Abstracts from the first UK Neonatal Transport Interest Group Conference

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Use of mobile inhaled nitric oxide during transport of neonates referred for extra corporeal life support: West of Scotland experience over a three year period

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Background

Inhaled nitric oxide (iNO) is an established therapy for infants with persistent pulmonary hypertension of the newborn. Glasgow is one of four Extra Corporeal Life Support (ECLS) centres within the UK, and the West of Scotland neonatal transport service frequently retrieves infants over long distances necessitating air transport. The service has the capacity to transfer with iNO using portable iNO cylinders specifically certified for safe operation at altitude. We report our experience with iNO during air and road transport of neonates to an ECLS centre over a three year period, discussing its practicalities, efficacy, and safety.

Methods

A retrospective case note review of the West of Scotland Neonatal Transport Database was performed of all infants transported to Yorkhill Hospital, Glasgow, UK, for consideration of ECLS. Extensive data on clinical condition was collected at referral, during transport, and on arrival at ECLS centre. Paired t test was used to compare referral and arrival characteristics. All analyses were performed using SPSS.

Results

Fifty-two infants were referred to the Glasgow ECLS between March 2003 and March 2006, 49 of whom were subsequently deemed suitable for transfer. Of these, 18 infants (37%) had iNO commenced by the referring centre, the remainder had iNO initiated by the transport team for all but one case. Overall there was a significant improvement in PaO_2, and significant reductions in fractional inspired concentration of oxygen (FiO_2) and oxygen index (OI) after transport (PaO_2: 7.19Kpa referral vs. 9.78Kpa arrival, p=0.02; FiO_2: 0.96 referral vs. 0.90 arrival, p= 0.01; OI: 33 referral vs. 25 arrival, p= 0.01).

For all transfers nitrogen dioxide levels never went above 2ppm, and all methaemaglobin levels pre departure, although not always checked, were less than 2%. There were also no adverse clinical reactions after commencement of iNO.

Conclusions

iNO significantly improves oxygenation in infants transported for ECLS consideration, and has a good safety profile. This reinforces the findings of previous studies which demonstrate efficacy of iNO during neonatal and paediatric transports. ■

A prospective review of adverse incidents during inter-hospital transfers of neonates by a dedicated neonatal transfer service

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Background

Adverse incidents can easily occur during the inter-hospital transfer of ill children for intensive care. There is evidence that the provision of a specialised retrieval team can reduce the number of adverse events during inter-hospital transfer of critically ill children. With regards to inter-hospital transfer of neonates, a recent study looked at critical incidents during the transfer of sick neonates between hospitals in the former Northern Health Region. There is, however, a lack of prospective data in the literature with regards to adverse incidents occurring during the transportation of neonates between hospitals, and particularly by a dedicated neonatal retrieval service.

Aims

- To quantify and categorise the types of adverse incidents occurring during emergency inter-hospital transfers of neonatal infants by a specialised neonatal retrieval team.
- To assess the risk level of these incidents.

Methods

A prospective study was conducted over a six month period (from 12th September 2005 to 11th March 2006) to review

all adverse incidents which occurred during emergency inter-hospital transfers by the London Neonatal Transfer Service. All staff members were asked to document on a specific form any occurrences that led to a less than perfect transfer. Each form was subsequently checked to ensure that no incidents were missed. The incidents were then categorised based on the retrieval team model described in the Paediatric & Neonatal Safe Transfer and Retrieval Course (PNeoSTaR). The risk level of each incident was measured using a modified risk assessment score.

Results

During the six month period, 346 emergency transfers were carried out by the London Neonatal Transfer Service. 125 transfers (36.1%) had at least one adverse incident. There were 205 adverse incidents in total. The median corrected gestational age of infants transferred was 32 weeks + 6 days (range 23 weeks to 9 months post-term), and the median weight was 1545g (range 480g to 7000g). The majority of adverse incidents (113 incidents, 55%) occurred while the team were at the referring hospital and during transportation to the receiving hospital. The majority of adverse incidents (71) occurred due to problems with preparing the patient for transfer at the referring unit. A significant number of incidents (50) occurred due to problems with communication at various stages of the transfer process.

