practice.

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Should we be using high flow therapy on the neonatal unit?

High flow therapy (HFT) has become an increasingly popular alternative to continuous positive airway pressure (CPAP) within neonatal units. However, there is little uniformity in its usage reflecting the lack of evidence. This article summarises a review of the literature presenting the evidence for this therapy and data collected through a network survey and a tertiary neonatal unit audit.

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Keywords

infant; newborn; positive pressure respiration; high flow therapy

Key points

Holme N., Harrison C. Should we be using high flow therapy on the neonatal unit? *Infant* 2012; 8(6): 172-176.

1. The published evidence for the use of high flow therapy (HFT) is limited and conflicting. Well-powered randomised controlled trials are required to determine whether HFT provides optimal treatment for babies.
2. There is no evidence of increased risk of adverse neonatal outcomes when using HFT.
3. Survey findings highlight a delay in repatriation of babies and a variable use of HFT among neonatal units within a large neonatal network.
4. Audit findings suggest HFT prolongs admission stay due to an increased number of steps in the weaning process.

To avoid ventilator-induced lung injury, neonatologists strive to wean neonates off the ventilator onto non-invasive modes of ventilation such as continuous positive airway pressure (CPAP). However, CPAP is associated with complications such as local nasal trauma, irritation of the nares, increased nasal secretions requiring frequent suctioning, and risk of infection, kinking of the nasopharyngeal prongs in the pharynx and overall perceived patient discomfort[1]. High flow therapy (HFT) has become an increasingly popular alternative to CPAP over the last few years. A blend of oxygen and air is administered to the patient via nasal cannulae at flow rates between 1L/min and 8L/min. The minimum usually administered is 2.5-3L/min. The oxygen/air mixture is typically heated and humidified. As the flow rate increases so does the positive airway pressure. HFT is used for the treatment of apnoea of prematurity, mild forms of respiratory distress syndrome and the prevention of extubation failure.

The reported advantages of HFT include fewer ventilation days, reduced nasal trauma and more frequent contact with the care giver promoting attachment[2-3].

The major disadvantage is that airway pressure is not measured, theoretically increasing the risk of pneumothoraces. Earlier reports of airway colonisation with *Ralstonia pickettii* in a small number of cases were linked to a manufacturing flaw with Vapotherm™ filter cartridges. This has since been remedied. Recommendations from the Centers for Disease Control and Prevention (CDC)[4] led to new guidelines regarding single use filter cartridges and changing filter cartridges after 60 days of cumulative use. No further cases have been reported.

HFT usage is becoming well established within paediatric intensive care and neonatal units. Paediatric respiratory wards are also embracing this modality and its usage features on some paediatric wards outside of the intensive care setting. The need for evidence of HFT's effectiveness and use has never been stronger to enable uniformity of practice within the field of neonatology.

Evaluation of current evidence

A literature search looking for studies reporting on the effectiveness of HFT in neonates was conducted, focusing on length of stay and re-intubation rates. The search strategy involved the following:

Primary sources: A search of EMBASE and MEDLINE healthcare databases via the OVID interface identified 21 articles (search performed May 2012). Five articles were relevant. Limits: Publication year 1948-current, English language and human.

The following MeSH headings were used [infant, premature/or infant, Newborn/] AND the following keywords search [high flow nasal cannula.mp OR Vapotherm.mp)]. The references of the above articles were scanned along with the linked articles, no further articles were found. For this review, papers measuring oropharyngeal and oesophageal pressures or other outcomes were excluded. The five relevant studies are summarised in **TABLE 1**.

Secondary sources: A search of the Cochrane database identified one relevant article[8].

Citation	Study group	Study type	Outcome	Key result
Campbell et al, 2006[5]	40 Intubated preterm infants **Gestation** IF-CPAP:27.6 ±1.9 HHFNC: 27.4±1.6 **Birthweight** IF-CPAP: 925±188g HHFNC: 1008±157g	RCT – unblinded but concealed allocation Pilot study HHFNC vs IF-CPAP	**Primary outcome:** Incidence of re-intubation within 7 days **Secondary outcome:** Change in O_2 requirement pre- and post-extubation, frequency of apnoea and nasal damage	Increased oxygen requirement and apnoeas with HHFNC Relative risk of re-intubation with HHFNC compared with IF-CPAP 2.1 (CI 1.3-3.0, p=0.003)
Woodhead et al, 2006[6]	30 Intubated neonates **Gestation** HHHFNC: 31±3.6 weeks HFNC: 32±3.1 weeks **Birthweight** HHHFNC: 1630±812g HFNC: 1715±880g	RCT masked crossover HFNC vs HHHFNC After 24hr device swapped over	**Primary outcome:** Success of extubation **Secondary outcomes:** Respiratory rate, nasal mucosa damage	Extubation failure rate prior to crossover: Vapotherm™: 0/15 HFNC: 2/15
Shoemaker et al, 2007[3]	101 Premature infants **Gestation** nCPAP: 28±1.4 weeks HHHFNC: 27.6±1.5 weeks **Birthweight** nCPAP: 1050±241g HHHFNC: 1017±235g	Retrospective descriptive study HHHFNC vs nCPAP	Adverse neonatal outcomes including re-intubation rate	No significant differences in major outcomes Re-intubation rate: nCPAP 14/36 (40%); HHHFNC 12/65 (18%) (OR 10.7, 95%, CI 2.6-44, p=0.02)
Holleman-Duray et al, 2007[2]	111 (total 114 – 3 infants never intubated) **Gestation** Historical cohort 27.4±1.6 weeks HFT: 27.6±1.3 weeks **Birthweight** Historical cohort: 1000±310g HFT: 1060±261g	Retrospective descriptive study HHHFNC vs nCPAP Historical control	Adverse neonatal outcomes including re-intubation rate	No significant differences in major outcomes Failed extubation: Control = 7/47 (15%) HFNC = 8/64 (13%) (No statistics provided) HHHFNC group spent fewer days on ventilator: 11.4 ±12.8 vs 18.5±21, p=0.028
Abdel-Hady et al, 2011[7]	60 ≥28 weeks gestation 30-no HFT, 30-HFT **Gestation** nCPAP 31.1±2.6 weeks HFT 31.0±2.4 weeks **Birthweight** nCPAP 1.6±0.39g HFT 1.6±0.38g	Randomised, open label, controlled trial HHHFNC vs nCPAP	**Primary end point:** Duration of oxygen therapy in days **Secondary end points:** Duration of respiratory support etc	6/30 No-HFT and 7/30-HFT failed initial weaning (p=1) Days on oxygen [median (interquartile range)] No-HFT 5 (1-8) HFT 14 (7.5-19.25) p=<0.001 No difference in length of hospitalisation

TABLE 1 Studies of the use of high-flow oxygen via nasal cannula as a mode of non-invasive respiratory support.
Terms: nCPAP – nasal continuous positive airway pressure, IF-CPAP – infant flow CPAP, HFNC – high flow nasal cannula, HHFNC – humidified high flow nasal cannula, HHHFNC – humidified heated high flow nasal cannula.

Safety and complications

The safety and effectiveness of HFT was questioned by the recent Cochrane review[8]. The review found four studies[5,6,9,10] were suitable but due to significant heterogeneity a meta-analysis was not possible. The overall conclusion was that 'there is insufficient evidence to establish the safety and effectiveness of high flow nasal cannula (HFNC)'.

The inability to measure the pressures administered theoretically increases the risk of pneumothoraces. The amount of pressure generated by HFT is determined by flow rate, size of leakage around the nasal cannula and degree of mouth opening. Kubicka et al measured oral cavity pressure using small nasal cannulae and found that only with the smallest infants, highest flow rates and mouth closed could significant but unpredictable levels of CPAP be achieved[11]. In contrast Locke et al demonstrated that even when the flow was only 2L/min, pressures of 9.8cmH_2O could be delivered[12]. None of the studies reviewed here demonstrated any increased risk of pneumothoraces. This finding is supported by Saslow et al who demonstrated no difference in end distending pressure between CPAP and HFT[13].

Nasal CPAP versus HFT

The study conducted by Campbell et al[5] is the only study to be conducted as a randomised control trial (RCT) which compares HFT with CPAP. Despite the small numbers the study demonstrates a statistically significant increase in extubation failure rates in the HFT group. An equation described by Sreenan et al[14] was used to calculate the flow rate in the

HFT group. However, the flow rates were very low (1.4-1.7L/min). The lack of a positive effect was likely to have been the result of the low flow rates adopted. Unheated gas cannot be adequately humidified even if it passes through a humidifier, resulting in high flow rates being intolerable and damaging. If heated gas had been used with greater flow rates within the HFT group extubation may have been more successful.

The above findings have been contradicted by Shoemaker et al[3] and Holleman-Duray et al[2]. These studies were retrospective descriptive studies with greater numbers. Shoemaker concluded that HFT reduces extubation failure rates when compared with CPAP and Holleman-Durary found no difference in extubation failure rates. Both studies used heated humidified gas and higher flow rates compared to Campbell et al[5].

Benefits of heated and humidified HFT

The small randomised crossover trial performed by Woodhead et al[6] simply looked at the comparison between humidified heated high flow oxygen and simple high flow oxygen. The guidelines of the American Association of Respiratory Care were used to assess when extubation was appropriate[15,16]. None of the infants on the humidified heated HFT (HHHFT) modality failed extubation and HHHFT was used to 'rescue' infants failing on simple HFT. This highlights the importance of using heated, humidified gases. It should be noted that higher pressures were used in the HHHFT group which may have explained its success. The highest flow rate with non-humidified/heated gas was a mean of 1.8L/min and for HHHFT the mean was 3.1L/min.

Different models

Miller et al[9] demonstrated no difference between the Fisher and Paykel nasal high flow (NHF™) and Vapotherm™ models in terms of the need for reintubation. This was only a small pilot study looking at 39 infants in total and was underpowered.

Duration of oxygen therapy – CPAP vs HFT

Abdel-Hady et al[7] conducted a randomised, open-label, controlled trial comparing HHHFNC and nCPAP. They looked at the duration of oxygen therapy in days as the primary outcome and the duration of respiratory support, duration of nCPAP days, length of hospitalisation, weaning success, and duration of weaning, need for intubation and mechanical ventilation and occurrence of complications as second end points. The weaning strategies used are summarised in **FIGURE 1**. Low flow rates of ≤2L/min were used. The key finding was that HFT increased the number of days premature infants required oxygen therapy ($p<0.001$) as compared with nCPAP. However, despite this there was no significant difference in duration of hospitalisation. In addition this study identified that 63% of infants weaned to HFT did not require oxygen therapy but demonstrated a need for the distending pressure generated by HFT. Another explanation for this is that the principle mechanism of action for HFT may be flushing through the dead space of the nasopharyngeal cavity decreasing the overall dead space and resulting in alveolar ventilation as a greater fraction of minute ventilation[17]. No other studies were identified for comparison.

Neonatal network survey

Anecdotally it seemed that there was no uniformity of use of HFT within the authors' region, and that it was becoming problematic transferring babies between units due to the variable availability of HFT.

To try to get a true picture of what was happening within the region, an online survey was designed and distributed to all the lead nurses within Yorkshire and North Trent Neonatal Networks in June 2011 to determine the usage and availability of HFT within a Strategic Health Authority (SHA) in Yorkshire and Humber. The region has an annual birth rate of approximately 75,000 births with 20 neonatal units in total and a dedicated transport service (Embrace), which carries out approximately 1,700 neonatal transfers per annum.

If an electronic response was not obtained, a telephone consultation was conducted. Data were collected on HFT availability, application, weaning protocols and complications. All 20 units within the SHA were included in the survey with a 100% response rate. Eight of the 20 units (40%) used HFT including all five tertiary centres. Four of the eight units used a guideline and these were all tertiary centres. The survey highlighted a delay in

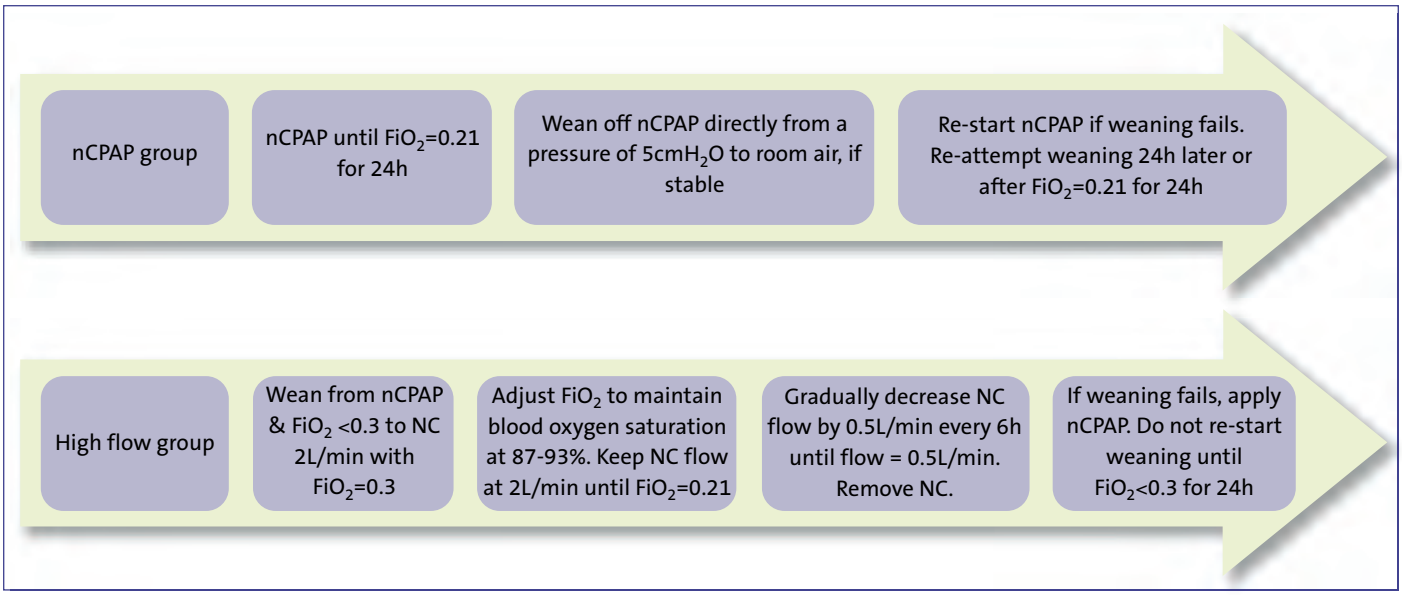

FIGURE 1 Summary of weaning regimens used by Abdel-Hady et al[7].
Key: nCPAP – nasal CPAP, NC – nasal cannulae, FiO_2 – fraction of inspired oxygen.

