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Nasal Complications Related With Cpap Treatment

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Abstract

AIM: In preterm infants who have a tendency for hypoxia, continuous positive airway pressure (CPAP) support is one of the standard treatments being used today. Although newborns are prone to complications, too many complications have not been reported in literature due to CPAP in newborn period. In this study, complications in preterm infants have been reported who had nasal CPAP treatment which were considered to be related to this.

METHOD: Within the scope of the study, 82 babies who were hospitalized in the newborn intensive care unit and had nasal CPAP between September 2014 and September 2017 have been evaluated. During this time period, the newborns that had nasal CPAP treatment have been evaluated in terms of nasal complications in certain intervals.

RESULTS: During this period, complications which are considered to be related to Nasal CPAP have been observed in 6 babies. In 4 newborns, nasal columellar hyperemia related to the use of masks and in 1 newborn, columella necrosis has been seen. In two of the patients, intranasal synechia has been observed. While intranasal synechias were unilateral in 1 patient, it was observed as bilateral multiple nasal synechia in another patient.

CONCLUSION: Continuous positive airway pressure treatment is a lifesaving method when required. However, it may cause certain complications due to pressure and pressured air in the newborn period which is open to all kinds of trauma. It is important to know about these complications and identifying and preventing them in the earliest time possible since the treatment is long and difficult.

Key Words: Continuous positive airway pressure, Nose Diseases, Nasal obstruction

Introduction

Since the newborn period is usually open to changes in terms of respiration, the baby's respiration should be followed closely during this time. In particular babies who are premature are more prone to respiratory failure in the newborn period. Respiratory distress syndrome (RDS) is a clinical situation caused by lack of surfactants and immaturity of the lungs which emerges in the first 4 hours of birth and is characterized by cyanosis which lasts for more than 24 hours, fast and groaning respiration and intercostal and subcostal retractions. In newborns, the gestational week and birth weight are important in terms of the development of RDS. In 44% of the newborns whose birth weight is 500-1500 and 50% of babies younger than the 30th gestational week, RDS is an important cause of mortality and morbidity. [1]

The purpose of treatment for RDS observed in preterm infants is to replace the surfactant and correct hypoxia, hyper-

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capnia and acidosis. In RDS treatment, there is indication of continuous positive airway pressure if the partial oxygen pressure is below 50 mmHG even in 70% oxygen concentration. With nasal continuous positive airway pressure (NCPAP) treatment's early use becoming common, the use of intubation or invasive ventilation has significantly decreased in RDS treatment. [2] The application of NCPAP treatment has been observed to prevent invasive application besides contributing to the development of lungs.[3] In addition, the low rate of morbidity of the modality of this treatment and havinga speedy and easy learning curve allows it to be used frequently.

Besides the regional complications of NCPAP treatment (such as nasal trauma, nasal skin problems), there are systemic (such as pneumothorax, intraventricular hemorrhage) complications as well. [4,5] The most important disadvantage of NCPAP treatment is the requirement for the mask used in the treatment to fully contact the face in order to provide the sufficient amount of pressure. In order to be able to prevent air leakage between the mask and nasal cavity, the mask is fixed on the head area. The pressure of the mask can lead to some regional problems.

In about 1% of the newborns, RDS is observed. [1] The purpose of this study is to present the nasal complications which develop due to NCPAP treatment used nasally through the mask in RDS treatment, which is a frequently seen problem. In addition, the study aims at discussing ways of protection against these complications with treatment methods.

Materials And Methods

Preterm infants born on the 28th-36th gestational week and whose follow-up was done in the newborn intensive care unit during the period of September 2014-September 2017 have been included in the study. Infants with additional handicaps (such as congenital malformation) and those intubated due to serious respiratory problems have been excluded.