There were six incidents which could potentially cause major harm, 23 moderate incidents, and 32 minor incidents. 143 incidents had insignificant impact on the patient. When considering the likelihood of recurrence of these incidents, eight incidents had a moderate risk score (all six major incidents were in this category), 51 incidents were low risk, and 145 incidents were very low risk.

Conclusions

Adverse incidents can easily occur during neonatal transfers, even if performed by a dedicated transfer service. Certain stages of the transfer process are more prone to incidents than others. The majority of incidents did not pose a significant risk to the patient. Nevertheless, there remains a proportion of incidents which could result in either temporary or permanent harm to the patient, even if the likelihood of recurrence is low overall.

To minimise the occurrence of adverse incidents, a transfer service should have regular audit of its practice, a risk management process to reduce the recurrence of each incident, and a regular educational programme for staff incorporating the principles of safe transfer. ■

Neonatal transport practitioners: A viable alternative to traditional transfer teams?

Background

The majority of UK neonatal transfer teams are staffed by a combination of physicians, nurse practitioners and neonatal nurses. All junior medical staff change on a regular basis and this, combined with European Working Time Directive regulations, limits their exposure to transfers, requiring longer periods of supervised practice. The generic nature of specialist registrar training also brings the relevance of neonatal transfers as 'training' into question. Neonatal nurses are in short supply and depleting units undertaking transfers of nurses is clearly undesirable. ANNPs and consultants are too expensive to cover transfer services around the clock. Alternative staffing arrangements are clearly required. This paper describes a pilot programme for training paramedics to undertake neonatal transfers and their subsequent introduction to clinical practice.

Methods

Funding was obtained from the NHS Modernisation Agency. Candidates were selected using a behavioural-based interview technique, with weighting for particular domains. Successful candidates undertook a part time training programme (600 hours), based in the neonatal unit, over nine months. This comprised formal teaching and supervised practice in NICU, SCBU and transfer environments. Course assessment was undertaken using a combination of OSCE stations and a competency-based portfolio.

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Results

Seven of the eight participants successfully completed the course. Initial interview rankings closely predicted subsequent performance both during the course and at final assessment. Following a period of preceptorship in the transfer environment combined with regular periods of practice within the NICU, the practitioners are now undertaking solo transfers of increasing complexity alongside their regular work. The programme and subsequent practice implementation is currently being assessed as a separate research exercise. Preliminary results indicate that integration with existing neonatal staff has been successful and the practitioners feel very supported both in their training and practice environments.

Conclusions

We have demonstrated that it is possible to utilise this model for neonatal transfers and integrate it into existing neonatal and ambulance services. Key to the success are student selection, support during training and multidisciplinary commitment. This has major implications for the potential development of transfer services across the UK. ■

Ambulance car seat challenge audit

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Background

Physiological monitoring studies indicate that some preterm infants experience episodes of oxygen desaturation, apnoea, or bradycardia when seated in standard car safety seats. The American Academy of Pediatrics (AAP) recommends that all preterm infants should be assessed for cardiorespiratory stability in their car seat prior to discharge – the "car seat challenge". This screening test is increasingly being used in UK neonatal units.

Despite many unit-based physiological monitoring studies, no evidence exists on cardiorespiratory status of these infants in the moving vehicle. We describe the first 21 infants of an ongoing audit which assesses the cardiorespiratory stability of infants in a car seat in transit, aboard a road ambulance, transferred by the West of Scotland Neonatal Transport Service (Nets).

Methods

Infants who required transfer and met Nets inclusion criteria for car seat transfer were included in the study. Heart rate and oxygen saturation were monitored for the duration of ambulance motion. Data collected included clinical history, feeding, and length of journey. Any events were recorded as per Princess Royal Maternity Hospital Car Seat Challenge Protocol, including sleep/wake status, and positioning.

