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Nasal High-flow During Neonatal and Infant Transport In Victoria, Australia

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The Paediatric Infant and Perinatal Emergency Retrieval (PIPER) service based in Melbourne, Victoria performs approximately 2800 transfers of neonates and young infants annually, of which >1100 are emergency transfers.

Respiratory distress is common in this population, and treatment has traditionally been provided with nasal continuous positive airway pressure (CPAP), or endotracheal mechanical ventilation (MV).

Heated, humidified nasal high-flow (nHF) treatment is increasingly popular in neonatal care,(1) including in tertiary and non-tertiary centres in Victoria. We introduced a guideline for nHF treatment during transport in July 2014. Use of nHF was deemed appropriate for stable infants established on nHF, and for preterm infants beyond the first days of life who were recommenced on respiratory support. nHF was not recommended as primary support for early respiratory distress, but if already commenced by the referring hospital, nHF could continue at the discretion of the transport consultant. As our team transfers infants beyond the neonatal period (up to 6 kg in weight), nHF was also used for infants with bronchiolitis, consistent with practice in another Australian paediatric transport service,(2) and tertiary paediatric hospitals in Melbourne.

We aimed to audit the use of nHF during transport, whether nHF was successfully applied throughout transport, and whether any adverse events occurred.

Ethical approval was provided by the Royal Children's Hospital, Melbourne (No. 34172). All infants for whom nHF was applied by the transport team (at the referring hospital or during transport) were recorded. Data were collected during or soon after transfer. Successful transfer on nHF was defined as arrival at the receiving hospital without any change to respiratory support mode.

Transfers were classified as either emergency transfers, or planned elective transfers, as triaged by the transport consultant. For emergency transfers a routine follow-up phone call was made within 72 hours to document any changes in clinical status.

Data were analysed using Microsoft Excel (Microsoft Office 2016) and are reported as mean (SD), median (interquartile range), or number (%) as appropriate.

The audit was conducted from July 2014 until December 2016, during which time 1684 infants receiving respiratory support were transferred. nHF was initiated on 118 occasions (7%), including 101 emergency transfers (86%), and 17 elective transfers (14%). Infant demographics and outcomes are shown in Table 1. Infants were of median birth gestational age (GA) 37 weeks and median birth weight 2680 g. At transfer, most infants were >40 weeks post-menstrual age and >3 kg in weight.

In 79% of cases nHF was commenced by the referring hospital, prior to transport team arrival. During four emergency transfers (3%), the transport team chose to change from nHF to CPAP prior to departure. In all 114 infants in whom transfer on nHF was attempted, this was completed successfully. Median nHF flow during transport was 8 Litres per minute (L/min). No incidences of endotracheal intubation, pneumothorax, or technical/equipment issues were reported during transfer.

Approximately half of infants transferred had bronchiolitis. Primary nHF use for respiratory distress syndrome (RDS) or transient tachypnoea of the newborn (TTN) was infrequent (7% of cases).

nHF use is now widespread in neonatal and paediatric populations.(1, 3) However, there are few data describing nHF use during inter-hospital transport of neonates and infants. We found nHF was used in a small proportion of transfers conducted by our team. This may reflect our patient population; a substantial proportion of respiratory support transfers are for preterm infants presenting soon after birth with RDS or TTN. Our nHF guidelines recommend against primary nHF use in newborn preterm infants, as treatment failure occurs more commonly than with CPAP.(1)

In this population, we found transfer using nHF was successful, with no reported adverse events. In four cases (3%) the transport team had sufficient clinical concern to change treatment from nHF to CPAP before departure, indicating that the ability to provide alternative support such as CPAP or MV remains critical for neonatal transport services. At post-transport follow-up, 24/104 infants (23%) were receiving CPAP, NIPPV, or MV, suggesting that successful transfer on nHF does not necessarily predict ongoing treatment success.