The newborns have been followed-up by a nurse during the time they were in the newborn intensive care unit through daily follow-up forms. The follow-up forms have been prepared with the newborn intensive care unit team and filled out by the follow-up nurse (Figure 1). The patients were followed-up in regular intervals during their stay at the intensive care unit. The patients were followed-up the day the nasal CPAP treatment began and on the 1st, 3rd, 7th and 20th days in terms of nasal complications. In the follow-up process, nasal examinations have been performed, however nasal endoscopic evaluations have also been performed when it was required. After the patients were discharged from the newborn intensive care unit, they have been evaluated in terms of nasal pathologies for 6 months, each time they came for pediatric follow-ups. 82 newborn babies have been included in the study, who were brought to the hospital for their regular check-ups after they were discharged and were evaluated in the intensive care unit.

Figure 1: Daily follow-up nurse form of patients receiving NCPAP treatment

…. day of NCPAP treatment		
Finding	**Yes**	**No**
Redness on the front part of the nose		
Nosebleed		
Difficulties in feeding		
Increase in NCPAP pressure		

Approval of each of the newborns' parents were received. Data obtained from the patients have been compiled in an archive and these data have been evaluated retrospectively. Due to retrospective design of the study we did not apply for ethics committee approval.

Results

The average gestational age and birth weight of the patients have been determined as 32±3.1 weeks and 1328±530 grams. Gestation week of 42 newborn babies (51.2%) has been determined as below 32 weeks. 53.6% of the newborn babies included in the study were males. 79.2% of the babies included in the study were born through the cesarean method. The patients have been supported with an average of 5-8 cm. H_2O pressure with the NCPAP treatment.

In 6 out of 82 babies included in the study (7.3%) were observed to have nasal complications. The complications have been evaluated in general under 2 headings. While nasal skin complication has been observed in 4 infants due to pressure, nasal mucosal complications have been observed in 2 infants due to pressured air.

The first group has been separated as nasal complications observed due to nasal mask pressure. In the study, complications have been observed in 4 babies due to pressure. In 1 baby who caused us to initiate the evaluation process, it has been observed that columella necrosis has developed (Figure 1). While the 32week preterm baby was being put

Figure 1. Columellar defect developed in the newborn receiving NCPAP treatment

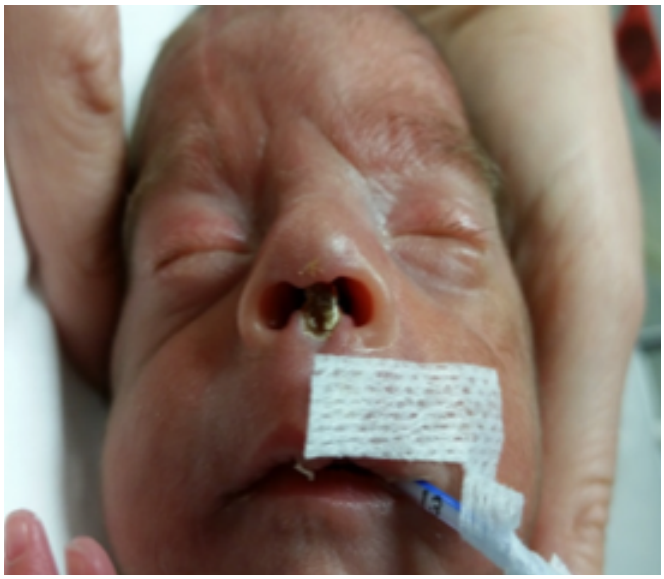

Figure 2. Appearance of columellar defect developed in the newborn receiving NCPAP treatment after secondary healing.

under NCPAP treatment due to RDS, hyperemia began to develop on the skin in the columella region on the 3rd week of the treatment. After the hyperemia was noticed, although soft sponge support and topical moisturizing creams were applied in between with the purpose of reducing the pressure caused by NCPAP treatment, it has been observed that there was total skin necrosis in the columella region. After the treatment of the respiratory distress of the patient and passing on to treatments without pressure following continuous positive airway pressure firstly with intermittent positive airway pressure (IPAP), the columellar necrosis was able to be followed in stable state before the situation worsened. The defect which developed in this patient was followed-up and it was observed that it was completely closed with secondary healing (Figure 2).