Results

Of the 21 infants transferred, 14 were born preterm with an average corrected gestational (CGA) age of 41 weeks and weight of 3.07kg on day of transfer. Of the seven term infants average weight was 3.69kg on day of transfer. Average journey time was 35 minutes and typically involved a combination of city roads and motorway. Fifteen infants had all passed a unit car seat challenge first time prior to the ambulance car seat challenge.

Overall 20 of the 21 infants passed the ambulance car seat challenge. Good head and airway position were maintained throughout for all infants. The one failure (seizure and desaturation) was for an ex-prem with a CGA of 38 weeks and weight of 2.53kg who had passed a unit car seat challenge five days previously. The failure was thought to be related to a recent onset infection.

Conclusions

Preliminary findings from this audit indicate that good head and airway position is maintained throughout vehicle transport and that infants who pass the unit car seat challenge are also stable in vehicle transport. Suggestions for future research are discussed. ■

Nasal continuous positive airway pressure during neonatal back transfer

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Introduction

Neonatal networks and dedicated intensive care retrieval systems are evolving in the United Kingdom. Early back transfer to referring level 2 units [as defined by the British Association of Perinatal Medicine (BAPM)], could facilitate more efficient use of tertiary level intensive care cots. Use of nasal continuous airway pressure (nCPAP) during neonatal transportation may allow earlier back transfer of nCPAP dependent babies who would otherwise have to remain at a tertiary centre.

Methods

In a prospective study between July 2003 and May 2005, we have used nCPAP as a means of respiratory support for nCPAP-dependent infants during neonatal transfer to base/home hospitals. Two weeks later, a telephone call was made to the accepting units to ascertain if there had been any clinical deterioration following transfer. The study group was compared with a historical cohort of nCPAP-dependent infants who had to wait to undergo transfer when they were no longer nCPAP dependent.

Results

We compared 41 infants in our study group with 58 historical controls. The groups had a median birth gestation of 26 weeks (25-28) and 27 weeks (25-29) respectively, which were not statistically different. We transferred smaller and younger babies on nCPAP with a median weight of 920g (739-1073g) vs. 1128 gms (832-1650); p value< 0.001. Median post menstrual age at transfer on nCPAP was 29 weeks (28-31) vs. 32 weeks (30-35); p< 0.001.This group transferred on nCPAP spent less time on our neonatal unit: 8 days (3-12) vs. 15 days (6-33). There were no reports of clinical deterioration that could be attributed to the timing or mode of transfer.

Conclusion

Transfer of selected small infants using nCPAP appears to be practical, safe and could ensure intensive care cot availability. Our study led to the development of a pathway to select babies who can be safely transferred on nCPAP from our tertiary centre at Hope Hospital to their base hospital. ■

Critical dependence of acetate thermal mattress on gel activation temperature

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Background

Sodium acetate gel mattresses provide an active method of patient warming through release of latent heat of crystallisation. They can be used as an adjunct to incubator care or as an exclusive heat source.

Objective

To determine activation temperatures of the Transwarmer™ mattress needed to achieve plateau temperatures of 38-42°C, and to monitor its effectiveness in clinical use.

Design and setting

In vitro testing of mattress temperature. Audit of use by a neonatal transport team in addition to incubator care.

Methods and outcome measures

Transwarmer™ mattresses were activated at initial temperatures ranging from 5 to 40°C. Mattress temperature was recorded up to four hours to determine peak and plateau temperatures. An audit of patient temperature during 64 neonatal transfers evaluated the effect of specific warming measures on change in patient temperature during the transfer process.