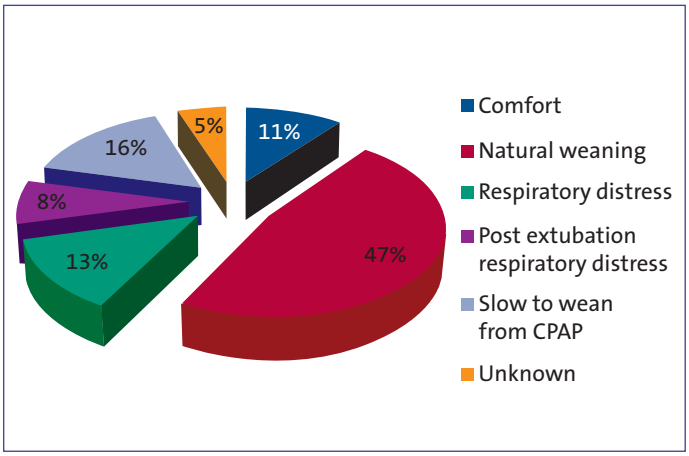

FIGURE 2 Indication for HFT within a tertiary neonatal unit.

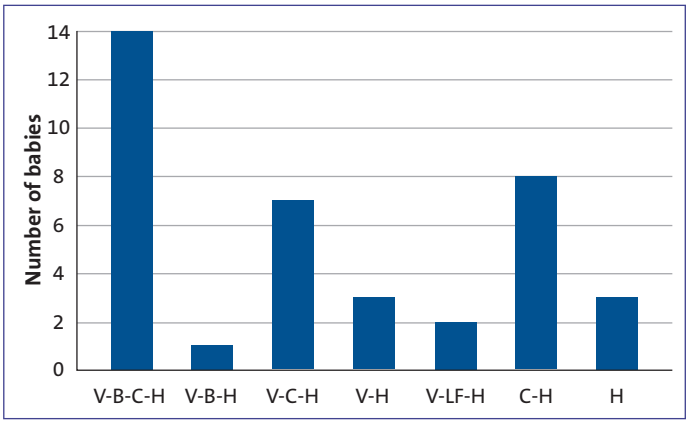

FIGURE 3 Weaning regimens used within a tertiary neonatal unit.
Key: V = ventilated, B = BiPAP, C = CPAP, H = HFT, LF = low flow.

repatriation due to lack of HFT at local units with referring units keeping babies until they had been weaned off the HFT. There seemed to be resistance to putting babies onto CPAP for transfer, as it was described as a "backward step" in their management by referring centres. This has cost implications and impacts significantly on the family waiting for repatriation transfers.

Interestingly a recent telephone survey (Steele J, June 2012) by the regional transport service showed that over the last year, use of HFT has increased with 12 units now using HFT, highlighting that despite minimal evidence this therapy is being used as routine respiratory support for many babies.

Use of HFT in a tertiary neonatal unit

An audit was conducted in January 2012 to assess the practical usage of HFT within a large tertiary unit (Leeds Teaching Hospitals NHS Trust). Thirty-eight babies were analysed retrospectively over a six-month period March-August 2011. The indications for HFT are given in **FIGURE 2** and the variable usage of HFT within the weaning process is shown in **FIGURE 3**. HFT was mainly used as a step-down therapy, after bilevel positive airway pressure (BiPAP) or CPAP following extubation (**FIGURE 2**). Only 8% of infants were weaned directly from the ventilator to HFT (**FIGURE 3**).

The initial flow rate used was 6L/min in the majority of cases, irrespective of weight or gestation. The unit guideline (**FIGURE 4**) describes the usage of 8L/min in babies weighing greater than one kilogram. Only three babies used such a high flow rate. Only 24% of babies on HFT were weaned correctly as per the guideline (**FIGURE 4**). Half of babies required no escalation of their ventilatory support once on HFT.

The mean duration of time on HFT prior to babies needing an escalation in ventilator support was 11 days; 24% required CPAP and 29% of babies required re-intubation. The reason for escalation of support was variable – 27% for simple respiratory decompensation (defined as pH <7.25, pCO_2 >8, rising oxygen requirement, apnoeas or increasing work of breathing), 55% had sepsis or necrotising enterocolitis and 18% were electively re-intubated for surgery.

Twenty-nine per cent of babies receiving HFT needed no additional oxygen therapy. The mean time using HFT in air with no oxygen therapy was 6.5 days. No complications were reported.

A CPAP cohort (2008-2009) for comparison demonstrated chronic lung disease rates of 39% compared with 19% in the HFT group analysed. It is predicted that the duration of stay is prolonged with HFT due to the increased number of steps in the weaning process. The comparison between HFT and CPAP is difficult as the findings are likely to be affected by bias as cases have not been matched between the two groups. Any analysis must be interpreted with caution and well designed trials are required.

The audit results demonstrate that despite a guideline being in place, the use of HFT is not consistent and can at times be detrimental to the baby by prolonging the length of stay on the neonatal unit due to a prolonged weaning phase of respiratory support. Anecdotally prior to the introduction of BiPAP and high flow therapy, babies were extubated on to CPAP and relatively quickly onto low flow oxygen therapy. BiPAP, and now HFT, have introduced further weaning stages post extubation (see **FIGURE 3**). The audit shows the majority of babies are extubated on to BiPAP, then CPAP, then HFT before low flow oxygen is used, if needed. The low failure rates reported within this audit are however encouraging. The use of HFT needs to be incorporated within extubation guidelines to prevent the increased number of steps in the weaning process since the adoption of this modality. Due to lack of evidence there is no consensus on the correct way to use and wean HFT.

Since carrying out this project, HFT continues to be used in the authors' unit. Nursing staff are enthusiastic about its use and how comfortable the babies are on this therapy. Work is being done to tighten criteria for use and possibly eliminate unnecessary weaning steps, by considering its use post-extubation.

Conclusions

The anecdotal evidence is that HFT is perceived to be a useful modality. It was identified from the network survey that 100% of nurses questioned preferred HFT to CPAP as it was perceived to be more comfortable for the babies and enhanced bonding with carers. However, the truth is that many neonatal units across the country have adopted this mode of respiratory support despite conflicting and insufficient evidence with a Cochrane review stating that 'there is insufficient evidence to establish the safety and effectiveness of HFNC'[8]. Adequately powered RCTs and meta-analyses with limited heterogeneity are eagerly awaited. Specifically studies addressing the questions surrounding optimal flow rates and effective weaning methods need to be undertaken. Evidence is awaited to support the use of HFT as a primary mode of non-invasive respiratory support replacing

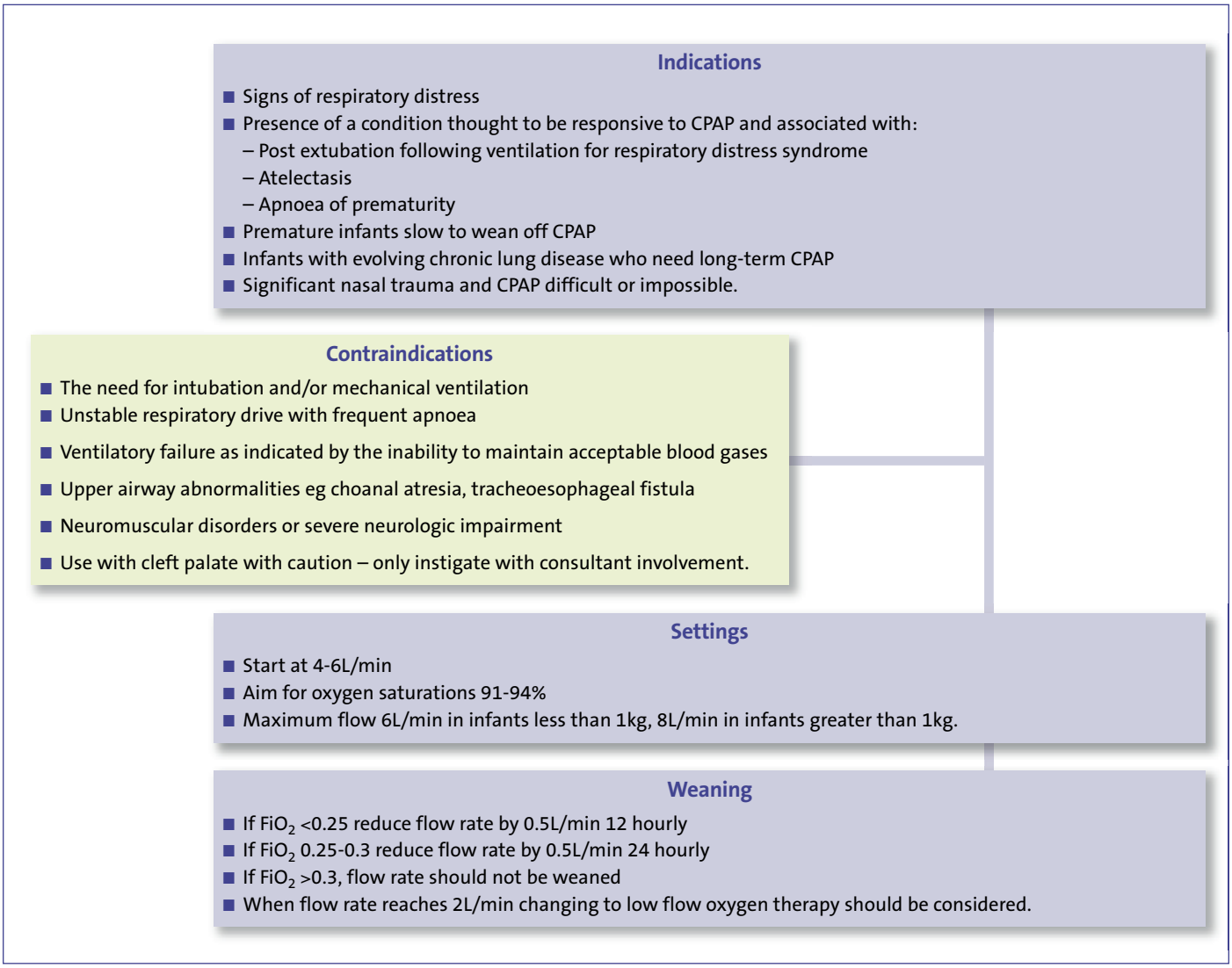

FIGURE 4 Summary of guidelines for HFT taken from the Leeds Teaching Hospitals NHS Trust 'Protocol for the Use of High Flow Therapy in the Newborn Infant' adapted from the Oxford Radcliffe Hospitals guideline.

CPAP. Ongoing studies in Australia and North America may provide this.

If HFT is considered optimal treatment for babies with respiratory compromise, it should be available within all units and in the transport setting, to prevent the delay in repatriation of babies.

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Reflections on thirty years of neonatal care

FOCUS

Margaret M. Sparshott
Retired neonatal nurse

As a retired neonatal nurse with more than 30 years' experience, I have seen great changes taking place and enormous improvements in the technology used to keep preterm babies not only alive, but with the promise of a good quality of life. From 1968 until my retirement, I worked as a neonatal nurse in Greece, in Switzerland, and in Plymouth, England. My particular interests include the effects of pain on the newborn baby, which influenced me to create a pain scoring system for the newborn, and the great difficulty parents experience in coping with the loss of a baby who dies without ever having lived.

The early years: Aghia Sophia Children's Hospital, Athens, 1968-74

From 1968-74, I worked as a staff nurse in the preterm baby unit of Aghia (Saint) Sophia Children's Hospital in Goudi, a suburb of Athens. To my knowledge, the only other special care baby unit (SCBU) in Greece at that time was in Thessaloniki in the north. The hospital was a handsome modern building set in well-tended walled gardens, with a separate nursing school in the same grounds. Medical care and nursing were of a high standard, but equipment was basic – there was no money to spare. There were no sophisticated life support systems but the staff improvised and made best use of the facilities they had, such as creating continuous positive airway pressure (CPAP) to support immature lungs using rubber tubing, glass containers and nasal prongs.

Top: Holding one of our infants on the premature baby unit, Athens. *Above:* Nursing colleagues at Athens.

Outside the Aghia Sophia Children's Hospital, Goudi, Athens.

Babies came to our SCBU from all over Greece, in baskets or boxes, usually wrapped in rags, sheep's wool or straw. There was an ever-present risk of infection, mainly from *E. coli*. On one tragic occasion every baby in the unit died, even those who were almost ready to be sent home. Babies with diarrhoea were given cold sweetened tchai (tea), which was usually very effective. Visiting was restricted; the maternity hospital was in another part of Athens and often it was weeks, if not months, before parents could set eyes on their children.