Hyperemia was observed in 2 of the 3 other babies in the columella and in 1 baby in the nasal dorsum which is considered to be related to pressure. The early diagnosed patients through regular follow-up were observed to improve on their own as the mask pressure was removed.

The second group complication has been observed to be the nasal synechias formed due to the pressured air given through intranasal route. In 2 newborn babies, intranasal synechia was seen which was considered to be related to NCPAP treatment. In the evaluation of the preterm baby who was born on the 28th week with a birth weight of 800 grams has been followed-up in the newborn intensive care unit due to respiratory distress syndrome and colitis diagnosis receiving NCPAP treatment about respiratory and feeding problems, prevalent synechias were observed in both nasal cavities (more on the right side) (Figure 3,4). The family of the patient was informed and no intervention was carried out due to possible complications.

The patient was followed-up since the nasal oxygen treatment state was stabilized. The patient was discharged with nasal oxygen treatment. The patient whose condition was stabilized with nasal oxygen support was applied nasal bal-

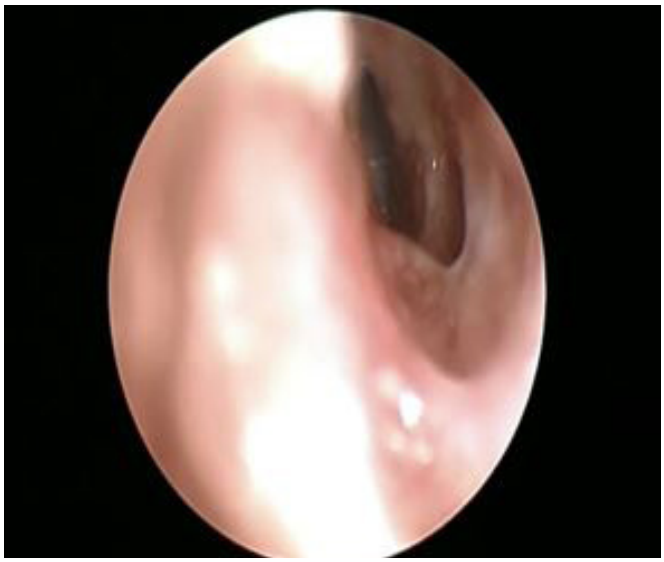

Figure 3. Diffuse intranasal synechia in newborn that has NCPAP treatment, left nasal cavity

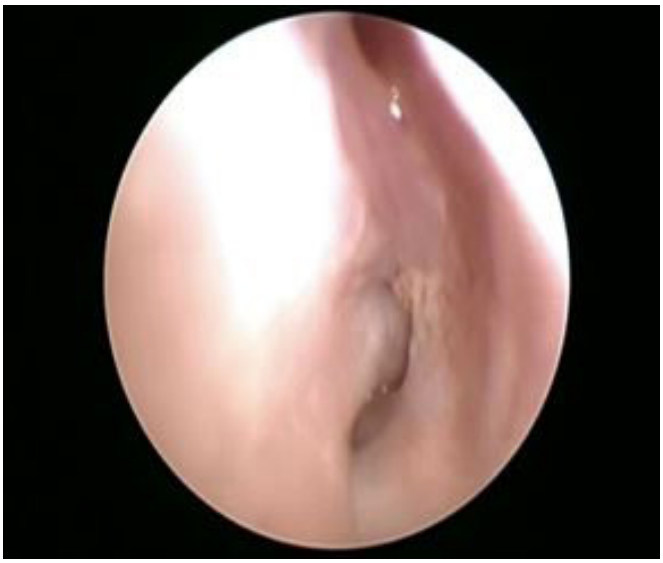

Figure 4. Diffuse intranasal synechia in newborn that has NCPAP treatment, right nasal cavity

loon dilatation in the epicenter. In the follow-up examination of the patient a year later, it has been observed that there was no change in the nasal synechias. The intervention planning (opening the synechias) was carried out in accordance with clinical follow-up and the development state of nasal structures.

