Abstract: Neonatal subcutaneous emphysema is a very rare complication of endotracheal intubation or surgery; however, only a few cases of spontaneous subcutaneous emphysema were reported in a neonate. The patient presented in respiratory distress with a low $S_O2$; however, no clinical signs of subcutaneous emphysema were seen. An initial chest radiograph was negative for subcutaneous emphysema. Nasal continuous positive airway pressure (CPAP) was started to manage the respiratory distress, and subcutaneous emphysema spontaneously developed. Discontinuation of nasal CPAP with close monitoring eventually resolved the subcutaneous emphysema. Recognition of rare complications due to nasal CPAP may provide physicians with more insight to intervene and provide patients with proper care.

Subcutaneous emphysema is a condition in which air becomes trapped under the skin [1]. This is usually due to iatrogenic causes such as accidental injuries during surgery or intubation [2]. Neonatal subcutaneous emphysema is a very rare complication as compared to older children, even though air leak syndromes, such as pneumothoraces and pneumomediastinum, are relatively common [3]. A patient with subcutaneous emphysema will present with soft-tissue swelling and crepitus, which can be observed on physical exam [4]. Subcutaneous emphysema usually localizes in the clavicular region as a pocket of air in severe cases [5]. In very few cases reported, the addition of CPAP to manage respiratory distress has been shown to cause subcutaneous emphysema in a neonate [3]. The positive pressure applied by ventilator inspiration can promote the expansion of the gas through the communicating fascial planes down the partial pressure gradient [6].

Case description

On September 21, 2021, a male infant was born at 37 weeks gestation through vaginal delivery to a G2P1 29-year-old white female with grunting and tachypnea, with the $S_O2$ ranging from 90 to 92. Apgar scores were eight and nine at 1 min and 5 min, respectively. The neonatologist was called secondary to the need for supplemental oxygen. After approximately 10 min of observation, the infant continued to demonstrate intermittent grunting, but the tachypnea resolved. The distressed infant worsened over the next 20 min as mild cyanosis was starting to develop and the $S_O2$ dropped to 88–90, so the infant was transferred to the NICU for further management. An initial chest radiograph portrayed no significant pneumothorax or pleural effusion, with cardiothymic silhouettes within normal limits (Figure 1A).

The patient was started on nasal CPAP 5 cm with $FIO2$ at 0.25 to manage the low oxygen saturation and improve the respiratory distress of the male infant. Following 2 days of being on nasal CPAP, the infant’s respiratory distress only improved mildly from an oxygen saturation of 90–91 to 93–94. However, on the second day of admission, there was concern for the development of subcutaneous emphysema near the right clavicle extending over the chest. The findings from a physical examination demonstrated crepitus on palpation with 3–4 cm × 2 cm subcutaneous pockets caudal to the mid-right clavicle extending over the midline. Clavicles were intact and showed no signs of fracture or infection. A chest radiograph was ordered and confirmed physical examination findings with chest wall emphysema involving the upper chest and bilateral pneumomediastinum (Figure 1B). Nasal CPAP for respiratory distress was discontinued and the infant was monitored closely for any signs of worsening respiratory function. The patient’s $S_O2$ remained at 90–91, yet the patient showed no signs of severe respiratory distress. Daily chest radiographs were obtained to assess the extent
of the subcutaneous emphysema, which was shown to decrease in severity every day.

After 1 week of close observation, the infant’s chest radiograph showed complete resolution of symptoms, with his $S_aO_2$ ranging from 97 to 99 and no signs of subcutaneous emphysema or crepitus on physical examination. The final chest radiograph depicted no pneumomediastinum or subcutaneous pockets at the mid-right clavicle (Figure 1C). The patient’s stable vitals and resolution of respiratory symptoms cleared the patient for discharge. At the time of discharge, the mother of the patient consented to a case report being written based upon the patient’s unique presentation. The patient presented no signs of respiratory distress or subcutaneous emphysema during his pediatrician appointment 1 week postdischarge.

### Discussion

Neonatal subcutaneous emphysema is a very rare complication that could be detrimental to a neonate’s life because of the diminishing effect it has on the respiratory function of a child. There are rare case reports of CPAP causing spontaneous subcutaneous emphysema in children [3]. In this case, the patient presented in respiratory distress and developed subcutaneous emphysema after starting nasal CPAP, which ultimately resolved with discontinuation of nasal CPAP. With the patient’s respiratory distress, the decision to start the neonate on CPAP was the most optimal decision to improve the $S_aO_2$ clinically, even with the rare chance of having subcutaneous emphysema as a complication. Physicians should be aware...
of this rare complication of nasal CPAP in neonates, although it should not prevent physicians from following the standard of care for an infant in respiratory distress. The knowledge of rare complications, such as neonatal subcutaneous emphysema, can promote proficient recognition and intervention. Physicians should remain vigilant in the case that tracheal trauma or rupture can be the cause of subcutaneous emphysema, such as in the case of a difficult intubation.

Conclusions

Nasal CPAP has the potential to cause subcutaneous emphysema in a neonate. However, physicians should still follow the standard of care and provide infants in respiratory distress with nasal CPAP due to the benefit of nasal CPAP outweighing the potential risk of subcutaneous emphysema developing.

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