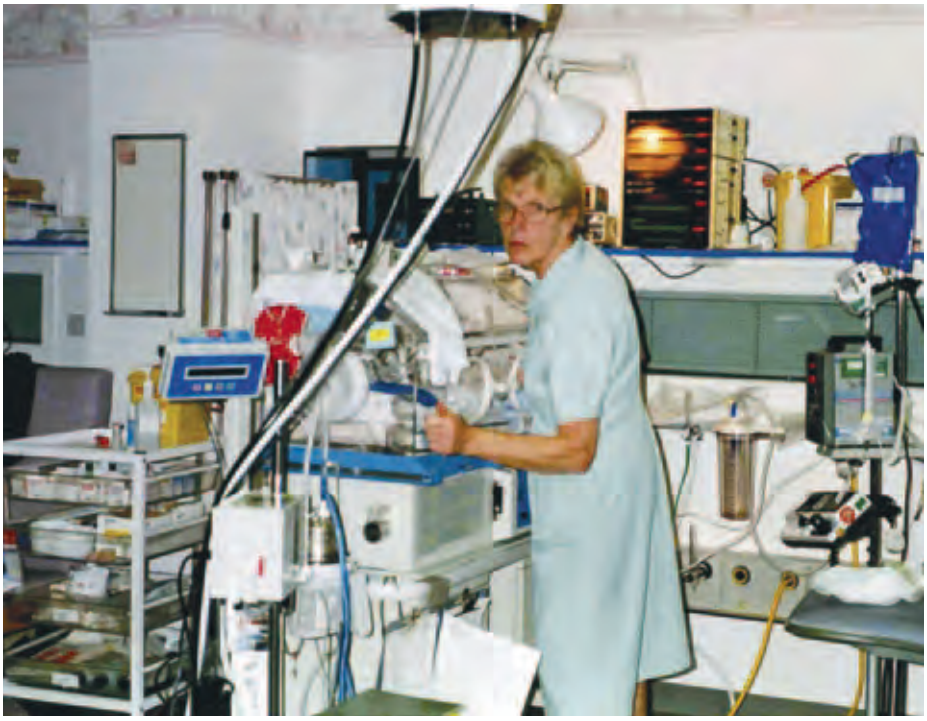
Neonatal jaundice requiring exchange transfusion was common at that time. The babies were bound, papoose-like, to a cruciform splint and usually slept calmly through the whole procedure in spite of the hours it took to complete – perhaps demonstrating how comforting swaddling is for the newborn. The house officer on call performed the procedure with an attendant nurse, using a 20mL syringe and discarding the used blood into an enamel bowl. This procedure was extremely tedious for the doctor and on one occasion the doctor complained of feeling dizzy and shaken. It wasn't until we noticed the blood swilling in the bowl that we realised we were in the middle of an earthquake.

Phototherapy was in use and the lamps were very similar to those used today. We would place babies with jaundice close to the windows to benefit from the light, while taking care to protect them from the hot sun of Greece. There was a curious custom at that time among the remote villages; babies with jaundice would arrive with shallow cuts in a cruciform pattern on their backs. These were made, usually by superstitious grandmothers brandishing knives, in order to 'let the devil out' with the blood.

Antibiotics were given intramuscularly, with the result that injection sites became as hard as chunks of wood. Intravenous fluids could be given but scalp veins were frequently used with needles fixed into place by plaster of Paris. Extravasation and consequent scarring was commonplace.

Geneva, Switzerland 1976-87

In 1976, following a brief spell at the Simpson Memorial Hospital in Edinburgh, I moved to the neonatal unit in Geneva, which was attached to the maternity hospital, making life much easier for



The NICU Plymouth.

parents than it had been in Athens. Switzerland, being a much wealthier country, had more sophisticated equipment than Greece. There were monitoring systems, syringe pumps and ventilators – although ventilation was hazardous as the ventilators were very basic and could not be set to different breathing rhythms.

Antibiotics were given intravenously; the neonatal nurses were experts in placing intravenous needles so there was less tissue damage but babies were pricked many times during their stay and frequently showed many scars. In Switzerland at that time, nurses were authorised to perform venepuncture, which relieved the pressure on junior doctors and, since the nurses became very adept, saved the babies some discomfort.

Parents were given strict instruction on visiting times but they were shown how to help care for their baby and a room was provided for the mothers whose babies were able to breastfeed. The parents were also shown nursing techniques, such as nappy changing, bathing and tube feeding.

Derriford Hospital, Plymouth, England, 1987-99

The last part of my career was spent as a staff nurse in the NICU of Derriford Hospital in Plymouth. By this time visiting hours had become much more flexible and parents were encouraged to help with the care of their baby at the earliest opportunity. The more stable ventilated babies were permitted to leave their incubators and were placed against their mother's bare skin – 'kangaroo' care. The presence of parents and siblings was now seen as crucial to the long-term well-being of the family.

Innovators such as Heidelise Als, with her synactive model of neonatal behavioural organisation[1] and T.B. Brazelton with his neonatal behavioural assessment scale[2], were beginning to encourage perception of the newborn baby as a person who, though incapable of speech, had emotions which could be read and understood.

Around this time neonatal units were becoming 'user-friendly'. As part of the ENB405 Neonatal Nursing course, I researched environmental problems for the sick newborn baby in hospital; stress caused by pain and other factors such as light, noise, day and night routines, and separation from parents[3].

By the time I retired in 1999, ventilators had become so sophisticated that the slightest chest movement could trigger ventilation. Life support systems had become very complex; this was and is very daunting to parents, who feel their baby is concealed by tubes and wires.

Changes over so many years could cause difficulty for a nurse who began work in a neonatal unit 30 years earlier! Hands-on nursing skills must be accompanied by expertise with technical apparatus and an understanding of abundant monitoring systems. When I started nursing, we were not trained to understand ventilators, machines and monitors. I learnt to adapt but some failed; one sister about my age worked all her nursing life on neonatal units but could not cope with these complexities and would hide herself in the store cupboard whenever there was an emergency admission.

After I retired, I recorded some of my experiences with bereaved parents and in 2009 I published 'Holy innocents: grieving for the death of a baby'[4]. I explored the different forms of grief experienced when losing a baby before, during and after birth and the needs of all family members; mothers, fathers, siblings, grandparents, etc. The book addresses the experiences of parents left angry and frustrated by staff insensitive to their needs and the spiritual needs of parents with different religious beliefs. I feel it is important to help parents 'move on' after they have endured the first grieving period, and later remember and mourn their baby as a member of the family; someone who did live, if only for a short time.

Life in an NICU is not a normal one for very small babies but we can try to make it as loving as possible. There are some things that are never out of date and never too late to learn: how to keep our babies comfortable and free from pain and how to reassure and comfort parents who are in great distress.

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A case of monozygous preterm twins with gastroschisis

Gastroschisis is a structural defect present at birth in which part of the abdominal wall is missing, allowing the intestines and other organs to protrude through the opening. This article highlights a rare case of gastroschisis affecting a set of monozygous preterm twins. The proposed aetiology of gastroschisis is reviewed alongside a discussion of how this case report might contribute to current understanding of the pathogenesis of the condition.

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Keywords

gastroschisis; monozygous; preterm; twins; aetiology

Key points

Darke J., Emmerson A., Narasimhan R. A case of monozygous preterm twins with gastroschisis. *Infant* 2012; 8(6): 180-181.

1. The incidence of gastroschisis is increasing and identifying a cause for this condition is therefore vital.
2. The prevailing opinion is that the aetiology of gastroschisis is largely exogenous.
3. This case describes a rare occurrence of monozygous twins with gastroschisis and hence contributes evidence for the interplay of genetics and environmental factors in the pathogenesis of the condition.

Gastroschisis is a congenital defect, characterised by protrusion of the intestine through a paraumbilical defect of the abdominal wall (**FIGURE 1**). It is not normally associated with other congenital anomalies and most babies born with this condition are expected to survive normally. This is a relatively rare problem but the incidence is increasing. The calculated incidence ranges from 1-5 in 10,000 worldwide[1]. In the UK, the incidence has increased from 2.5 in 10,000 (1994) to 4.4 in 10,000 (2004)[2]. Most cases appear in the first pregnancy of younger mothers. Geographically there appears to be a north-south divide in rates of gastroschisis across the UK: southern England has a lower prevalence than the Midlands, northern England, Wales and Glasgow[3].

There is currently no known definitive cause of gastroschisis but most consider the aetiology likely to be exogenous in nature. There has been much speculation about the contribution of maternal drug and alcohol consumption in pregnancy[4] but the causative relationship remains inconclusive. The most widely accepted explanation is disruption to the blood supply in early pregnancy, in particular early interruption of the fetal omphalo-mesenteric arterial blood supply[2].

Given that gastroschisis generally occurs sporadically, hereditary factors have tended to be understated. There are only a few isolated case reports of recurrence in families[5]. Gastroschisis has been previously noted in both monozygotic and dizygotic twins[6], but the occurrence of this appears to be extremely rare. This observation

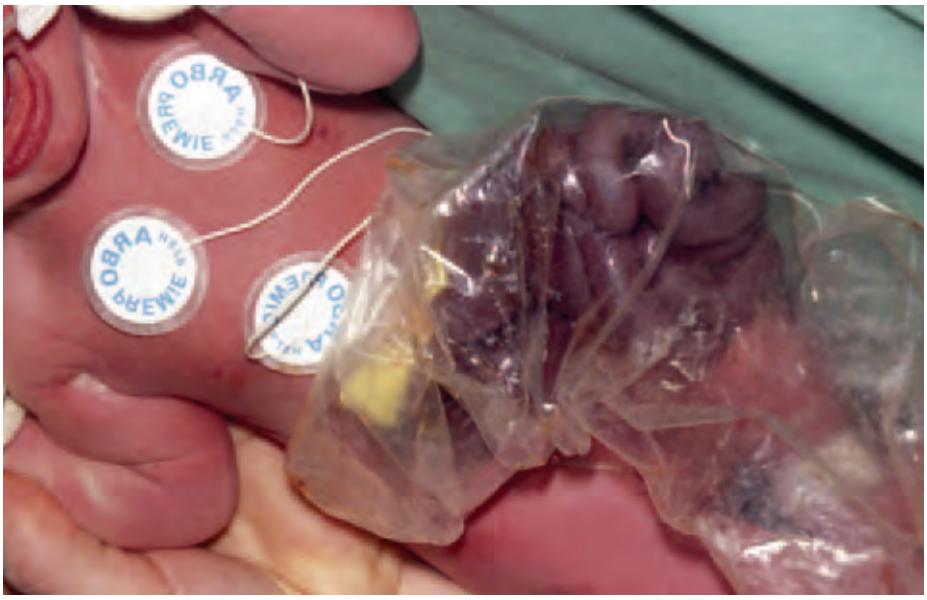

FIGURE 1 Protrusion of the intestine. Photograph supplied by Medical Illustration Unit, Central Manchester Foundation Trust.

combined with case reports describing cases of twins in which only one twin is affected is further support for an exogenous aetiology of this condition[7].

The case

The mother was a 19-year-old, previously fit and well, primiparous woman of low socioeconomic status and slight build. She was rubella immune, had negative antenatal serology and was not documented to have smoked, drank alcohol or used drugs during the pregnancy. Antenatal scanning detected monochorionic diamniotic twins with intra-uterine growth restriction, too little amniotic fluid (oligohydramnios) and gastroschisis. They were delivered at a local district general hospital (DGH) by emergency caesarean section for worsening maternal pre-eclampsia at 29 weeks' and four days gestation.

The babies were delivered in good condition, with Apgar scores of 9 at one and five minutes. Cord gases were satisfactory and neither baby required any resuscitation at birth. The birthweights were 1000g and 1080g for Twin A and Twin B respectively, which were both below the tenth centile for gestation.

Both babies were intubated and ventilated electively for transfer to the regional neonatal surgical unit on day 1 of life. Once there, both underwent full corrective surgery and had broviac catheters sited to aid administration of parenteral nutrition while feeds were established.

They progressed well postoperatively, with minimal ventilatory requirements. Twin A was extubated on day 7 postoperatively, and Twin B was extubated on day 3. They both required a period on continuous positive airways pressure (CPAP) for presumed surfactant-deficient lung disease of prematurity (SDLD) and feeds were slowly established. Twin B did considerably better than Twin A: CPAP was discontinued by day 12; by day 20, Twin B was fully enterally fed. Twin A remained on CPAP with a slow increase in enteral feeds up to discharge from the tertiary unit on day 37. She was also noted to have a moderate sized patent ductus arteriosus (PDA) on echocardiogram. An update from the DGH on day 144 revealed Twin A to have required CPAP until day 42 and subsequently high-flow humidified oxygen delivery (Optiflow™) until day 58. At the time of publication, she remained on 0.03-0.06L/min of nasal cannula oxygen and had established full enteral feeds, although still requiring some feeds via the nasogastric tube.

Discussion

Gastroschisis remains a reasonably rare problem, but the incidence has increased sharply from the early 1960s when it was approximately 1 in 150,000, to the current UK incidence of around 4.4 in 10,000[2]. Although this discrepancy may be partially explained by improvements in reporting practices, it remains a worrying trend.

Studies have demonstrated a relationship between maternal demographics and drug and alcohol use in pregnancy. It has been suggested that the pathogenesis in this context is explained by a vascular accident at the time of involution of the right umbilical vein or of the development of the superior mesenteric artery[2]. Certainly, the relationship between gastroschisis and the use of vasoactive substances in pregnancy lends credence to the hypothesis of a vascular aetiology. Some studies have been able to demonstrate elevated risks associated with maternal use of asprin, ibuprofen, and pseudoephedrine[4].

Genetic factors are also under investigation. One early study suggested a deletion of the BMP1 gene resulted in a phenotype that resembled a human neonate with gastroschisis. Blood samples were collected from patients with gastroschisis but no mutation of the human BMP1 gene was identified[8]. This study therefore provided further evidence of a non-genetic aetiology for gastroschisis. Another study[9] suggested a range of genetic polymorphisms that were found to be associated with an increased risk of gastroschisis, particularly in association with maternal smoking; the hypothesis supports a joint interaction between genetic and environmental factors.

Epidemiologically, geographic gradients are suggested in Europe and the UK[3]. Gastroschisis seems more frequent in Caucasians, and in northern compared to southern Europeans. The increasing prevalence of the condition suggests that environmental factors that have also increased in prevalence are likely to be involved. This is supported by the observation of a relationship between maternal factors such as young maternal age, low socioeconomic status, low maternal body mass index (BMI), poor maternal diet and discordant family life[1]. The understanding of these factors is important, as it will help in the development of preventative strategies in the future.

