Surfactant administration during spontaneous breathing via a thin endotracheal catheter

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Abstract. In the past two decades exogenous surfactant administration has been a cornerstone of therapy for preterm infants and is known to be effective either given prophylactically in the delivery room or later as selective therapy to infants with established respiratory distress syndrome. Its introduction in neonatal practice in the early 90s was followed by a significant decrease in overall neonatal mortality. With the evolution and refinement of intensive care for preterm infants, the role of exogenous surfactant therapy is changing. The more widespread use of nasal continuous positive airway pressure (n-CPAP) as a primary mode of respiratory support means that many preterm infants now avoid intubation in the delivery room or in early post-natal life. Still, about 50% of them, will require intubation for surfactant delivery for evolving respiratory distress syndrome (RDS) during the course of hospitalization. In view of the difficulties and side effects that may be associated with intubation for surfactant delivery, less invasive ways of surfactant administration have been pursued. The rationale and the available evidences inherent the administration of surfactant via a thin endotracheal catheter during spontaneous breathing will be discussed. (www.actabimedica.it)

Key words: respiratory distress syndrome, thin ednotracheal catheter, exogenous surfactant administration

Introduction

Respiratory distress syndrome (RDS) is the most common disease of very preterm infants and its established treatment is the administration of exogenous surfactant. The results of many clinical trials published during the last 20 years suggest that early or “prophylactic” administration confers better results in terms of mortality and morbidity than late “rescue” therapy (1). As a consequence of this evidence it became a standard practice to electively intubate in the delivery room the majority of very preterm newborns at risk of RDS with the purpose to administer surfactant as soon as possible.

However, in some area of the world like Scandinavia, a strategy of stabilization of preterm infants with continuous positive airway pressure (n-CPAP) and surfactant administration as a rescue therapy has always remained the preferred approach to RDS of prematurity obtaining similar clinical outcome, if not better, than the intubation-mechanical ventilation plus surfactant administration strategy (2).

Since about 50% of the preterm newborns initially stabilized with n-CPAP may eventually end up to be intubated for evolving RDS and receive surfactant at a later stage of the disease, the InSurE procedure (Intubation for surfactant administration and rapid extubation to n-CPAP) was developed in Denmark in the 90’s in order not to withhold surfactant in infants who are in need of it and, at the same time, restoring n-CPAP as soon as possible avoiding the prolongation of mechanical ventilation (MV) which is known to exert remarkable side effects to the lung structure (3).

This strategy gained a widespread diffusion in many NICUs around the world and confirmed in many clinical studies its efficacy compared to a strategy of lat-
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Based on these results, the introducing center continued to use the method. During a 4 year observational period, the choice of n-CPAP as initial modality of respiratory support significantly increased from 69% to 91% compared with historical control ($P = 0.01$) with a rate of n-CPAP with surfactant administration of 75-86%. The increased use of n-CPAP with or without surfactant was accompanied by a significantly reduced need for MV during the initial respiratory illness (27% vs 63%, $P = 0.01$). In the group of infants initially stabilized with n-CPAP, meanly with surfactant, a lower mortality (7.7% vs 42%), BPD (7.1% vs 33.3%), severe IVH (5.2% vs 33.3%), pneumothorax (2.6% vs 6.7%) were recorded (6).

Following the promising results deriving from a single center experience a randomized controlled trial of surfactant administration with this technique (the AMV trial-avoiding mechanical ventilation) was conducted in 12 German NICUs. Infants with a gestational age of 26-28+6 weeks were enrolled if they were being managed on n-CPAP and required an FiO$_2 \leq 0.30$ in the first 12 hours of life. Randomization was to receive surfactant via a thin feeding catheter (the intervention group, n = 108), or to continue on n-CPAP (n = 112). All infants were subsequently managed with n-CPAP unless intubation criteria were reached. The main trial results was that infants in the intervention group had a lower rate of MV during the first 72 hours of life (28% vs 46%) and less need of supplemental oxygen at 28 days of age (7).

Recently a modified version of this technique named “the Hobart method” has been described and implemented in Australia; instead of the flexible feeding catheter that may be difficult to insert through the vocal cords with the use of a Magill’s forceps, especially for those neonatologists who may be unfamiliar with this technique because they solely practice oral intubation, a semi-rigid 16 gauge vascular catheter (Angiocath) that can be guided through the vocal cords without a trocar or forceps has been used.

A 2 site feasibility study of the Hobart method including 61 preterm infants with a gestational age of 25-32 weeks has been recently published. This group received surfactant during spontaneous breathing if they were treated with n-CPAP as initial respiratory support, were younger than 24 hours of age, required
a CPAP pressure ≥ 7 cm/H₂O and an FiO₂ ≥ 0.30 (25-28 weeks gestation) or ≥ 0.35 (29-32 weeks' gestation). Compared to historical controls achieving the same CPAP and FiO₂ thresholds, surfactant treated infants show a reduction in need for intubation ≤ 72 hours and a shorter duration of oxygen therapy (8).

Another interesting study (single center RCT) aiming to describe the feasibility of early administration of surfactant via a thin feeding tube during spontaneous breathing (Take Care procedure) and to compare early MV requirement with the InSurE procedure has recently been published. A population of 200 preterm infants with a GA ≤ 32 weeks who suffered from RDS and on n-CPAP as primary respiratory support, were randomized to receive surfactant treatment either by the Take Care or InSurE procedure. The results indicate that the Take Care technique was feasible and successfully reduced the MV requirement in the first 72 hours of life, shortened MV duration and resulted in a lower BPD rate when compared with the InSurE technique (9).

Noteworthy all available evidence suggests that both techniques of surfactant instillation by brief tracheal catheterization, either using a feeding or vascular catheter, are safe and relatively well tolerated.

Definitive data inherent the safety and efficacy of this apparently less invasive way of surfactant delivery will hopefully come from the results of 2 ongoing prospective multicenter RCT’s in Germany and Australia.

The first one (NINSAPP-trial ISRCTN 64011614) aims to investigate the efficacy of surfactant administration during spontaneous breathing with n-CPAP or during MV in the therapy of RDS in premature infants ≤ 27 weeks of GA; the primary outcome is survival without BPD at 36 weeks PMA.

The second one (OPTIMIST-A trial ACTRN 12611000917932) will compare, in a population of 25-28 GA weeks preterm infants, the Hobart method of surfactant administration during n-CPAP treatment with standard care (continuation of n-CPAP); the primary outcome is death or physiologic BPD at 36 weeks PMA. A peculiarity of this study is that the intervention will be masked from the duty clinicians by involvement of a treatment team not directly involved in the clinical care of that infant.

References


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