Results

Mattress starting temperature was strongly correlated with peak and plateau temperature ($r=0.99$, $p<0.001$). To achieve the target temperature of 38-42°C, the Transwarmer™ mattress requires activation between 19.2 and 28.3°C. A temperature of 37°C could be generated by activation at 17°C. Audit data demonstrated that use of the mattress was associated with a 1.03°C increase in patient temperature above that achieved by incubator care alone (95% CI 0.54 to 1.52°C, $p<0.001$). Temperature increase varied widely in individual patients in whom the mattress was used (between -0.2°C and +2.7°C).

Conclusions

Although this mattress can be effective in raising patient temperature during neonatal transport, safe use is critically dependent on gel temperature at the point of activation. ■

A comparison of end-tidal and arterial measurements of carbon dioxide on neonatal transport

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Background

Carbon dioxide monitoring of the ventilated neonate usually involves frequent venepuncture. This remains possible during continuing intensive care on neonatal transport by use of the i-STAT portable clinical analyser. Given the practical issues faced on transport of the ventilated neonate, a reliable method of continuous carbon dioxide monitoring is highly desirable. The west of Scotland neonatal transport service uses end-tidal carbon dioxide monitoring and this study was performed to assess its reliability. A previous study suggested unreliability.

Methods

A prospective study was performed involving nine ventilated neonates undergoing transport by the west of Scotland neonatal transport service. They were all enrolled with written parental consent. Paired recordings between $etCO_2$ and the unit gas analyser were taken on departure and on arrival. Paired recordings were taken between $etCO_2$ and the i-STAT analyser on transport. Correlation and differences were analysed using pearson correlation, Bland Altman plots and paired t-test performed using SPSS.

Results

Nine infants were enrolled in the study with a maximum of 12 paired recordings between $etCO_2$ and unit gas machine $paCO_2$, and nine paired recordings between $etCO_2$ and iSTAT $paCO_2$. etCO2 correlated strongly with unit gas machine $paCO_2$ ($r = 0.96$; $p = 0.00$) and iSTAT $paCO_2$ ($r = 0.81$; $p = 0.01$). On paired t test there were no significant differences between $etCO_2$ and unit gas machine $paCO_2$ or iSTAT $paCO_2$.

iSTAT $paCO_2$ correlated strongly with gas machine $paCO_2$ ($r = 0.88$; $p = 0.00$). On paired t test there was no significant difference between iSTAT $paCO_2$ and unit gas machine $paCO_2$.

On Bland Altman plots 83% of $etCO_2$ recordings were within 1 Kpa of paired gas machine $paCO_2$, and 89% of iSTAT CO_2 recordings were within 1 Kpa of paired gas machine $PaCO_2$.

Conclusions

End tidal CO_2 monitoring and iSTAT analysis are reliable methods of assessing ventilation on transport. Both remain in use by the west of Scotland neonatal transport service. ■

A prospective audit of antenatal transfers across the Greater Manchester MCN

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Objectives

To examine the totality of perinatal transfer across Greater Manchester in relation to a series of set aims and standards.

Design

Prospective audit of antenatal transfers arranged and completed by a centralised transport service over a 12 month period.

Setting

The Greater Manchester Strategic Health Authority is the largest in the country with 34, 463 deliveries per annum. The audit examined all the transfers between the 13 main hospitals in the region, two of which are tertiary centres with one providing fetal medicine.

Methods

Data sources: Audit form returns from participating units and data routinely collected by the North West Perinatal Cot Bureau. Audit data was validated by the audit coordinator through a series of visits to each unit to cross reference the unit data with audit data.

Main outcome measures

The frequency and clinical appropriateness of antenatal transfers. Reasons for transfer, and reasons for failure to achieve a transfer. The use of tocolytics and steroids in preparation for *in-utero* transfer.