These observations indicate the need for further studies investigating possible interactions between genetics and the environment as an explanation for gastroschisis. Current thinking is that the aetiology of gastroschisis is likely to be found in the interplay of multiple genes, and the addition of environmental exposures. This would be supported by the current case of twins with identical genetic and environmental exposures. This case fits the demographics of a young, first time mother of low socioeconomic status and appears to be one of the few case reports of gastroschisis documented in twins.

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Breastfeeding could save the NHS millions

Research commissioned by UNICEF UK reveals that low breastfeeding rates in the UK are costing the NHS millions of pounds.

A report entitled 'Preventing disease and saving resources: potential contribution of increasing breastfeeding rates in the UK' shows that moderate increases in breastfeeding could see potential savings to the NHS of approximately £40m per year.

The UK has one of the lowest breastfeeding rates in the world, particularly in terms of duration of breastfeeding. Improvements in care have led to more women starting to breastfeed, but many mothers encounter problems that can cause them to stop before they had planned to. UNICEF UK is calling for more support to encourage mothers to breastfeed for longer.

Image: UNICEF UK/Jill Jennings.

Protecting newborn babies against whooping cough

The Department of Health has announced that pregnant women will be offered whooping cough vaccinations to protect their newborn babies following a rise in cases and deaths among young infants.

Whooping cough, also known as pertussis, affects all ages but young infants are at highest risk of severe complications and death because they are not usually fully vaccinated until they are around four months old.

The move comes as the latest figures for England and Wales, released by the Health Protection Agency (HPA), show a large increase in cases in young infants. Chief Medical Officer Dame Sally Davies said: "Whooping cough is highly contagious and newborns are particularly vulnerable. Nine infants have died as a result of whooping cough this year and there have been 302 cases of the disease in children under three months old."

The vaccine will be offered to pregnant women between 28 and 38 weeks' gestation during routine antenatal appointments with a nurse, midwife or GP.

The temporary programme will be monitored by the HPA and the Medicines and Healthcare products Regulatory Agency (MHRA).

New guidelines for early-onset neonatal infection

The healthcare guidance body NICE has published new guidelines on the use of antibiotics for the prevention and treatment of early-onset (within 72 hours of birth) neonatal infection. The guidance should aid faster diagnosis and treatment for newborn babies who have an infection and avoid needless use of antibiotics in those who do not.

Early-onset neonatal bacterial infection is a major cause of mortality and morbidity in newborn babies. It is the cause of death for one in four babies who develop it, even when given antibiotics. Organisms from the mother's genital tract usually cause these infections, including group B Streptococcus (GBS), *E.coli*, Pseudomonas and Klebsiella. Such infections may develop suddenly and rapidly, with mortality particularly high in premature babies and those with a low birth weight.

The guidance recommends that the NHS needs to prioritise the treatment of sick babies and use antibiotics appropriately to avoid the development of bacterial resistance to antibiotics.

The guideline is available at guidance.nice.org.uk/cg149

NurseAid is now known as Cavell Nurses' Trust

Cavell Nurses' Trust, formerly known as NurseAid, has rebranded as the charity looks to continue its essential work supporting nurses, midwives and healthcare assistants. The charity was established in 1917 following the death of heroic British nurse Edith Cavell during the First World War.

Over the last five years, Cavell Nurses' Trust has provided financial support worth more than £2.5 million to thousands of working and retired nurses and midwives, students and healthcare assistants in need.

The Trust also runs an annual scholarship awards scheme, designed to help nursing and midwifery students at the start of their careers.

More information is available at www.cavellnursestrust.org

Diabetes during pregnancy – how is the baby affected?

Dr Karen Logan *(pictured)* of Imperial College London has been awarded funding by the charity Action Medical Research to investigate how a mother's diabetes during pregnancy affects her baby.

Babies born to mothers who suffer from diabetes during pregnancy are at least four times more likely than other babies to develop type 2 diabetes later in life. However, there is no way to predict which of these babies will actually develop diabetes.

Dr Logan's study will look at the 'metabolic fingerprints' of babies born to mothers who developed diabetes during pregnancy – by assessing the pattern of naturally occurring substances in the urine and measuring the distribution of body fat.

Small Wonders Change programme – an update

The Small Wonders Change programme aims to support neonatal and midwifery staff to enable the families of sick and premature babies to be more actively involved in their baby's care in ways that are known to improve the health outcomes of the child and wellbeing of the family. At the heart of the Change Programme is the Small Wonders DVD consisting of 12 films following 14 families through their experience of having a baby on the neonatal unit.

To drive forward the embedding of the Small Wonders DVD across the UK, Best Beginnings has recruited Small Wonders Champions; these are mostly neonatal nurses or midwives who have volunteered their time to champion the roll out of the DVD within their units.

To monitor progress and to enhance support, Best Beginnings sent a survey to the 414 Champions in each of the 136 neonatal units that have the DVD. Results from the 33 neonatal units that responded were incredibly positive. The Champions estimated that 60% of relevant staff had watched all, or the majority, of films and 70% of Champions had started distributing the DVD to parents (hospitals are encouraged not to give the DVD to parents until all relevant staff are familiar with the content).

Images© Best Beginnings with thanks to Lyanne Wylde Photography.

In addition to this, when asked how useful units found the Best Beginnings Champion resources, 60% of respondents said 'very useful' and 24% said they found them 'extremely useful'.

Best Beginnings would like to say a huge thank you to the Small Wonders Champions for their incredibly hard work. They will be holding a celebratory get-together for Small Wonders Champions and other neonatal staff at the UNICEF UK Baby Friendly Initiative Annual Conference in December.

View the survey at www.bestbeginnings.org.uk/small-wonders-progress-and-activity. For more information, feedback and suggestions contact andrea@bestbeginnings.org.uk

Neonatal rapid access clinic: an innovative practice to reduce neonatal readmissions to hospital

This article describes a nurse-led rapid access clinic (RAC) that was established in 2011 to reduce the number of neonatal readmissions to hospital, while also addressing the increasing demand for early postnatal discharge. Review of the service after one year demonstrates that it has been successful in meeting its objectives and improving the delivery of care to babies and their families in the local area.

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Keywords

newborn; readmissions; weight loss; jaundice; breastfeeding

Key points

Skene C., Gupta A., Flaherty M., Sherwood E. Neonatal rapid access clinic: an innovative practice to reduce neonatal readmissions to hospital. *Infant* 2012; 8(6): 184-186.

1. The rapid access clinic (RAC) is an innovative practice that can reduce the need for neonatal readmission and shorten the length of stay post-delivery.
2. Midwifery and neonatal staff collaborate in the clinic to support mothers who are breastfeeding.
3. The new service enables early discharge and optimises the use of neonatal and midwifery resources.
4. Families, community midwives and hospital staff value the RAC.

A rapid access clinic (RAC) was set up in 2011 by a team of advanced neonatal nurse practitioners (ANNPs) working alongside specialist infant feeding midwives and neonatal clinic staff. The setting was a regional maternity hospital and tertiary neonatal unit where there are more than 7,400 deliveries a year and an increasing trend towards early postnatal discharge.

Prior to setting up the RAC, babies with significant weight loss or jaundice in the first week of life were referred back to hospital for a medical review. This frequently led to further investigations, supplementary feeding and readmission to hospital. Addressing the needs of these babies and their families, not only added to the workload of midwifery and neonatal staff, but at times led to a delay in other postnatal ward work such as the discharge of healthy babies. The aim in setting up the RAC was to reduce the need for neonatal readmission while still facilitating early postnatal discharge[1,2]. As this was achieved by utilising existing resources more efficiently, rather than commissioning a new service, the cost implications were negligible.

The daily RAC, which is run by an ANNP from the neonatal team, offers an easily accessible environment for the review of babies who have been previously discharged from the postnatal ward. Babies are assessed in the clinic by the ANNP and specific breastfeeding support from a specialist midwife is available, if required. Any necessary investigations are carried out and a plan is made for continued management at home or readmission to hospital, as necessary. The ANNP team also provides a telephone consultation service for community midwives to discuss concerns prior to hospital referral and establish whether a plan for home management might be more appropriate.

A review of the RAC that took place a year after it was established identified a reduction in neonatal readmissions and a shortened length of stay for some groups of babies. The RAC service also provided support for breastfeeding mothers, improved the patient experience and had a positive impact on the community midwifery team and hospital staff.

Setting up the RAC

The RAC was initially set up and managed by an ANNP team with support from a specialist infant feeding midwife, neonatal clinic staff and medical staff, if required. The community midwives could contact an ANNP on weekdays, between 9am and 4pm to discuss the care of babies with jaundice or weight loss and arrange a same day appointment for babies less than seven days' old. Following a clinic assessment, babies were either discharged with a clear feeding plan and follow-up with a community midwife, or admitted to a postnatal ward for hospital-based interventions such as phototherapy or intensive feeding support. The outcome of each clinic visit was communicated to the referring midwife on the same day or following morning.

The referral criteria for the RAC were later extended to facilitate the discharge of well neonates who required further investigations. For example, some babies

Reason for referral	Number of babies seen in clinic	Number of babies readmitted
Jaundice	110	43
Significant weight loss	95	21
Significant weight loss and jaundice	56	23
Blood tests*	67	
Serum bilirubin post phototherapy (SBR)	50	10
Review following newborn examination in the community	33	
BCG vaccination (missed prior to discharge)	19	
Review of feeding following early discharge	5	
Other	13	
Total	448	97

TABLE 1 Activity in the RAC over 12 months, May 2011-2012.
* Full blood count (FBC), thyroid function tests (TFTs), cortisol levels, urea and electrolytes (U&E).

with jaundice were discharged following phototherapy with a plan to return to the clinic for serum bilirubin measurement 12-18 hours later, according to NICE guidelines[3]. Previously, such babies would have remained in hospital until a satisfactory bilirubin level could be recorded. In addition babies who required further assessment following newborn examination in the community or early review following transitional care discharge, were reviewed in the clinic. **TABLE 1** describes activity in the RAC over twelve months, between May 2011 and 2012.

Reduced readmission and length of stay

Two hundred and sixty-one babies attended the RAC with significant weight loss or jaundice or both (**TABLE 1**). Prior to the establishment of the clinic, almost all of these babies would have been readmitted to the postnatal wards for investigations and medical management, which often included supplementary feeding. During the first year of the clinic however, only 33% of these babies (87 babies) required readmission to hospital.

Fifty babies with jaundice were discharged following phototherapy rather than remaining in hospital for a repeat serum bilirubin measurement 12-18 hours later. A plan was made for them to return to the RAC the following day for bilirubin measurement, which led to the readmission of only 10 of these babies (20%).

In addition to the babies attending the RAC, the care of many other babies was discussed between an ANNP and community midwife by telephone, resulting in a plan to manage the baby at home. At least 110 such telephone referrals were documented. There was therefore an additional group of babies who not only avoided hospital readmission, but also clinic attendance.

Support for breastfeeding

Although breastfeeding rates within the UK have increased from 62% in 1990, to 81% in 2010[4], it is apparent that many women find breastfeeding difficult during the first week of their baby's life[5,6]. Prior to the establishment of the RAC, babies with weight loss or jaundice were likely to have the additional challenge of receiving supplementary formula feeds as part of their management plan, while also trying to establish breastfeeding. In the RAC however, 134 breastfeeding mothers were encouraged and supported to continue exclusive breastfeeding by a member of the specialist infant feeding team. Supplementary feeding was only introduced if the baby appeared to be dehydrated on clinical examination, which was confirmed by a raised serum sodium level, or if there was an obvious problem with lactation.

In addition to the specialist infant feeding midwives, all ANNPs attended a two-day 'Baby Friendly' accredited course. They were therefore able to provide breastfeeding support such as help to refine the latch position or technique improvements for hand expression. During telephone discussions, they also utilised a breastfeeding assessment chart, which was developed by the infant feeding team, to help identify which babies could be safely managed at home.

Improved patient/family experience

Almost all babies were weighed by a clinic nurse and then seen by an ANNP within a few minutes of their arrival at the clinic. Investigations were normally followed up within 1-2 hours and parents were offered the choice to wait for results or return home to be contacted later by phone. If readmission was necessary, the ANNP and the ward midwife arranged it quickly and directly. One parent expressed satisfaction with the RAC during an interview for a hospital news magazine:

> "An appointment was made for us to attend clinic later that day and once we were there we were in and out with no waiting around. It was a major positive not to be readmitted to the ward. As well as freeing up ward space, it meant that no other arrangements had to be made to look after our other child".

A community midwife highlighted the value of the RAC for families during a meeting to evaluate the progress of the clinic:

> "I think the clinic is a huge improvement on referring babies to the wards. Psychologically, it is generally more positive to be checked over in a clinic environment rather than being reviewed on the ward".

Impact on community midwives

The RAC offered a simple direct method of referral for community midwives, who previously needed to contact both midwifery and neonatal hospital staff to discuss the referral and arrange a postnatal bed. In addition, the outcome of each clinic visit, for example a feeding plan, weight measurement, follow-up visit, or the need for readmission, was reported directly back to the referring midwife. One community midwife highlighted the impact of this simple process of referral and feedback:

> "…it is significantly quicker and easier for us to refer and it has been good to get verbal feedback".

Impact on hospital staff

As anticipated, the establishment of the RAC had a positive impact on the

workload of both midwifery and neonatal staff. Previously, all babies were directed to a postnatal ward for review by the medical team who were also responsible for the labour ward. This sometimes meant a long wait for the family and increased pressure on busy midwives to support families waiting for a review or investigation results. The allocation of one ANNP to deal with telephone referrals, clinic reviews and readmissions led to a reduction in the number of babies returning to the postnatal ward and provided a more efficient review process as described by the postnatal ward matron:

> "It is now much easier to manage patient flow as it was often difficult finding a bed and the family were left sitting in a day room. Now the babies that are admitted are easily accommodated and are seen more quickly as the process has already started".