We report nHF use primarily for emergency transport (86% of our population). Two British neonatal transport services have reported their experience with nHF; most transfers were elective, and infants were required to be stable on nHF for 24 hours to be eligible for transfer on nHF.(4, 5)

We used higher nHF gas flows (median 8 L/min), and included transfers over greater distances and durations, reflecting Australian geography. We manage infants beyond the neonatal period, resulting in approximately half our population having a diagnosis of bronchiolitis. Successful use of nHF for bronchiolitis has been reported by another Australian paediatric transport service,(2) and in a recent large randomised trial in paediatric hospitals.(3)

We conclude that many infants can be successfully and safely transferred using nHF beyond the immediate newborn period. Provision of nHF is a useful adjunct for neonatal transport services, but the capacity to deliver CPAP and endotracheal MV remains essential.

List of Abbreviations

CPAP	Continuous positive airway pressure
FiO_2	Fractional inspired oxygen
GA	Gestational age
L/min	Litres per minute
MV	Mechanical ventilation
nHF	Nasal high-flow
NIPPV	Nasal intermittent positive pressure ventilation
PIPER	Paediatric Infant and Perinatal Emergency Retrieval
RDS	Respiratory distress syndrome
SD	Standard deviation
TTN	Transient tachypnoea of the newborn

COMPETING INTERESTS

The authors have no competing interests to declare.

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REFERENCES:

1. Roberts CT, Hodgson KA. Nasal high flow treatment in preterm infants. *Matern Health Neonatol Perinatol* 2017; 3:15

2. Schlapbach LJ, Schaefer J, Brady AM, Mayfield S, Schibler A. High-flow nasal cannula (HFNC) support in interhospital transport of critically ill children. *Intensive Care Med* 2014; 40:592-9

3. Franklin D, Babl FE, Schlapbach LJ, Oakley E, Craig S, Neutze J, et al. A Randomized Trial of High-Flow Oxygen Therapy in Infants with Bronchiolitis. *N Engl J Med* 2018; 378:1121-31

4. Boyle MA, Dhar A, Chaudhary R, Kent S, O'Hare SS, Dassios T, et al. Introducing high-flow nasal cannula to the neonatal transport environment. *Acta Paediatr* 2017; 106: 509-12

5. Brunton A, O'Shea J. Letter to the editor regarding the article 'Introducing high-flow nasal cannula to the neonatal transport environment'. *Acta Paediatr* 2017; 106: 1362

Table 1: Infant demographics and outcomes. Values are median (interquartile range) unless stated.

Characteristic	Total (N=118)
Birth gestation, weeks	37 (32-39)
Birth weight, g	2680 (1470-3360)
Transfer gestation, weeks	41 (38-44)
Transfer weight, g	3400 (2670-4060)
Transfer age, days	28 (13-51)
Male gender, no. (%)	77 (65)
Duration of transfer, hours	1.6 (1.2-2.2)
Type of transfer, no. (%):	
Emergency	101 (86)
Planned elective	17 (14)
Mode of transfer, no. (%):	
Road	104 (88%)
Air	14 (12%)
Transfer distance, km	24 (12-73)
Diagnosis, no. (%):	
Bronchiolitis	58 (49)
Suspected/confirmed cardiac anomaly	17 (14)
Return transfer to infant's initial neonatal unit	11 (9)
RDS/TTN	8 (7)
Other	24 (21)
Maximum set gas flow, L/min	8 (6-8)
Delivered oxygen (%) at transport team arrival*	30 (21-37)
Last blood gas prior to transport team arrival**	
pH, mean (SD)	7.33 (0.08)
pCO_2, mm Hg, mean (SD)	50 (8)
Blood gas on nHF pre-departure***	
pH, mean (SD)	7.31 (0.09)
pCO_2, mm Hg, mean (SD)	53 (13)
Delivered oxygen (%) during transport	29 (21-35)
Delivered oxygen (%) at follow-up****	25 (21-30)
Respiratory support at follow-up: no. (%) (N=104)	
None	17 (16)
Low flow oxygen	12 (12)
nHF	51 (49)
CPAP	14 (13)
Nasal intermittent positive pressure ventilation	1 (1)
MV	9 (8)

RDS, respiratory distress syndrome; TTN, transient tachypnoea of the newborn; FiO_2, fraction of inspired oxygen; nHF, nasal high-flow; CPAP, continuous positive airway pressure; MV, mechanical ventilation; SD, standard deviation

* Data unavailable for one infant

** Blood gas performed on 83 infants prior to transport team arrival

*** Blood gas performed on 33 infants on nHF prior to departure from referring hospital

**** Data unavailable for 28 infants