Results

During the audit period there were 345 requests for *in-utero* transfer, 290 of which were arranged and completed. In total there were 8.5 antenatal transfers per 1000 deliveries and 18.2 postnatal transfers per 1000 deliveries in Greater Manchester over the audit period. 261 antenatal transfers were completed as a result of threatened or actual premature labour, with 19 being transferred due to pre-eclamptic toxaemia (PET). Of the 345 requests for *in-utero* transfer, 55 were declined, the main reason being that transfers were deemed inappropriate as a result of consultant to consultant discussion. Of the 290 transferred, 27% had completed a full course of steroids at least 24 hours prior to transfer, while only 13% had been given a first dose of steroids prior to transfer. Analysis of cervical dilation and contraction frequency before and after transfer indicates that the vast majority of women transferred were not in advanced labour – the median cervical dilation before and after transfer was 0cm. Only 1 patient who presented with threatened or actual pre-term labour progressed rapidly, delivering within 1 hour of arrival at the accepting unit.

Conclusions

Analysis of the audit data has highlighted that antenatal transfers in Greater Manchester were managed safely as the vast majority of women did not present in advanced labour. It is postulated that the service policy for obstetric consultant to consultant discussion prior to transfer has assisted in preventing any clinically inappropriate transfers This may however result in a lower ratio of antenatal to postnatal transfers than elsewhere, the ratio of antenatal to acute postnatal transfers was 1.2:1. The audit data has demonstrated the success of a centralised cot bureau service but has also highlighted possible areas for improvements in clinical practice, such as the administration of antenatal steroids prior to transfer. The audit data has also quantified the current activity for antenatal transfers in Greater Manchester, highlighting the importance of auditing antenatal and postnatal transfers together elsewhere in the UK. ■

An audit of postnatal transfers in the Greater Manchester MCN: Effects of introducing a dedicated network based team

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Objectives

A prospective audit of postnatal transfers across the North West Neonatal Network

Design

A prospective audit of neonatal transfers arranged and completed by the Greater Manchester Neonatal Transport Service (GMNeTS) over the first 12 months.

Setting

Transfers to and from the 13 main hospitals in the Greater Manchester area that provide neonatal care, two of which are tertiary centres.

Data sources

Audit form returns from participating units and data routinely collected by the North West Perinatal Cot Bureau. The data was compared to a 12 month regional survey in 2000 and a smaller in-house audit in 2002.

Main outcome measures

The characteristics of the babies transferred, the response

times of the transport team and the distribution of timing of transports. The reasons, frequency and clinical appropriateness of neonatal transfers. Stabilisation and physiological changes during transfer.

Results

A total of 628 neonatal transfers were completed by the transport service – 240 acute, 388 non acute planned transfers. The rate of postnatal transfer was similar to that seen previously (20.3 per thousand live births in 2000) with over 90% of acute transfers across the network being undertaken by GMNeTS. The commonest cause of acute postnatal transfer was the need for specialist NICU, followed by neonatal surgery. Eighty per cent of all acute transfers were led by the registrar however the number of ANNP-led acute transfers increased from 2 in 2000 to 34 in 2005. For acute transfers, the mean time to locate a cot was 31 minutes however the time taken for departure of the transport team increased to 135 minutes. The mean stabilisation time was 93 minutes compared to 111 minutes in 2002. The number of acute referrals at weekends remained similar however the proportion of daytime referrals reduced from 75% in 2000 to 52% in 2005. The physiological parameters showed an overall trend of improvement prior to and throughout transfer compared to our previous audit in 2002, although a complete dataset was obtained in only 60% of acute transfers.

Conclusions

The data demonstrates consistently higher rates of postnatal transfer within the Greater Manchester conurbation over the last five years compared to other published studies in the UK. The introduction of a dedicated team and perinatal cot bureau has not increased transfer requests but they have become more evenly distributed across the 24 hour period facilitating the transfer of sick neonates at any time of the day. The service has undertaken a very high proportion of acute transfer requests from the network but has seen a significant increase in the dispatch time due to a variety of factors including ambulance service constraints. Despite a slight reduction in stabilisation time the physiological stability improved in transit suggesting a safe, high quality approach to postnatal transfer. The ongoing developments in ANNP-led transport have provided a modest impact which will increase with the number and experience of the ANNPs. ■