Future plans

Following the service evaluation, it was agreed by all stakeholders that the RAC should not only continue, but also expand. An ANNP will now be available for clinic referrals and discussions between 9am and 6pm every day, including weekends. This extended service will be reviewed again at the next stakeholder meeting.

In order to provide support to mothers who are breastfeeding throughout the extended clinic hours, a wider group of specialist midwives will be utilised. Around 90% of hospital midwives are already trained in breastfeeding management: a small group will be identified to work alongside a member of the specialist infant feeding team to support parents in the RAC.

Since the start of the RAC, data relating to the reason for referral, method of feeding and outcome of visit have been recorded. This was particularly useful when reviewing the service. The database will now be expanded to include the exact time of discharge, mode of delivery and previous breastfeeding history. This information will be helpful in identifying potential risk factors for neonatal readmission and informing further practice development initiatives.

Parents' comments about the clinic have been valuable in developing the service so far and further assessment of parent experience is planned. Comments from the healthcare professionals and administrative staff supporting the clinic are also provided on a regular basis and will continue to inform any future developments.

Conclusion

Overall, the RAC has achieved its initial objectives and is clearly valued by families, community midwives and hospital staff alike. It has reduced the postnatal ward workload associated with potential newborn readmission by approximately 60% and reduced the length of stay for babies with jaundice who require phototherapy. It has also facilitated the early discharge of babies from transitional care, supported mothers who are breastfeeding and helped to optimise the use of neonatal and midwifery resources.

Acknowledgements

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Perceptions of mothers expressing breast milk on the neonatal unit following preterm delivery

It can take many weeks before babies who are born early are ready to start feeding from the breast. Maintaining lactation until their infant is ready to breastfeed can prove problematic for some mothers. This study explores the feelings and experiences of mothers who give birth to preterm infants towards expressing and maintaining breast milk while their infant is cared for in the neonatal unit. It highlights the challenges for mothers wishing to express breast milk for their newborn preterm infant and recommends areas of practice that could be improved.

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Keywords

preterm; neonatal unit; breastfeeding; expressing; breast milk

Key points

Wilson D. Perceptions of mothers expressing breast milk on the neonatal unit following preterm delivery. *Infant* 2012; 8(6): 187-190.

1. Where a mother stays as an inpatient following the birth of her preterm infant needs consideration as staying on the postnatal ward proves difficult for most.
2. Professionals should ensure all mothers are helped to start expressing breast milk as soon as practically possible and that this support is tailored to meet their individual needs.
3. Support needs to be consistent and maintained throughout the mother's journey; from expressing to breastfeeding and through discharge into the home environment.

The World Health Organization (WHO) and the UK Department of Health (DH) recommend that every infant should be exclusively breastfed for the first six months of life[1,2]. Breastfeeding is an unequalled way of providing the perfect nutrition for the healthy growth and development of infants[1,2]. Human milk is species-specific and has adapted throughout evolution to meet the nutritional requirements of the infant[3]. Its unique composition, particularly its immunological properties, cannot be replicated by artificial milk[4,5].

It can take many weeks before infants who are born preterm are ready to start feeding from the breast. Maintaining lactation can be problematic, particularly for those mothers of very preterm infants who may need to sustain a milk supply for many weeks before their infant is ready to breastfeed. Expressing breast milk is seen by many mothers as something positive and something that only they can do for their infant[4,6,7], however it can also be distressing when they are unable to continue because their milk has 'dried up'.

This study was designed to gain an insight into the feelings and experiences of mothers who give birth to preterm infants, towards expressing and maintaining breast milk while their infant is being cared for in the neonatal unit. Ethical approval was obtained from both the Local Research Ethics Committee and Trust Research and Development Department.

There is extensive evidence surrounding the benefits of breastfeeding and breast milk, however women who choose to breastfeed their preterm infant have difficulties that mothers who give birth at term do not encounter. Complications during pregnancy, labour or post-delivery may leave the mother unwell and most preterm infants will be too small or sick to consider breastfeeding. This often requires the use of milk expression techniques for initiation and maintenance of the mother's milk supply. It is acknowledged in the literature that mothers of preterm infants experience both physiological and emotional challenges, which can adversely affect breastfeeding[6,8-11]. Expressing as soon as possible after delivery is recommended and adopting a pattern of frequent expression is essential during the early weeks post-delivery when lactogenic hormones directly influence milk production[7,9,11]. Unfortunately, women who need to express milk for prolonged periods frequently report diminishing milk volume[11].

Methodology and design

A qualitative approach was identified for this study with data collection in the form of semi-structured interview. Descriptive phenomenology was chosen as the research methodology; facilitating the concept that only those who experience phenomena are capable of communicating it to the outside world. It is a method not intended to generate theory, but to be descriptive and provide an insight into the lived experience with the purpose of enhancing knowledge[12,13].

Participants were chosen by purposive sampling. Eight women were interviewed, of whom six had successfully left hospital

breastfeeding their infant. The sample reflected cultural diversity: white British (n=4), black African (n=2), white other (n=1) and other (n=1). The age range of participants was also wide and ranged from 21-37 years.

The interviews took place in each mother's home 1-3 weeks following discharge. All the interviews were recorded and subsequently transcribed. A copy of the transcript was returned to each participant for verification.

To provide structure and guidance, analysis was based on Colaizzi's procedural steps[14]. Following the first stage of analysis there were 59 themes. These themes were subsequently placed into five categories: provision, emotions, environment, complications and breastfeeding.

Findings

The findings are predominantly quotes from the transcripts making it descriptive rather than explanatory, in keeping with descriptive phenomenology. This not only ensures the true feelings of participants are portrayed, but that the conclusions are determined from the data and not from the interpretation imposed by the researcher, which is in keeping with phenomenological methodology.

Provision

The provision category comprised the themes of advice, communication, privacy, support and technique. Technique refers to expressing breast milk, for example:

"When she showed me how to do it properly I was getting that little bit more." (Interview 3 No: 11)

Support was a common theme but unfortunately a large majority of the discussion around support was negative with mothers feeling they did not receive a lot of support:

"... I felt I was just expected to cope, whereas I felt I was going through a lot worse than anybody else because I didn't have my baby and I needed the support more." (Interview 7 No: 205)

"I think it's (postnatal ward) just really busy and intended for people who are well and just going to go home. So in terms of support then ... not really." (Interview 8 No: 259)

Reliance on close family members for support when expressing was obvious:

"I got a grip of it on my own with the help of my sister." (Interview 2 No: 112)

"He (partner) would do anything that needed doing while I was expressing." (Interview 7 No: 248)

Lack of specialist advice has been cited in many studies as the largest barrier to breastfeeding initiation[9,15]. A BLISS survey also found support to be inconsistent[7]. Although this study was small in number it highlights confusion over who should take responsibility for advising mothers on expressing breast milk, which BLISS also describes in a much larger study[7].

"I think the postnatal girls expect the special care girls to go through it with you and I think special care expect the midwives." (Interview 5 No: 139)

One mother discussed how:

"Many people make you feel that it would be so much easier all round if you went onto bottle feeding." (Interview 5 No: 151)

This again is not a unique experience, as 5% of the women who took part in the BLISS survey also reported experiencing pressure to move onto bottle feeding[7]. Inevitably many mothers discussed receiving conflicting advice:

"You do not know what to do, you don't know who to listen to. But I read the BLISS publication and they said get up through the night to express and so I did my own thing in the end. I felt I did it all on my own." (Interview 5 No: 144)

The conflicting advice does not stop within the unit; when a mother is discharged home she is still confused with differing opinions. One mother who was discharged successfully breastfeeding her baby with a nipple shield says:

"... but the health visitor was like 'you're not using those are you, they're a disaster for breastfeeding'." (Interview 8 No: 312)

A lack of privacy has previously been highlighted in the literature[9,16,17]. Mothers identified a lack of personal privacy both on the postnatal ward and the neonatal unit:

"There is not really any privacy, obviously you pull the curtains round ... no-one ever knocks or says 'can I come in' so anyone could walk in, so you just feel on edge, you can't relax doing it (expressing). " (Interview 8 No: 265)

"I was just behind the screen, and there was gaps and people could still see between the gaps." (Interview 3 No: 37)

When discussing the use of designated rooms for breast milk expression:

"Sometimes you go in and about five different people would come in, in the time you were in there, and invariably they don't knock." (Interview 8 No: 287)

"So people would just come in and leave the door open, and you think well I'm a bit stuck here, I can't get up and close the door." (Interview 8 No: 293)

Emotions

The general perception of pregnancy is that you will have a normal healthy full term baby. Unfortunately this is not always the case, as one mother describes her experience:

"It's harsh, the whole experience was the worst of my life, obviously you never expect that you are going to have a preterm baby." (Interview 7 No: 236)

The birth of a preterm baby has been acknowledged as an extremely difficult time for a mother[6]. Mothers appear to find it particularly difficult and emotional as an inpatient on the postnatal ward.

"It's really disheartening as you see all the other mams, lying on the bed getting skin contact and you just think, oh my God this is horrible." (Interview 6 No: 182)

"You've just been separated from yours over in special care and you are walking past every one else with their babies and their car seats getting ready to take them home and it's really hard, it's torture." (Interview 7 No: 243)

Environment

The environment category comprises themes discussing the physical environment, including the postnatal ward, home and the infant's environment – the incubator. One mother acknowledged how much of a barrier an incubator can be between mother and baby:

"Midwives were like, 'oh yeah, just try and have skin contact with your baby', but she was in an incubator – I couldn't." (Interview 6 No: 181)

While acknowledging that the postnatal ward was trying to keep her out of the main ward, the following quote provides food for thought:

"They put you right at the back, and although they are trying to do their best by putting you in a room on your own, they're make you walk past every single mother and baby when you go to your room." (Interview 7 No: 242)

Home is acknowledged as a more relaxing environment than hospital and one mother advised that she could produce double the amount of milk when expresseing at home:

"You feel like you can't do anything (on the ward), everyone can see what you are doing. It's a bit like you can't really relax until you come home and do normal stuff with them." (Interview 8 No: 321)

Complications

The complications category comprised problems that were perceived to be difficult. Some themes were felt to be close in meaning, such as control and permission, but as the emphasis within phenomenological analysis is to keep true to the words of the participants, they were individually identified.

While not acknowledged by all participants, a feeling of lack of control was identified, having to ask permission to do the simplest, most natural tasks and feeling like everyone else is looking after their baby.

"It is not even my decision, it's theirs, everyone is looking after your baby for you." (Interview 5 No: 166)

"Even when you hold her, you need to ask permission from the nurses to hold her." (Interview 5 No: 160)

"She was only allowed out, not even an hour a day … I couldn't have much contact with her and it was horrible." (Interview 6 No: 187)

"She was just so tiny and I wasn't able to hold her very much." (Interview 3 No: 23)

"Having quite limited time for cuddles, everything is a bit of a military operation." (Interview 1 No: 105)

Lack of control has previously been acknowledged[8]; mothers may find themselves and their infant in a public and medically orientated setting where the focus is on the infant's physical needs and survival.

Keeping siblings occupied on the ward can be difficult, particularly in the intensive care environment with lots of machinery to tempt small children.

"It was hard for her. Going to the hospital every day trying to sit quiet so that she didn't disturb the other babies." (Interview 7 No: 249)

Breastfeeding

The most relevant category for this project was breastfeeding. There are 10 themes relating to breastfeeding, which include breastfeeding, breast milk, supply and expressing. Following a preterm birth, providing breast milk becomes an important part of the baby's care and a mother will often welcome the chance to express milk as something positive she can do for her baby[7]. It is an opportunity for the mother to participate in the care of her baby and make a unique contribution to her baby's health[6].

"Expressing, although difficult, was a good thing because you feel that you are bringing something to your baby." (Interview 1 No: 103)

However expressing did not come easy to some mothers:

"I kept on encouraging myself to do it." (Interview 4 No: 47)

"You sort of think, is anyone else finding this a bit of a pain?" (Interview 8 No: 332)

And perhaps not very glamorous, with analogies from three participants to a dairy farm:

"It's not particularly glamorous and you are obviously a bit like you're attached to a milking machine but it serves a purpose doesn't it?" (Interview 8 No: 279)

"You just feel like a robot going to the milking shed as I called it." (Interview 6 No: 193)

"My mam would call us Daisy the cow". (Interview 7 No: 248)

Finding time to express breast milk for some mothers can be problematic; there is little time left for anything else, travelling backwards and forwards to the hospital twice a day or picking other children up were given as examples:

"You feel like you have no life because we couldn't go anywhere because by the time you go out it's time to express." (Interview 5 No: 145)

One of the participants commented on the valuable time taken expressing breast milk in the breastfeeding room, and would have appreciated the opportunity to express by the cot side:

"Time, at least for me, was quite precious and quite limited to see 'Baby', so I didn't want to spend any time in another room expressing spending another half hour without seeing her." (Interview 1 No: 85)

Being able to express breast milk close to the baby can also help with milk production[6,7].