In a 34 week preterm baby, synechia was seen in the left nasal cavity in the examination performed due to respiratory problems. The pathology of the patient was decided to be followed-up since it did not cause serious feeding and respiratory problems in daily life.

Discussion

The NCPAP treatment has been in use since the 1970's. This treatment involves applying positive pressure to the airways of a baby who can breathe on his own. Through this method,

The alveoli and airways are kept open and they are prevented from collapsing. As a result, less respiratory effort, less paradoxical respiration, less apnea and better gas exchange are made possible with NCPAP treatment in preterm infants. In addition, if it is initiated very early on in RDS treatment right after birth in very small preterm infants, it reduces the need for mechanical ventilation and surfactants. [6] The application of NCPAP in preterm infants with RDS reduces mortality by 66%.[7]

NCPAP treatment is usually initiated in general as 5-6 cm-H2O pressure, FiO2 0.60-0.80, 5-8 lt/minute flow rate and the rest of the treatment is planned in accordance with the blood gas values. [8]

Among the complications of this treatment are: pulmonary leaks, intraventricular bleeding, retinopathy and regional nasal complications. [9]

During NCPAP treatment, skin complications are not seen rarely and have been reported to occur in rates reaching 60%. In our study, the rate of nasal complication has been determined as 7.3%. The rate of serious (requiring treatment) nasal complications has been determined as 2.4%. Since there is no data in the literature about synechia, comparisons with the literature in our study has been carried out with the rate of skin complications. Skin complications are directly proportional to the birth week of the infant, gestational age and the duration of the treatment. The protective care treatments carried out during this treatment have very limited effects. [10]

A majority of the complications in the skin are caused by the pressure applied by the NCPAP device on this region. Although different styles of using the device to reduce complications have been suggested, the mask used in this process needs to contact the face to prevent pressure loss. This causes problems related to contact. [11,12] Therefore, it is important to be aware of this complication and take precautions which reduce the pressure on the skin and protective precautions such as using moisturizing and protective creams. In our study, we have seen the importance of the form we have developed to prevent complications through the identification of the problem of pressure during follow-up work. With the identification of the pressure during the hyperemia stage by the intensive care unit nurse, more serious pressure complications have been prevented.

Pressure ulcers are defined as sores which occur due to pressure and strain on the skin. These ulcers can be superficial or deep in the skin tissue. These lesions are frequently on skin on top of bone tissue or at places where rigid devices contact the skin. Extended pressure, tension, pulling and increased moisture are also effective in the development of these lesions. [13,14]

In addition, especially the skin of preterm infants are less durable against mechanical weights compared to normal babies. The subcutaneous fat tissue of newborns and infants is relatively more. Moreover, the fat tissue of newborn infants has higher amounts of water/lipids ratio compared to adults. In this case, this causes the skin and subcutaneous tissues in infants to be more easily get deformed and leads to the formation of deep tissue ulcers.[15]

As different from adults, more than 50% of pressure sores in newborns and infants are related to medical devices.[16,17] Therefore, materials such as the CPAP masks, saturation probes, ECG/EEG electrodes and cables used in intensive care units are the greatest external risk factors for pressure sores.[15] Pressure sores rates up to 23% can be observed in intensive care units. More than 50% of these cases are related to a medical device.[16,17]

When the pressure duration increases, deformation begins on the skin and in subcutaneous tissues. Firstly, mechanic damage starts in the cells. If the pressure and distortion continues, local ischemia and blockage in lymphatic flow develops. This can cause tissue necrosis as a result.[15]

In the columellar necrosis case we have encountered which was caused due to pressure, the protective precautions were not useful in terms of preventing necrosis. In this case, although the respiratory difficulties of the patient decreased in the beginning, an intervention was not planned since it continued. In terms ofthe follow-up of the patient, it was planned since secondary healing began. In the follow-up, it has been observed that the columellar defect was completely closed. Although the defect was completely healed, how the scar tissue will affect the development of the nose will be observed in long-term follow-ups.

