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Case Report

Weaning off heated humidified high flow nasal cannula successfully in a 24-week extreme low birth weight infant in South-South Nigeria: a case report

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ABSTRACT

The use of heated humidified high flow nasal cannula (HHHFNC) has become increasingly popular for providing noninvasive respiratory support for neonates with respiratory distress syndrome (RDS). However, there are several challenges to its use as primary respiratory support in extreme low birth weight (ELBW) preterm infants delivered before 28 weeks gestational age (GA), these include: lack of established guideline; and conflicting reports from studies on the risk of respiratory failure (apnea), necrotizing enterocolitis (NEC), bronchopulmonary dysplasia (BPD) and death. In Nigeria, HHHFNC is not widely known nor used in most neonatal care facilities, including level III Neonatal care facilities. Despite adequate literature search, there is little or no known report or guideline for the successful use of and weaning from HHHFNC in ELBW neonates, delivered before 28 weeks GA in the Country. We present the successful weaning from HHHFNC as primary respiratory support at 30 weeks post conception age (PCA) in an ELBW preterm infant (weighing 700 gm) with severe RDS, delivered at 24 weeks GA in a neonatal care facility in Nigeria. HHHFNC was commenced at 6l/min following surfactant administration and successfully weaned off at 2l/min at 30 weeks PCA, with no incidence of apnea, BPD, NEC, air leaks, nasal septum damage and death. HHHFNC used as noninvasive primary respiratory support for ELBW preterm neonates with severe RDS delivered before 28 weeks GA is effective and safe; in addition, weaning off HHHFNC in this group of infants at 30 weeks PCA should be explored and recommended as a guideline in Nigeria and globally.

Keywords: HHHFNC, High flow oxygen cannula, Prematurity, ELBW, Very low birth weight, RDS

INTRODUCTION

The incidence of RDS increases with decreasing GA with as high as 98% of babies born at 24 weeks having RDS.[1,2] Severely premature infants (<28 weeks gestation) with ELBW, weighing less than 1000g, are prone to severe RDS. Traditionally, management of RDS in ELBW infants involves the prophylactic administration of surfactant and mechanical ventilation.[3] Over the last two decades, the standard therapy has been: the commencement of nasal bubble continuous positive airway pressure (NBCPAP) in the delivery room and administration of surfactant.[4-6]

HHHFNC is a newer mode of non-invasive respiratory therapy compared to NBCPAP in neonates, which involves the delivery of heated humidified fractionated oxygen via binasal prongs at high flow rates of up to 8l/min in neonates.[6-8] Several studies, including a meta-analysis have shown the non-inferiority of HHHFNC in comparison to NBCPAP, when used post-extubation, to wean off NBCPAP and as primary respiratory therapy in preterm infants delivered after 28 weeks gestation with

RDS. Similar to NBCPAP, it particularly reduces total ventilator days, occurrence of BPD, intraventricular hemorrhage, necrotizing enterocolitis, and retinopathy of prematurity.[6] Unlike NBCPAP, HHHFNC has some added benefits, which include: simpler delivery device (nasal prongs), improved parental interaction, less bulky set up, earlier establishment of feeding, reduced nasal trauma, and nursing preference.[9-11]

Several hospital/district based guidelines have been established for the use of and weaning off HHHFNC when used post-extubation, to wean off NBCPAP and as primary respiratory therapy in preterm infants delivered after 28 weeks GA.[6,12,13] However, the use of HHHFNC as primary respiratory support in infants delivered before 28 weeks GA or birth weight under 1000 gm ELBW is not widespread; and few studies done have documented conflicting reports on the risk of necrotizing enterocolitis, BPD and sepsis associated with the use of HHHFNC in ELBW infants.[14-17] Thus, there is no established guideline documented in literature for the use of and weaning off HHHFNC in these infants delivered before 28 weeks GA.

In Africa, especially Nigeria, the situation is more precarious, as the use of HHHFNC in preterm infants with RDS is not popular. Thus, the outcome and guideline for the use of HHHFNC on very small preterm infants with RDS delivered before 28 weeks has not been readily documented. In this article, we present the successful weaning off HHHFNC at 30 weeks PCA, when used as primary respiratory support in an ELBW preterm infant, weighing 700 gm, delivered at 24 weeks GA, with no incidence of bronchopulmanary dysplasia (BPD), necrotizing enterocolitis (NEC), sepsis, apnea and death in Nigeria.