Kangaroo care or 'skin-to-skin care' was a positive intervention and all but one mother (who found the lack of privacy difficult) looked forward to her special time with her baby. Skin-to-skin contact between mother and baby can stimulate milk production and forms an important part of the transition process from expressing breast milk to breastfeeding. Some women did report an increase in milk supply after having kangaroo care but unfortunately this was not experienced by all women:

"When I express it would take a good two or three minutes to start to get my milk coming out, but when I did kangaroo care I had to use a towel because the milk would just drop." (Interview 5 No: 149)

"I enjoyed it, but I can't really say it helped the milk flow because I expressed after one of the days but I didn't notice any significant difference." (Interview 2 No: 120)

Sadly maintaining their milk supply is a common worry for most mothers and unfortunately for some mothers, their milk supply does deteriorate:

"The period when it wasn't coming out, most of the time I feel discouraged, why has my milk suddenly gone, what happened to it?" (Interview 4 No: 60)

"When you hear people say you're staring to run out, you think oh no, what am I going to do, but there is nothing you can do is there really?" (Interview 8 No: 328)

"I even had a bib from her incubator for her smell, but it didn't work." (Interview 3 No: 30)

"It dried up and I didn't have anything left to do for her." (Interview 2 No: 22)

Mothers certainly compare how much milk they are able to produce:

"I was always looking to see how much everyone else had … it was nice to see that other people had about the same amount in their bottles." (Interview 8 No: 331)

"This other mum came in … with two bottles of milk and said 'I only did one side' and we were there with our little piddly bits and I just thought God if I could get that much I would completely relax about it." (Interview 8 No: 326)

Conclusion

The findings of this study are not contradictory to the literature and mostly reaffirm the findings of previous studies. However, despite previous research, practice does not appear to have changed. Collaboration between postnatal and neonatal wards is essential if service improvements are to be made. The challenge for professionals is to ensure all mothers are supported to start expressing breast milk as soon as practically possible and that this support is tailored to meet their individual needs. The support needs to be consistent and maintained through-out their journey, from expressing breast milk to breastfeeding and through discharge into the home environment. Support must then be followed into the home, either by a specialist community neonatal team in collaboration with the health visitor, or by encouraging a stronger link between health visitors and the neonatal unit.

At a local level, a temporary breastfeeding co-ordinator post was initially created to support new mothers with expressing breast milk and infant feeding. This role proved extremely successful, not only in maternal satisfaction but also breastfeeding initiation and discharge rates. The post has since been made permanent by the Trust.

It is common practice for mothers to be cared for on the postnatal ward while their infant is admitted to the neonatal unit. However, where a mother stays while they remain an inpatient following birth also needs consideration; staying on the postnatal ward proves difficult for most. The mothers see other new mothers holding their newborn infants and families with car seats getting ready to take their newborn infants home. Mothers with infants on the neonatal unit are likely to leave the postnatal ward without their infant while their child remains a patient on the neonatal unit. Finding an alternative area for these mothers to be cared for would alleviate some of their emotional distress. This was not possible at the author's hospital although the antenatal ward was discussed.

As the findings from this study complement the findings of others, it is not felt that further research in this area is needed at this time. However, future research is needed to look at how best the multidisciplinary professionals can work together to provide specialist and comprehensive breastfeeding support to mothers of preterm infants to ensure their specific needs are met through their breastfeeding journey from birth to discharge and beyond.

Acknowledgements

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Introducing the Innovating for Life Awards

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- Improving access for expectant mothers
- Educational tools
- Communication networks
- Working practices

If you have an idea or an existing programme that could be added to this list, the *Innovating for Life Awards* could help you take your project forward.

Last year's winner: Midwifery category
Mindfulness-Based Childbirth and Parenting Project
Lead applicant: Dr. Sian Warriner, Consultant Midwife, Midwifery Team, John Radcliffe Hospital, Oxford University Hospitals NHS Trust
The Mindfulness-Based Childbirth and Parenting (MBCP) project promotes mindfulness meditation during pregnancy, childbirth and the parenting relationship; and parenting education, family health and supportive peer relationships; to help address fear, pain, stress and depression. The aim is to equip expectant parents with specific skills to negotiate the transition to parenthood and decrease anxiety and depression during pregnancy and beyond.

Last year's winner: Neonatal category
Improving Neonatal Airway Management
Lead applicant: Dr. Richard Mupanemunda, Consultant Neonatologist, Birmingham Heartlands Hospital Neonatal Intensive Care Unit
A 4-step intervention project aimed at improving the management of infants with difficult neonatal airways. This will be through the development of an algorithm, an equipment kit, improved training and a neonatal clinical pathway.

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2. Both awards are open to individuals and / or teams in the UK.
3. Entries should be made either by the individual or the team.
4. Each entry should be supported by a statement of no more than 1000 words, to include the following:
   - Background to the need for intervention and rationale
   - Proposed change / innovation / intervention
   - Methodology of implementation
   - Desired outcomes
   - Assessment and measurement of progress and success
   - Cost and resources
   - An explanation of how the individual / group would utilise the grant
5. For each entry, there should also be a supporting statement of no more than 300 words signed by the Head of Midwifery or Clinical Director verifying that the entrant has indeed achieved or shared the idea that is described in their submission. Applications should be supported by the unit and an academic institution where relevant.
6. Each submission will be judged by up to six judges.
7. Each category will have one winner.
8. Entries from teams/individuals closely associated with Infant journal or Cow & Gate, be that employee, spouse, close relative or regular contributor or columnist are welcome but please declare any conflict of interest.
9. **The closing date for entries in all categories is 31st December 2012.**
10. The decision of the judges is final and no correspondence can be entered into.
11. The same piece of work cannot be submitted into both categories.
12. The organisers reserve the right to reject an entry, if in their opinion it fails to comply with the rules and conditions.
13. The judging panel reserves the right to consult an independent expert if it needs to when deciding on winners.
14. No submitted entry material can be returned, including images, DVDs etc.
15. If an entry is received after the official closing date without prior approval, the organisers reserve the right to refuse the entry.
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If you have any questions please call 020 8971 6416.

Individual and / or all team members' names and job titles

_____

_____

_____

_____

_____

Please specify which award category you are entering: ☐ Neonatal care ☐ Maternity care

Contact Name _____ Contact Number _____

Contact Address _____

Email _____ Postcode _____

Your innovation please describe this on a separate page in no more than 1,000 words, including the following:

- Background on the need for intervention and rationale
- Proposed change/innovation/initiative/ intervention
- Methodology of implementation
- Outcome(s)/desired outcome(s)
- Assessment and measurement of progress and success
- Cost and resources
- An explanation of how you would use the £10,000 grant

The criteria by which the submissions will be judged include:

- The potential impact/value of your innovation
- Rigour of process/evidence
- Feasibility for adoption as a standard practice

Please include a supporting statement from your team Head of Midwifery or Clinical Director as evidence of your innovation or sharing of the idea described in your submission.

Additional evidence is optional. If you would like to include items, such as audit data, photos, DVDs, please send them with your entry.

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Innovating for Life.

Setting up a UK-based perinatal aeromedical transport and retrieval service

The need for a nationally funded and co-ordinated perinatal air transport service for England and Wales is well recognised. Considerable expertise, resources and infrastructure are required to establish a high-quality, safe service. This article describes the development of a national and international, fixed-wing, perinatal air transport and retrieval service based at Oxford Airport.

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Development of perinatal centres across the UK provides co-location of high-risk obstetrics, maternal and fetal medicine alongside neonatal intensive care. The benefits, in terms of outcome and survival, justify transfer of high-risk mothers and neonates to a perinatal centre. However, perinatal services in the UK are continually stretched beyond capacity and this, combined with the unpredictable nature of certain obstetric and neonatal emergencies and increasing centralisation of specialty services, contributes to an increasing need to move patients between facilities.

The recognisable hazards of the transfer of a high-risk patient must be balanced against the potential advantages gained after arrival at the receiving unit. Access to a specialised perinatal air transport capability can help to mitigate potential adverse consequences of either long distance or time-critical transfers to ensure the best possible outcomes for mother and baby. Currently, England, Wales and Northern Ireland do not have the benefit of access to clinically led and nationally funded specialty air transport services for newborn infants or sick mothers. Although the Scottish Air Ambulance Service and the Ministry of Defence have provided significant support to England and Wales over previous years, access to these resources is unsustainable in the future.

This article describes the instigation and

Keywords

aeromedical; air transport; neonatal intensive care; high-risk obstetrics

Key points

Bennett C., Moran L., Collins S. Setting up a UK-based perinatal aeromedical transport and retrieval service. *Infant* 2012; 8(6): 194-197.

1. Increasing centralisation of specialty services and capacity pressures on perinatal centres necessitate the transfer of neonates and obstetric patients between facilities.
2. Access to a safe and high-quality air transport service may provide a clinical advantage in long distance and time-critical transfers.
3. Air ambulance services must comply with both aviation and healthcare regulatory bodies.

FIGURE 1 A fixed-wing air ambulance.

development of a national and international, fixed-wing, perinatal air transport service based at Oxford Airport, complementing an existing paediatric intensive care and adult critical care aeromedical capability. The relationship between the multi-professional facets of the operation and the legal compliance required to deliver a high quality and safe perinatal aeromedical transport and retrieval service are described.

Setting up a perinatal air transport service

The opportunity to develop a perinatal air transport service within the robust infrastructure of an existing and well-regarded air ambulance company based locally in Oxford was fortunate. The operator already had appropriate aviation endorsements, fully owned and highly suitable aircraft, 24-hour logistical support, flight crew and engineering provision. Their cumulative experience (accrued over 27 years), an excess of 16,000 missions and their willingness to invest in the set-up costs of specialty equipment and team training, facilitated the timely development of a high-quality and clinically led service.

Operational and legal considerations

It very quickly became apparent that an air ambulance service is an excellent example of a high stake/high cost operation which is dependent on the optimal deployment of each and every component of the service. A process of continual monitoring, evaluation and the ability to bring about positive change set the framework for quality, safety and value for money (**FIGURE 2**).

Legally, an air ambulance service must comply with both aviation and healthcare regulatory standards. The European Aviation Safety Authority, Joint Aviation Authority (Europe) and Civil Aviation Authority (CAA) govern aviation response. Air ambulance flights (other than primary mission or search and rescue helicopter flights) operate under CAA rules and regulations in the same way as civilian (commercial) public passenger transport. This includes a robust auditing process for all aspects of the service, including airworthiness of the aircraft, engineering and servicing portfolio, pilot training, duty hours and re-accreditation, flight operations, aircraft insurance and safety management systems. There is also a

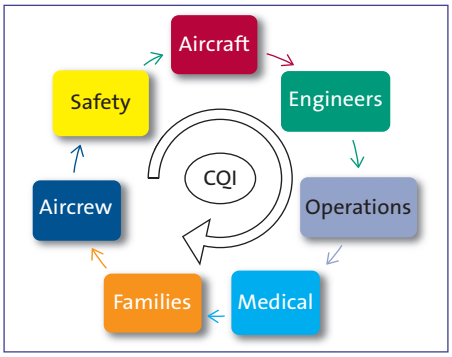

FIGURE 2 Interplay between the elements of an air ambulance service and the need for continuous quality improvement (CQI).

regulatory requirement that all medical equipment taken on board the aircraft is aviation-safe and certified for use on designated aircraft. The service should hold an Air Operations Certificate (AOC) that defines its compliance with CAA regulations, the area of operation for each aircraft type and the accountable, nominated posts of responsibility. The additional benefit of access to on-site engineering allows better fleet management as there is faster turnaround time and routine servicing can be scheduled to complement the demands of the service.

All air ambulance services in England and Wales should be registered with the healthcare regulatory body – the Care Quality Commission (CQC). Criteria for registration are dependent on the type of patients cared for by the service. For those services undertaking critical care transfers this includes transport services and medical advice, treatment of disease and injury plus diagnostic services. This allows for invasive monitoring for the transport of the critically ill patient. CQC compliance incorporates the storage and checking of drugs, maintenance of equipment, cleanliness and infection control policies, staff checks (eg criminal records bureau), patient nutrition and feedback from users and clients. The service should have appropriate personal liability and medical indemnity insurance. It is particularly important to ensure that insurance covers all aspects of clinical work undertaken as many policies specifically exclude care involving labour and delivery, unless separately negotiated.

The European Air Medical Institute (EURAMI) undertakes benchmarking of UK air ambulance services. The service described in this article has been awarded EURAMI's highest-level accreditation – 'Special Care'. The US-based Commission on Accreditation of Transport Services (CAMTS) is gaining in popularity for many UK-based services with provision for independent accreditation of both land and air transport provision.

The service is operational 24/7 with on-call availability of both medical and operations staff. The operations team are responsible for trip planning including landing permits, overflight permissions and airport handling arrangements. All missions are planned to take into account flight and medical crew duty hours as well as entry and exit (customs) regulations. In addition to general trip planning and logistical support, the operations teams can also arrange appropriate land transfer ambulances or replenishment of medical consumables including oxygen, if required during the mission.

Family-centred care

The priority to deliver a family-centred model of care led to the instigation of a parent forum that was involved from the start of service development. Their input has proved invaluable and has supported the endorsement that BLISS has kindly given to the service. It is particularly important to understand a family's wishes to accompany their baby or partner, to be included in their care or to have a photographic diary of the transfer.

Requirements for the service

A review of published literature highlighted the most common clinical indications for air transport in neonatal and high-risk obstetric patients. This enabled definition of the hazards of flight and adverse events and permitted construction of a profile of strategies to manage predictable hazards. The mitigation of flight stresses, including amelioration of noise and vibration, and the effect of altitude (in terms of oxygen availability and expansion of gases) were taken into account. The support received from the Scottish Air Ambulance Service and other aeromedical services overseas was invaluable. The collated information, combined with an understanding of operational logistics and parent feedback, enabled construction of a list of equipment and drugs and training and operational requirements for the service. A scope of care was developed along with standard operational policies (SOPS), clinical guidelines, quality assurance policies and safety frameworks, including an

FIGURE 3 Loading twin infants and equipment on to the aircraft.

application for confirmation of approval from the CAA for the carriage and use of nitric oxide in the air. The service contributes to the medical team clinical governance processes including 'no blame' reporting of incidents or near misses and auditing and monitoring of key performance indicators.

It was clear that the service needed to have capability to provide facilities for *in utero* and *ex utero* transfers, double stretcher capability (for combined neonatal and obstetric transfers or twins) and sufficient space to accommodate the appropriate escorting medical team and a family member, whenever possible. Likely neonatal transfers included long distance repatriation as well as step-up care, including nitric oxide and provision for transfer on extracorporeal membrane oxygenation (ECMO). At present a 60-minute response time can be achieved for the majority of urgent requests; additional senior staff provision would be required to provide a fully immediate service.