In the sinonasal mucosa, the defective area after the mucosal injury occurs is firstly filled with granulation tissue. Depending on the size of the defective area, the closing of the defect takes about a few weeks with epithelial cell migration. The defect which occurs is repaired functionally with the remodeling stage.[18] Some local factors (hypoxia, malnutrition) or systemic problems (immune deficiency, diabetes) which can be seen during the healing of the defect can disrupt this process. This can cause the formation of excessive granulation tissue and as a result bonding. This abnormal healing pattern which takes place inside the nose can cause sinonasal synechias.[18,19]

Sinonasal synechia is a pathology which seriously disrupts air flow from the nose. In the literature, a record of a case which is closely related to NCPAP use and sinonasal synechia has not been found. In the cases we have seen, nasal structures' being immature and prone to trauma and the pressure caused by NCPAP treatment have been regarded as the reasons for the formation of sinonasal synechia. Another factor which can be blamed in mucosal injury which is the beginning of the formation of sinonasal synechia is nasal aspiration which is not done correctly. Depending on nasal aspiration which is not done accurately, nasal synechia can occur with mucosal damages which are reciprocal in the nasal mucosa. In this study, it has not been able to see which is the basic trigger factor in mucosal damage in the formation of sinonasal synechia. However, both due to a lack of significant trauma history during aspiration and bleeding history which can occur after mucosal damage, mechanical damaging has not been considered as a basic factor for mucosal damages.

Sinonasal synechia is a frequently seen complication after nasal surgeries. It can be treated by opening the synechia, however if the sides of the synechia are in closer position, then synechia may reoccur again. In order to avoid this, splints can be applied between the sides of synechias until mucosal healing is completed.[20,21]

The patient we have seen with bilateral nasal synechia was examined endoscopically under general anesthesia in order to exclude possible other pathologies and evaluate the severity of synechia. In the examination, it has been observed that there were severe synechias in both intranasal cavity. Partial air flow was possible for both nasal cavities. Nasal choanal atresia and any other nasal pathologies have not been observed. Due to possible complications (cerebrospinal fluid leakage, bleeding, etc.) due to surgery, the follow-up of the patient was planned without extra surgical intervention. The patient was followed-up in a stabilized state with nasal oxygen treatment. After the patient was discharged with nasal oxygen treatment, nasal balloon dilatation has been performed in the epicenter with early diagnosis of nasal synechia. After the treatment of dilatation, any complications have not been observed, however significant improvement did not take place in the patient's breathing and nasal oxygen support was continued.

In the recent years, the use of high-flow nasal cannula treatment as an alternative to NCPAP treatment has been started. In this treatment, high-flow is given with a nasal cannula instead of a mask and mild RDS is treated in newborn preterm infants. Among the advantages of this treatment are its being easier to use and less nasal trauma. However, this treatment is not suitable for every patient and more and more studies are necessary to improve the effect of this treatment.[22]

Since babies are not used to mouth respiration in the newborn period, nasal pathologies during this time can cause serious respiratory problems. The treatment methods of these problems can also cause nasal edema and blockage. The packages which are used after the nasal synechia operation or other complications due to surgical intervention

can lead to serious respiratory problems. Therefore, since the general conditions of both of the patients were stable in these two cases, intervention was delayed as much as possible until sinonasal growth was completed.

Conclusion

As a result, NCPAP treatment is a treatment modality which is relatively noninvasive and causes fewer complications used in the treatment of RDS in preterm infants. Besides the systematic complications of this treatment modality, in the application area can cause local complications as well. Especially since newborn babies do nasal respiration, a pathology which may effect nasal airflow can cause respiratory difficulties. It is extremely important to recognize the complications which may arise with this treatment modality and prevent pathologies before they are formed. The primary aim of this study is to create an awareness about the possible nasal complications of NCPAP treatment.

Acknowledgement

Conflict of interest

There is no conflict of interest in the study.

Financial Disclosure

The author has no financial disclosure. The study is authors' own work.

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