CASE REPORT

Baby E, a female 2-hour old infant, who was delivered at 24 weeks GA, as the first of a set of twins. She weighed 700 gm at birth and she was referred from a major public secondary health care facility and transported in the arms of a nurse in an ambulance wrapped in a single layer of light cotton fabric, with oxygen administered via nasal prong at 2l/min and maintaining oxygen saturation at 95-99%. Silvermann score done was 8; at presentation, she was grunting, hypothermic (<35.0 C), with subcostal recession (SCR) and intercostal recession (ICR). On arrival, she was nursed under the radiant warmer, surfactant was administered via Intubate-surfactant-extubate (INSURE) method, and HHHFNC was commenced immediately at 6l/min with FiO_2 (fractionated inhaled oxygen) at 0.50-0.56 (Figure 1). She maintained normal oxygen saturation (SpO_2) at 89-99%. On day 3, high flow was adjusted to 4l/min at FiO2 below 0.45; RDS started to resolve on day 4. FiO_2 was subsequently reduced by 0.04-0.05 weekly until FiO_2 of 0.28 was reached at 28 weeks. HHHFNC was regulated to a flow rate of 2l/min at 28 weeks PCA (Figure 2). HHHFNC was subsequently weaned off and discontinued at 30 weeks PCA (42 days of life) and low flow oxygen via neonatal nasal prong was commenced at an equivalent FiO_2 of 0.33 (which was the minimum FiO_2 achievable in our facility) at a flow rate of 0.5 L/min. At 32 weeks post GA, low flow oxygen was discontinued and she maintained SPO2 at upto 95-100% in room air (Figure 3).

Enteral feed using expressed breast milk was commenced within 72 hours of presentation. There was no incidence of necrotizing enterocolitis, retinopathy of prematurity, sepsis and intraventricular hemorrhage; caffeine citrate was commenced and continued till 32 weeks PCA. Apneic episodes and the need for other options of assisted ventilation never occurred.

Figure 1: On HHHFNC at birth, 24 weeks.

Figure 2: On HHHFNC at 29 weeks PGA.

Figure 3: Weaned off low flow oxygen at 32 weeks PGA.

DISCUSSION

The duration on HHHFNC was 42 days; this can easily be explained by the severe prematurity in this infant with ELBW. The age of weaning off HHHFNC at 30 weeks PCA is similar to that reported by Kotecha et al where neonates delivered after 28 weeks, were weaned off HHHFNC after 10-13 days of life, corresponding to 30 weeks PCA.[16] A study, involving neonates delivered less than 28 weeks, reported an average duration of 60 days on HHHFNC before weaning to low flow oxygen, which is longer than that reported in this article.[14] This could be due to an oversight and the perception of safety of HHHFNC and thus, HHHFNC may have been left on babies longer than necessary. Of utmost importance is that 2 weeks after weaning off HHHFNC, the ELBW infant was weaned off low flow oxygen successfully, without the risk of BPD. This is in contrast to the observation in the study by Dalal et al where more patients on the HHHFNC had more BPD compared to those on NBCPAP.[14] This could be explained by the fact that in our ELBW baby, the flow rates and FiO_2 on HHHFNC were gradually reduced from 6l/min to 2l/min and 0.55 to 0.28 respectively; while in the study by Dalal et al possible higher flow rates and FiO_2 were consistently used all through the study, increasing the risk of BPD (as there was no documentation on the set flow rates used during the study).[14]

The successful use of HHHFNC in this ELBW infant could be due to the fact surfactant and caffeine citrate were both administered. In addition, the baby was referred early within 2 hours of birth on non-heated humidified low flow oxygen, which was not used long enough prior to commencement of HHHFNC to cause hypothermia and oxygen toxicity. There were no other co-morbidities; and no apneic episodes noticed on presentation.

Enteral feed was commenced within 72 hours of admission in the NICU, as soon as mother's breast milk was available. Feeding was well tolerated even at a flow rate of 6l/min on HHHFNC, which was gradually reduced to 4l/min and then 2l/min as enteral feed increased daily. NEC was never a problem in this infant; unlike that reported by Dalal et al where the incidence of NEC was higher and the onset of enteral feeds was delayed in those on HHHFNC.[14] The practice of strict asepsis during feeding in our facility and the gradual reduction of flow rates on HHHFNC as feeding was optimized most probably prevented the occurrence of NEC.

CONCLUSION

In conclusion, we have presented and discussed the successful weaning off HHHFNC at 30 weeks PCA and its outcome (no risk of BPD, NEC and apnea of prematurity) when used as primary respiratory support in a preterm infant weighing 700 gm, delivered at 24 weeks GA.

In preterm infants delivered before 28 weeks gestation, the use of HHHFNC can be used as primary respiratory support for treating RDS, using the following guideline:

Recommendations

HHHFNC should be commenced at 6l/min, and flow rate then adjusted to 4l/min over the next 72 hours at FiO_2 of 0.45-0.55. FiO_2 should be gradually reduced by 0.04-0.05 weekly for infants less than 28 weeks until it reaches 0.21-0.28 at 30 weeks PCA. On HHHFNC, feeding via nasogastric tube can be commenced within 72 hours of life and optimized according to previous feeding protocol for preterm infants. On weaning off HHHFNC, low flow oxygen can be commenced at 0.5l/min using low flow neonatal nasal prongs.

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