Staff selection

The aeromedical team included consultants and senior trainees from neonatal, anaesthetic and high-risk obstetric backgrounds. Senior midwives joined senior neonatal nurses and nurse practitioners, experienced in both intensive care and transport medicine. Personal qualities included good communication skills, the ability to work independently, flexibility and enthusiasm. All staff were encouraged to notify their indemnity authority, hold appropriate personal travel insurance and ensure that they had received vaccination cover appropriate to potential overseas destinations. A suitable uniform was provided.

Training

The learning objectives for the multi-disciplinary perinatal aeromedical training programme were defined. All faculty members undertook CAA-approved crisis resource management (CRM) training with the pilots. The training programme includes aviation physiology, safety around the airport/aircraft, emergency procedures and familiarisation with equipment. Candidates were oriented to the aircraft including the rehearsal of loading and unloading of the equipment and/or patient and response to clinical and in-flight emergencies. A written test assessed knowledge and understanding of fundamental principles of aeromedical transport. A rolling schedule of continuing education was instigated to provide refresher training, *in situ* simulation, enhanced team working skills, familiarisation with new equipment and an opportunity to look at case studies and lessons learnt. Individuals were encouraged to gain familiarity with the management of both obstetric and neonatal emergencies by undertaking external, nationally recognised, resuscitation courses.

Equipment

Three incubator systems were designed and constructed on a LifePort stretcher base and bridge to be fully compliant with CAA regulations. Two of the systems were twin intensive care systems comprising a BabyPod, ventilator, multichannel monitor, capnography equipment and infusion pumps. The other – a neonatal critical care system – included provision for heat and humidification in both the incubator and ventilator circuit and incorporated a Draeger Isolette, ventilator, high-flow circuit, multichannel monitor, six infusion pumps and provision for nitric oxide. The implementation of these systems has been entirely clinically-led to provide an optimal platform for high-quality care equivalent to that provided within the regionally based newborn intensive care services. Obstetric equipment, as advised by the high-risk obstetric co-ordinators included a positioning wedge, delivery pack, a Doppler fetal heart monitoring device and portable ultrasound.

The equipment bags were organised in procedure-related packs and in such a way that the medical flight crew, in accordance with health and safety recommendations, could realistically carry them. Loading equipment onto the aircraft, safe stowage and access in-flight was carefully considered and rehearsed in training (**FIGURE 3**). Patient specific factors and worst-case scenario plans were reviewed. Where possible, equipment, including drug infusions, is secured within the immediate patient environment. Medical equipment dependent on a power supply remains fully charged and ready for deployment, with back-up battery supplies where indicated. In flight, the equipment can generally be run from an AC supply in the LifePort base unit, however all systems should be able to function independently during loading or transfer and in case of power failure. The teams are familiar with the battery life of their respective equipment and also the necessary calculations to ensure adequate supply of compressed air and oxygen. Power plug adaptors and country-specific oxygen connectors are required for international transfers.

Choice of aircraft

The aircraft selected for the service are all fixed-wing rather than rotary-wing (helicopter). They have been selected on the basis of available space to comfortably accommodate:

- patient stretcher
- a medical team, usually comprising a doctor and nurse
- an attending parent or family member
- two pilots
- access to the entire patient

This format may be adjusted slightly if the aircraft is in double stretcher configuration. In general, fixed-wing aircraft provide greater patient access and reduced flight stresses (noise and vibration) compared to the rotary-wing aircraft more

commonly selected for air ambulance missions. The cabin is pressurised and this can be adjusted to fit with a patient's medical needs – something that is not achievable in a rotary-wing aircraft. Fixed-wing aircraft have greater fuel efficiency, speed and range, yielding better performance over longer distances compared to rotary-wing aircraft.

Large loading apertures and height are important safety considerations (**FIGURE 4**). Loading and unloading a patient carries a high risk and any aircraft design that reduces this risk is extremely significant. The aircraft and incubator stretcher systems are fitted with certified restraint systems and the flight crew are responsible for loading appropriate floatation systems for the medical crew and passengers. Additional measures are deployed for the amelioration of adverse flight stresses dependent on the clinical need of the patient.

FIGURE 4 Loading a patient on to the aircraft.

Communication

The medical teams are deployed with a designated mobile phone loaded with all relevant contact numbers. Satellite phones in the aircraft enable the escorting team and supervising consultant to remain in contact throughout the duration of the transfer and also allow liaison with the receiving treatment facility. Teams are equipped with a ground positioning system-tracking device in case of emergencies. All referrals to the service come directly through a single point of contact with the operations team. The mission and medical details are passed immediately to the specialty on-call consultant to provide clinical input to deployment planning from the very outset. The operations team will instigate mission planning and co-ordinate conference calls, as required. These calls include the treating clinician in direct communication with the neonatal and/or obstetric consultant or senior co-ordinator plus a member of the operations team. All senior specialty co-ordinators have received aeromedical training in addition to their professional expertise.

Experience of the service

The service was launched in March 2011 and has completed over 40 missions (50,000 air miles). These have been distributed evenly between national (England, Wales and Scotland) and international destinations. Two-thirds of the transfers have involved high-dependency or intensive care patients. A specialty consultant, present at the airport to ensure that the team were fully briefed prior to departure, supervised (or delivered) all transfers. The median distance for long distance repatriations of preterm infants in the UK was 306 miles (range 157 to 558 miles). International destinations have included the European mainland, the Channel, Canary and Balearic Islands, Cyprus, Sicily, Morocco, Nigeria and Kazakhstan. International transfers have included repatriation to overseas locations as well as retrieval from abroad to a variety of destinations across the UK, Republic of Ireland or other European destinations. Funding sources have included the NHS, travel insurance providers, charitable donation and the Ministry of Defence.

Neonatal indications for aeromedical transfer have included step-up for respiratory problems (including ECMO), congenital surgical, neurosurgical and cardiac anomalies, sepsis and long distance repatriation following preterm delivery. All incubator systems provide access to conventional ventilation modalities plus continuous positive airway pressure (CPAP) and low flow oxygen (including twin capability). The intensive care incubator includes provision for a high-flow therapy heated and humidified system.

Obstetric indications for aeromedical transfer have included threatened premature birth (including multiple pregnancy), antenatal haemorrhage and maternal cardiac disease. Interestingly, there have been no births in flight. One mother gave birth at the referring centre prior to air transfer back to the UK; the majority of mothers in threatened preterm labour delivered with 48 hours of arrival at their destination hospital. Combined perinatal missions have involved co-transfer of sick neonate and high-risk postnatal mother following lower uterine segment caesarean section (LUSCS).

Conclusion

Considerable resources and infrastructure are required to support a high-quality perinatal aeromedical transfer service capable of providing *in utero* transfer, *ex utero* singleton and twin repatriation and intensive care (including nitric oxide and provision for transfer on ECMO).

The need for a nationally funded air transport service for England and Wales is well recognised. It now falls to clinicians to take this forward. Representatives from the Neonatal Transport Group and the British Association of Perinatal Medicine are collaborating with members of the Paediatric Intensive Care Society Transport Group to develop a clinical users service specification for perinatal and paediatric air transport services that can be presented to national commissioners.

Acknowledgements

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Bibliography

Jackson L., Skeoch C. Setting up a neonatal transport service: air transport. *Early Hum Dev* 2009;85:477-81.
Skeoch C., Jackson L., Wilson A.M., Booth P. Fit to fly: practical challenges in neonatal transfer by air. *Arch Dis Child Fetal Neonatal Ed* 2005;90:F456-60.

THROUGHOUT 12/13

Baby Friendly Initiative Training Courses

Breastfeeding and Relationship Building
15-16 November 12
3-4 January 13
Cost: £395

Train the Trainer
13-15 March 13
Cost: £695

Breastfeeding and Lactation Management for Neonatal Staff
27-28 March 13
Cost: £395
Venue: London

Further information on each course and how to book: http://unicefbfi.force.com/signup/EventsHome

THROUGHOUT 12/13

Understanding Newborn Behaviour and Supporting Early Parent-Infant Relationships

Training courses organised by The Brazelton Centre

Newborn Behavioural Observations (NBO)
3-4 December 12

Neonatal Behavioural Assessment Scale (NBAS)
11-12 March 13

Venue: Addenbrooke's Hospital, Cambridge
Contact: info@brazelton.co.uk
Tel: 01223 245791
London, WC1X 8SH
www.brazelton.co.uk

THROUGHOUT 12/13

Child Bereavement UK Workshops

Pregnancy Loss and Death of a Baby – Supporting Parents
26 November 12
Cost: £99
Venue: Manchester

When a Child Dies – Supporting Parents and Family Members
29 November 12
Cost: £99
Venue: Saunderton, Buckinghamshire

The Neonatal Experience – Loss and Grief Without a Bereavement
29 April 13
Cost: £99
Venue: Saunderton, Buckinghamshire
Contact: Training Team
Child Bereavement UK
Tel: 01494 568909
training@childbereavementuk.org
www.childbereavementuk.org

20-21 NOVEMBER 12

Trouble Up North 2012

The annual North Trent and Yorkshire Neonatal Network conference, sponsored by Chiesi Ltd.

Venue: The Waterton Park Hotel, Wakefield, South Yorkshire
Cost: Doctors £270, £135 single day
Nurses £195, £98 single day
Contact: Wendy Wombwell
wendy@cfsevents.co.uk
Registration online:
www.cfsevents.co.uk

23 NOVEMBER 12

Neonatal Transport Group Conference 2012

Hosted by Embrace Transport Service, the programme will include presentations by invited speakers on:

- Chairman's report
- National Dataset and time critical transfers
- Safety in transport
- Combined transport service experience

There will also be transport-related audit, research projects and poster presentations.

Venue: Royal Armouries, Clarence Dock, Leeds
Cost: £100 (including dinner). Team rates available
Contact: claire.harness@sch.nhs.uk
catherine.harrison@sch.nhs.uk

28 NOVEMBER-1 DECEMBER 12

Excellence in Paediatrics

The annual Excellence in Paediatrics (EIP) conference is a vibrant meeting that will explore, discuss and share the latest developments in general paediatrics. It aims to inform international paediatric health care professionals of the latest scientific developments and improve care delivery. Last year's conference attracted over 1,200 delegates from 77 countries.

Venue: Madrid, Spain
Contact: EI Congresses & Communications UK Ltd
Tel: +44 (0) 20 8326 5710
eip@2eic.com
www.excellence-in-paediatrics.org/content/68/conference

3-4 DECEMBER 12

Newborn Behavioural Observations (NBO)

A training course organised by The Brazelton Centre to help understand newborn behaviour and support early parent-infant relationships.

Venue: Addenbrooke's Hospital, Cambridge
Contact: info@brazelton.co.uk
Tel: 01223 245791
sympreg@imperial.ac.uk
www.brazelton.co.uk

3-7 DECEMBER 12

Neonatal Update 2012: The Science of Newborn Care

The annual five-day international meeting organised by Imperial College London regularly attracts a capacity international audience of senior neonatologists and paediatricians.

Venue: BMA House, London
Cost: £630-750
Contact: The Symposium Office
Tel: +44 (0) 20 7594 2150
sympreg@imperial.ac.uk
www.symposia.org.uk

5-6 DECEMBER 12

2012 Baby Friendly Initiative Annual Conference

Organised by UNICEF UK, the BFI conference is the UK's highest-profile event covering infant feeding issues.

Venue: Motorpoint Arena Cardiff
Information:
www.unicef.org.uk/BabyFriendly/Health-Professionals/Conferences/This-years-conference/

6-7 DECEMBER 12

Neonatal and Paediatric Ventilation

This popular course combines lectures with practical workshop sessions on a wide range of topics including:

- Initiation
- Maintenance
- Weaning off assisted ventilation
- Special ventilatory techniques

Venue: Institute of Child Health, London
Cost: £499 for Doctors; £329 for Nurses
Contact: ICH Events
Tel: 020 7905 2699
info@ichevents.com

THROUGHOUT 13

Bliss Study Day: Practical Approaches to Improving Family-centred Care – Part II

7 February 13 – London (Brunei Gallery: School of Oriental & African Studies)
6 March 13 – Manchester (Castlefield Rooms)

Cost: £60 for Nurses, £110 for Doctors
£15 discount for early bird bookings

Contact: katien@bliss.org.uk
Tel: 020 7378 1122
www.bliss.org.uk

13 JANUARY 13

SBK Healthcare Events Conferences in association with *Infant*

Developing the role of the ANNP
22 January 13

Cost: £384 + VAT

Neonatal service improvements
23 January 13

Cost: £384 + VAT

Venue: The Hatton, London

Contact: 01732 897788
www.sbk-healthcare.com

22 JANUARY 13

Ninth Northwest Neonatal Study Day

This study day, organised by Chiesi Connect, is aimed at all neonatal and paediatric medical staff.

Venue: Manchester Conference Centre

Cost: Nurses £70, Doctors £80

Contact: CFS Events Ltd
Tel: 0800 9177 405
wendy@cfsevents.co.uk
www.cfsevents.co.uk

25 JANUARY 13

New Ideas on Old Favourites

The sixth Annual Perinatal Conference is a collaboration of the Midlands and East Neonatal and Perinatal Networks. Registration is free for staff in the hosting networks and £50 for external delegates.

Poster submissions by 30 November 2012

Venue: Holywell Park, Loughborough University

Contact: Julie Peake
Neonatal Networks Administrator
London Road Community Hospital
Derby DE1 2QY
Tel: 01332 254657
juliepeake@nhs.net

1 FEBRUARY 13

Achieving Improved Outcomes in Neonatology – A Practical Approach

Organised by CFS Events on behalf of Cardiff University.

Venue: Hilton hotel, Cardiff

Cost: Nurses £65, Doctors £85

Contact: CFS Events Ltd
Tel: 0800 9177 405
wendy@cfsevents.co.uk
www.cfsevents.co.uk

11-13 FEBRUARY 13

Neonatal Cranial Ultrasound

Date for the diary. Organised by The Symposium Office on behalf of Imperial College London.

