

Columella necrosis in a child secondary to nasal continuous positive airway pressure during neonatal period

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SUMMARY

The advent of continuous positive airway pressure ventilation as a mode of treatment for respiratory distress syndrome for premature infants has increased the risk of nasal injuries such as pressure necrosis. We describe a case of a 24-week infant who received CPAP ventilation as a mode of ventilatory support for respiratory distress syndrome and the complication of pressure necrosis of the columella. There are many factors that predispose an infant receiving CPAP ventilation to nasal injury. Many strategies can be employed to reduce the incidence of nasal injuries such as the use of nasal barrier dressings, the use of nasal high flow oxygen (nHF) cannula instead of CPAP ventilation, and the use of nasal masks instead of nasal prongs for CPAP ventilation delivery. The treatment of pressure necrosis can be either medical or surgical. The use of ointments or growth sprays can be used in cases of skin breakdown. Surgical reconstruction can be offered in cases of nasal deformity.

INTRODUCTION

Continuous positive airway pressure (CPAP) is an efficacious mode of ventilation for respiratory distress syndrome. Since its first report in 1971 as a form of treatment of severely ill infants with idiopathic respiratory distress syndrome, there has been an increase in the usage of nasal CPAP ventilation.¹ Over the last 40 years it is considered the "gold standard" form of non-invasive respiratory support to treat preterm infants. However, the prolonged use of CPAP as non-invasive ventilation has increased the risk of pressure necrosis of the nose.^{2,3} The prevention of nasal injuries in very low birth weight and very preterm infants can be difficult despite highly skilled nursing.³ We report a case of severe cosmetic sequelae of such injury.

CASE REPORT

A 24-week female infant weighing 680grams, required assisted ventilation immediately after birth due to respiratory distress syndrome. The infant was born at a private hospital and required neonatal intensive care unit (NICU) admission and treatment. Her ventilation ranged from intubation, CPAP ventilation, and finally nasal prongs. She was also treated for retinopathy of prematurity and necrotizing enterocolitis. After a 3 month stay in the hospital, the infant was discharged with a weight of 2.1 kilograms. However, upon discharge parents noted a deformity of their child's

columella. The treatment instituted was only dressings over the raw columella skin, with no surgical debridement required. Hence, a diagnosis of columella necrosis was made.

At the age of 3 years, the patient presented to Department of Otorhinolaryngology, University Malaya Medical Centre for cosmetic reconstruction. Upon examination, it was noted that there was a columella defect, giving the impression of a single nasal aperture (Fig. 1). The nasal tip, philtrum and ala were preserved (Fig. 2). Anterior rhinoscopy evaluation confirmed that the nasal septum as well as both nares were intact. A flexible nasopharyngoscopy was performed which showed no abnormalities of the nasal septum, inferior and middle turbinates, as well as the postnasal space. A referral was made to our plastic surgery colleagues for columella reconstruction. The surgery was planned to be conducted when the child became older.

DISCUSSION

The most prevalent form of ventilatory support in newborns is CPAP ventilation with nasal prongs.² However, due to the wide usage of CPAP ventilation with nasal prongs, many forms of nasal injuries occur in newborns. In preterm infants, it is vital that the skin and mucosal membranes are intact to protect against infection (cellulitis, vestibulitis, nosocomial bacterial infections), discomfort, and nasal deformities (nasal tip deviation, nostril asymmetry, columella necrosis).³ Buettiker et al. have classified nasal injuries based on their severity into three grades: mild (Grade I), moderate (Grade II), and severe (Grade III). The Grade I injury encompasses persistent redness or nasal hyperemia with intact skin, whereas Grade II injury patients have partial skin loss, superficial ulcers, and bleeding. Grade III injuries encompass full-thickness skin loss and columella necrosis.^{3,4} A study by Fischer et al. reported nasal injury in 42.5% of infants receiving CPAP ventilation.⁵ The majority of the nasal injuries were Grade I (88.3%), Grade II (11%) and Grade III (0.7%).⁵ The mechanism of injury is principally due to the pressure caused by ill-fitting, inappropriate sizing, and positioning of the binasal prongs.³ The two main predictive factors for skin damage are the number of days on CPAP ventilation with nasal prongs and the gestational age.³

The onset of nasal injury to the columella can be seen as early as 18 hours or 2 to 3 days after initiation of CPAP.³ In terms of gestational age, nasal injury is most common before 30 weeks of gestation due to the poorly defined epidermal

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Fig. 1: Columella necrosis giving the appearance of a single nasal aperture.



Fig. 2: Columella necrosis with intact nasal septum.

skin layers and stratum corneum.³ The key to prevention is pressure relief. Identifying a nasal prong that is appropriately sized is of paramount importance. Nasal prongs that are too large tend to cause nasal flaring whereas nasal prongs that are too small may damage the internal nares due to excessive movement.² This is especially difficult in very preterm or low birth weight infants despite highly skilled nursing care.³ Hence, nursing staff in the NICU should be educated, trained and privileged in CPAP ventilation nursing care. A review by Naha et al. reported a higher risk of nasal injury in newborns cared for by non-privileged nurses (66%) as opposed to privileged nurses (11%).⁶

Many strategies can be employed to reduce the frequency of nasal injury in newborns receiving CPAP ventilation. A review by Imbulana et al., reported three main preventive strategies: the use of a nasal barrier dressing, the use of nasal high flow oxygen (nHF) cannula instead of CPAP ventilation, and the use of nasal masks instead of nasal prongs for CPAP ventilation delivery.³ The incidence of nasal injuries has been reduced by the usage of barrier dressings like silicone gel sheeting or hydrocolloid dressings placed like a mustache.³ The ideal dressing has not been identified.³ A study by Collins et al. compared two nasal dressings; a hydrocolloid material (Cannulaide) which was placed on the nose and upper lip and a Velcro-coated hydrocolloid dressing (Sticky Whiskers) placed on the upper lip of 132 preterm infants born at less than 32 weeks gestation. The preterm infants received either nasal high flow cannula or CPAP ventilation. There was no significant difference in nasal injury score between both types of dressings.⁷ Nasal injury rates are reduced with the use of (nHF) cannula compared to CPAP ventilation. However, in preterm neonates with moderate and severe lung disease, CPAP ventilation is still preferred.³ Nasal mask usage has

been suggested instead of binasal prongs. However, compared to the nasal mask, short binasal prongs are favored for oxygen delivery and popular CPAP ventilation configuration.³ Nasal injuries between both devices vary as noted by a study done by Yong et al.⁸ The nasal mask patients suffered more from crusting, narrowing of nasal passages, excoriation of the nasal septum, and redness at the base of the nasal septum. Whereas patients who used nasal prongs had bleeding, narrowing of nasal passages, and injury to the medial aspect of the nostril.⁸

Another strategy for prevention is to alternate use of nasal prongs and face mask every 4 to 6 hours.⁵ This strategy is especially useful for infants weighing less than 1500grams, or if an infant presents with mild to moderate nasal injuries.³ For the treatment of nasal skin breakdown: epidermal growth sprays, hirudoid cream, and mupirocin ointment have been suggested.^{3,5} A checklist should be employed by nursing staff, which should include a regular skin assessment and positioning of binasal prongs or nasal masks. The use of a barrier dressing or ointment should be instituted in cases of skin breakdown.

Common sequelae of nasal injuries include nasal deformities persisting beyond the neonatal period. These nasal injuries are nasal tip deformities, nostril asymmetry, columella injury, nasal septal injury, and nasal obstruction.³ These deformities may be both cosmetic and/ or functional, often requiring corrective surgery in later years. Systemic complications to newborns due to nasal injury could be sepsis secondary to gram-negative bacteria due to damage to the skin and mucosa. Graham et al. reported a correlation between CPAP ventilation and gram-negative sepsis in a case-controlled series.⁹

Among the treatment methods that can be offered is columella reconstruction surgery. Columella reconstruction can be done by either oral maxillofacial surgeons or plastic surgeons. One surgical method that can be used is the modified Cronin technique. This is based on the surgical principle to increase columella length whereby tissue from the nasal sill and the anterior nasal floor is rotated superiorly. The common challenge of columella reconstruction is due to its shape, limited vascularity as well as skin coverage.¹⁰

CONCLUSION

Columella necrosis can occur due to pressure from the nasal prongs used for positive pressure ventilation. Hence, early identification and prevention are important to avoid columella necrosis as this leads to cosmetic disfigurement and requires corrective surgery. Thus, awareness, education, and proper training of nursing staff in charge of neonates receiving CPAP ventilation is vitally important.

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