Venue: BMA House, London

Contact: The Symposium Office
Tel: +44 (0)20 7594 2150
sympreg@imperial.ac.uk
www.symposia.org.uk

25 FEBRUARY 13

National Developments in Neonatal Palliative and End of Life Care

The third annual Child Bereavement UK conference.

Venue: Thistle Marble Arch, London

Cost: £95 (£75 before 5 December 2012)

Contact: Tel: 01494 568911
www.childbereavementuk.org
conferences@childbereavementuk.org

31 MAY 13

SNNG Annual Conference

Scottish Neonatal Nurses Group annual conference and exhibition. Date for your diary. More details in a later issue.

Contact: www.snng.org.uk

5-8 JUNE 13

Sixth Europaediatrics jointly held with the RCPCH Annual Conference

Date for the diary. For the first time ever, Europaediatrics, the biennial conference of the European Paediatric Association, will be held jointly with the RCPCH's Annual Conference.

Venue: Glasgow, Scotland

Register your interest at:
http://www.rcpch.ac.uk/events/annual-conference

12-15 JUNE 13

24th Annual Meeting of the European Society of Paediatric and Neonatal Intensive Care (ESPNIC)

The multidisciplinary setting offers doctors and nurses from around the world the opportunity to influence their specialty by exchanging ideas and expertise with colleagues, hearing presentations by internationally acclaimed experts and participating in a highly innovative scientific programme.

Abstract submission deadline: 16 January 2013.

Venue: Rotterdam, Netherlands

Contact: Kenes International
Tel: +41 22 908 0488
espnic@kenes.com
http://espnic2013.kenes.com/

1-2 JULY 13

Reason Conference

Annual conference for neonatal nurses and doctors. Date for the diary – more information next issue.

Venue: University of Warwick, Coventry

Contact: CFS Events Ltd,
Unit E Mindenhall Court,
17 High Street,
Stevenage, Herts, SG1 3UN
wendy@cfsevents.co.uk
www.cfsevents.co.uk

5-8 SEPTEMBER 13

Eighth International Neonatal Nursing Conference

Organised by The Council of International Neonatal Nurses (COINN), the international conference focuses on neonatal nursing and aims to translate latest findings into clinical practice. The programme suits specialist and general nurses.

Abstract submission opens 5 November 2012.

Venue: Belfast, Northern Ireland

Contact: Kenes UK Ltd
Tel: +44 (0) 207 383 8037
coinn@kenes.com
www.kenes.com/uk
http://coinn2013.com/

If you would like to promote a study day or conference on this page free of charge then email the details to lisa@infantgrapevine.co.uk

ICON – 24/7 clinical support for Dräger customers

Dräger's proven technology provides the highest quality ventilation for patients. To complement their devices and to give the best added value, Dräger is pleased to offer its customers a free-of-charge 24/7 online and telephone-based educational resource called Intensive Care On-line Network (ICON).

ICON is available at no cost to Dräger customers using the following technology:

- Babylog VN500
- Babylog 8000
- Caleo incubator
- Jaundice management
- Adult ventilators

For information or to register, email: med-marketing.uk@draeger.com

The Giraffe Stand-alone Infant Resuscitation System

The Giraffe Stand-alone Infant Resuscitation System from GE Healthcare gives fast and easy access to a fully integrated solution for the resuscitation of newborns. Easily portable, it can be set up virtually anywhere it is needed, from labour and delivery to NICU or the well-baby nursery. Designed to meet the latest resuscitation guidelines, the unit supports:

- Both T-Piece and bag and mask resuscitation
- Effective airway management with fully integrated suction
- Monitored delivery of positive pressure during ventilation
- Blended air/O_2 gases needed during resuscitation and stabilisation.

The system combines all essential capabilities in a single, compact unit, making it perfect for high-risk deliveries, transport and bedside caregiving. It is easy to set up and keeps the care area clutter free by having all necessary components of resuscitation in one place. The system is available on a custom designed roll-stand or can be mounted on an incubator or transport device.

Contact: Richard Sleath, richard.sleath@med.ge.com, 01707 263570

Flow mode addition to SLE1000

The SLE1000 is a sophisticated, yet easy to use CPAP delivery system developed to treat newborns and infants.

The system can be used in servo-controlled mode giving practitioners the freedom to accommodate the unique care needs of the smallest patients. A new manual flow mode has been introduced – an ideal solution for providing a fixed flow to the patient, for use in the weaning process or regular CPAP application, providing a stable flow with minimal alarms. This manual flow mode operates like a conventional flow driver and can deliver flows between 2 and 12L/min.

The bonnet, nasal cannulae and nasal mask designs work together to help minimise the need for adjustments during therapy, allowing staff to spend more time caring for their patients and less time tending to the device.

For further information contact: SLE, 020 8681 1414, sales@sle.co.uk

Made in the UK – the upgraded Inspiration Cot by Sidhil

2012 has already seen a significant rise in sales for Sidhil's Inspiration Cot, the only one still produced in volume entirely in the UK. Designed to meet a comprehensive range of paediatric requirements, the product brings together a range of innovative functions with bright and attractive colours, making the cot particularly appealing for use in paediatric healthcare.

The latest enhancements include a redesigned handrail for improved ease of use, achieving improved strength with reduced weight. The cot also offers an optional cardiopulmonary resuscitation. system as well as special hinged sections in both head and foot ends to allow easy passage of IV lines and equipment. A traction set is also now available, designed specifically for use with the cot.

The cot features an electrically operated variable height tilting mattress platform with a height range of 535-870mm, allowing the carer to either stand or sit while administering treatment. This is complemented by unique drop-down telescopic design side rails, complete with removable head and foot ends, which allow easy access from all four sides.

For more information contact: Sidhil Ltd, 01422 233 000, www.sidhil.com

Trouble Up North 2012

NHS
North Trent Neonatal Network

YORKSHIRE NEONATAL NETWORK
PARTNERS IN CARE

North Trent and Yorkshire
Neonatal Network Conference

20th - 21st November 2012

The Waterton Park Hotel Wakefield,
West Yorkshire, WF2 6PW

Topics:

- Feeding Issues
- Death / Dying
- Substance Misuse and the Neonate
- Current Topics

Registration options	Doctor before 23:59 pm 23rd September	Doctor after 23:59 pm 23rd September	Nurse/Health professional before 23:59 pm 23rd September	Nurse/Health professional after 23:59 pm 23rd September
Attendance to full meeting, including conference dinner	£270 inc. vat	£290 inc. vat	£195 inc. vat	£215 inc. vat
Single day only, Conference dinner not included	£135 inc. vat	£155 inc. vat	£98 inc. vat	£118 inc. vat

Additional options:
Conference dinner tickets: £50 inc. vat

Register online at www.cfsevents.co.uk

Payment by American Express: If you would like to pay by American Express you can register for the meeting and pay by telephone. Please call Wendy on 0800 9177405.
If paying by cheque, please make payable to CFS Events Ltd. Please send cheque payments to:
Wendy Wombwell, CFS Events Ltd, Unit E, Mindenhall Court,
17 High Street, Stevenage, SG1 3UN
Tel: 0800 9177405 Fax: +(0) 44 1438 751520
Email: wendy@cfsevents.co.uk

Chiesi

This educational meeting is funded by Chiesi Limited and organised by CFS Events, on behalf of Chiesi
CHCUR20120113 - February 2012

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caffeine citrate

Treatment of primary apnoea of premature newborns

Peyona® 20 mg/ml solution for infusion and oral solution (caffeine citrate). Please refer to Summary of Product Characteristics (SmPC) before prescribing
Prescribing Information. Presentation Peyona® is a clear, colourless, aqueous solution at pH=4.7. Each 1 ml ampoule contains 20 mg of caffeine citrate (20 mg of caffeine citrate is equivalent to 10 mg caffeine). **Indications** Treatment of primary apnoea of premature newborns. **Dosage and Administration** The recommended dose regimen in previously untreated infants is a loading dose of 20 mg caffeine citrate per kg body weight administered by slow intravenous infusion over 30 minutes, **using a syringe infusion pump** or other metered infusion device. After an interval of 24 hrs, maintenance doses of 5 mg/kg body weight may be administered by slow intravenous infusion over 10 minutes every 24 hrs. Alternatively, maintenance doses of 5 mg/kg body weight may be administered by oral administration, such as through a nasogastric tube every 24 hrs. The dose expressed as caffeine base is one-half the dose when expressed as caffeine citrate (20 mg caffeine citrate are equivalent to 10 mg caffeine base). In preterm infants with insufficient clinical response to the recommended loading dose, a second loading dose of 10-20 mg/kg maximum may be given after 24 hrs. Higher maintenance doses of 10 mg/kg body weight could be considered in cases of insufficient response. Where clinically indicated, caffeine plasma levels should be monitored. The diagnosis of apnoea of prematurity may need to be reconsidered if patients do not respond adequately to a second loading dose or maintenance dose of 10 mg/kg/day. When given IV, caffeine citrate should be administered by controlled IV infusion. Caffeine citrate can be either used without dilution or diluted in sterile solutions for infusion such as glucose 50 mg/ml (5%), or sodium chloride 9 mg/ml (0.9%) or calcium gluconate 100 mg/ml (10%) immediately after withdrawal from the ampoule. Caffeine citrate can be administered by intravenous infusion and by the oral route. The product must not be administered by intramuscular, subcutaneous, intrathecal or intraperitoneal injection. *Duration of treatment:* The optimal duration of treatment has not been established. Treatment is usually continued until the infant has reached a post-menstrual age of 37 weeks, by which time apnoea of prematurity usually resolves spontaneously. Caffeine citrate administration should be stopped when the patient has 5-7 days without a significant apnoeic attack. If the patient has recurrent apnoea, caffeine citrate administration can be restarted with either a maintenance dose or a half loading dose, depending upon the time interval from stopping caffeine citrate to recurrence of apnoea. Because of the slow elimination of caffeine in this patient population, there is no requirement for dose tapering on cessation of treatment. As there is a risk for recurrence of apnoeas after cessation of caffeine citrate treatment monitoring of the patient should be continued for approximately one week. **Contraindications** Hypersensitivity to active substance or excipients. **Special Warnings and Precautions** Other causes of apnoea should be ruled out or properly treated prior to initiation of treatment with caffeine citrate (see SmPC for full details). Baseline plasma concentrations should be measured in neonates born to mothers who consumed large quantities of caffeine prior to delivery or newborns previously treated with theophylline. Extreme caution in newborns with seizure disorder. Caffeine has been shown to increase heart rate, left ventricular output, and stroke volume therefore caution should be exercised in newborns with known cardiovascular disease. Caution in newborns with impaired renal or hepatic function or suffering gastro-oesophageal reflux. Careful monitoring for development of necrotising enterocolitis. Caffeine citrate causes a generalised increase in metabolism, which may result in higher energy and nutrition requirements during therapy. The diuresis and electrolyte loss induced by caffeine citrate may necessitate correction of fluid and electrolyte disturbances. **Interactions** Inter-conversion between caffeine and theophylline occurs in preterm neonates; these active substances should not be used concurrently. Caffeine has the potential to interact with active substances that are substrates for CYP1A2, inhibit CYP1A2, or induce CYP1A2. However, caffeine metabolism in preterm neonates is limited due to their immature hepatic enzyme systems (see SmPC for full details). **Pregnancy and Lactation** Caffeine in animal studies, at high doses, was shown to be embryotoxic and teratogenic. These effects are not relevant with regard to short term administration in the preterm infant population. Caffeine is excreted into breast milk and readily crosses the placenta into the foetal circulation. Breast-feeding mothers of neonates treated with caffeine citrate should not ingest caffeine-containing foods, beverages or medicinal products containing caffeine (see SmPC for full details). **Undesirable effects** The known pharmacology and toxicology of caffeine and other methylxanthines predict the likely adverse reactions to caffeine citrate. Effects described include central nervous system (CNS) stimulation such as irritability, restlessness and jitteriness, and cardiac effects such as tachycardia, hypertension and increased stroke volume. These effects are dose related and may necessitate measurement of plasma levels and dose reduction. The adverse reactions described in short and long term published literature are: *Common*: infusion site phlebitis, infusion site inflammation; *Rare*: hypersensitivity reaction; *Not known*: sepsis, hypoglycaemia, hyperglycaemia, failure to thrive, feeding intolerance, irritability, jitteriness, restlessness, brain injury*, convulsion*, deafness* (*more frequent in placebo group), tachycardia, also associated with increased left ventricular output and increased stroke volume, regurgitation, increased gastric aspirate, necrotising enterocolitis (see SmPC for full details), urine output increased, urine sodium and calcium increased, haemoglobin decreased, thyroxine decreased. Caffeine may suppress erythropoietin synthesis and hence reduce haemoglobin concentration with prolonged treatment. Transient falls in thyroxine (**T4**) have been recorded in infants at the start of therapy but these are not sustained with maintained therapy. **Pharmaceutical Precautions** None. After opening the ampoule, the product should be used immediately. For storage conditions of the diluted medicinal product see SmPC. **Special precautions for disposal and other handling** Aseptic technique must be strictly observed throughout handling of the medicinal product since no preservative is present. For single use only. Discard any unused portion left in the ampoule. Do not save unused portions for later administration. No special requirements for disposal. **Legal category** POM. **Packs and Prices** Basic NHS price of £172.50 per pack of 10 x 1 ml ampoules. **Marketing Authorisation Number** EU/1/09/528/002. Full prescribing information is available from the **Marketing Authorisation Holder** Chiesi Limited, Cheadle Royal Business Park, Highfield, Cheadle, SK8 3GY. **Date of Preparation** April 2012.

Adverse events should be reported. Reporting forms and information can be found at www.mhra.gov.uk/yellowcard. Adverse events should also be reported to Chiesi Limited. (address as above) Tel: 0161 488 5555

Chiesi
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Date of preparation: June 2012 Code CHPEY20120643