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NEGATIVE PRESSURE PULMONARY EDEMA IN THE IMMEDIATE POSTOPERATIVE PERIOD OF MASTOPEXY WITH SCAR REVISION: A CASE REPORT

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ABSTRACT

Introduction: Negative pressure pulmonary edema (NPPE) is a rare and potentially severe respiratory complication, usually associated with acute upper airway obstructions such as laryngospasm. It is characterized by sudden hypoxemia resulting from extreme negative intrathoracic pressures, leading to fluid extravasation into the alveoli. **Case report:** A 28-year-old previously healthy female patient underwent mastopexy with scar revision under total intravenous general anesthesia associated with erector spinae plane block. In the immediate postoperative period, she presented with sudden desaturation and clinical signs consistent with NPPE. Lung ultrasound (US) revealed multiple coalescent B-lines, with favorable response after noninvasive ventilatory support. **Discussion:** This case reinforces the pathophysiology of NPPE described in the literature, associating vigorous inspiratory efforts against a partially obstructed airway with the development of edema. The importance of early diagnosis, point-of-care lung ultrasound, and noninvasive ventilation in the rapid reversal of the condition is highlighted. **Conclusion:** NPPE can occur even in young patients without comorbidities, following low-risk surgeries. Vigilance during the post-extubation period and early recognition of clinical signs are essential to avoid adverse outcomes. This report emphasizes the need for preventive strategies and training of the multidisciplinary team for the proper management of such complications.

Keywords: Pulmonary edema, Laryngospasm, Extubation, Hypoxemia, Lung ultrasound.

INTRODUCTION

Negative pressure pulmonary edema (NPPE) is a rare but potentially severe respiratory complication that occurs predominantly after acute upper airway obstruction, with laryngospasm being the main trigger[1]. The pathophysiology involves the generation of extreme negative intrathoracic pressures during forced inspirations against an occluded glottis, resulting in increased

venous return, elevation of pulmonary capillary hydrostatic pressure, and fluid extravasation into the alveoli[2]. Clinically, it manifests as sudden dyspnea, stridor, tachypnea, cyanosis, hypoxemia, and frothy pink secretions. Diagnosis is suggested by the clinical picture and confirmed by chest radiography, which reveals diffuse pulmonary infiltrates[3].

Treatment is based on ventilatory support, oxygen therapy and noninvasive ventilation, such as CPAP (Continuous Positive Airway Pressure) or BiPAP (Bilevel Positive Airway Pressure), with invasive ventilation or vasoactive drugs rarely being required[4]. Although often underdiagnosed due to its transient course, early recognition of NPPE is crucial to prevent adverse outcomes. Preoperative screening for respiratory diseases and careful monitoring during extubation are effective strategies for its prevention[3]. In this context, the objective of the present study is to report a case of NPPE in a young, previously healthy patient undergoing elective aesthetic surgery, highlighting the clinical presentation, the utility of lung ultrasound in diagnosis, and the response to noninvasive treatment.

CASE REPORT

A 28-year-old previously healthy female patient underwent mastopexy with scar revision under total intravenous general anesthesia, associated with bilateral erector spinae plane (ESP) block. The procedure was uneventful, and the patient was extubated on command at the end of surgery, still in a mild drowsy state, maintaining hemodynamic stability and spontaneous respiratory pattern.

During transfer from the operating table to the transport stretcher en route to the post-anesthesia care unit (PACU), the patient presented with sudden desaturation, accompanied by decreased level of consciousness and immediate need for ventilatory support with face mask and airway clearance maneuvers. Despite partial recovery of consciousness and ventilatory status, she remained hypoxemic even with supplemental oxygen via nasal cannula.

Given the acute clinical presentation and suspicion of a respiratory complication, point-of-care lung ultrasound (POCUS) was performed, showing a characteristic interstitial pattern: presence of multiple coalescent B-lines, associated with preserved areas with A-lines, consistent with NPPE. The observed pattern presented a ground-glass distribution (Figure 1), with involvement of the upper lung fields, as shown in Figure 2 by evident B-lines in the apices.

The patient was managed with supportive ventilatory measures, rest in an elevated supine position, supplemental oxygen therapy, and continuous monitoring. Clinical progression was satisfactory, with gradual clinical improvement and regression of ultrasound findings. Figures 3A, 3B, and 3C show serial images of the pulmonary apices after interventions, demonstrating decreased quantity and coalescence of B-lines, with progressive reappearance of A-lines, consistent with resolution of alveolar edema.

In Figure 4 (A, B, and C), a global recovery pattern is observed, with predominance of A-lines and residual presence of few B-lines, indicating progressive resorption of interstitial edema and evident ventilatory improvement. The patient progressed well in the postoperative period, without the need for reintubation or admission to the intensive care unit.

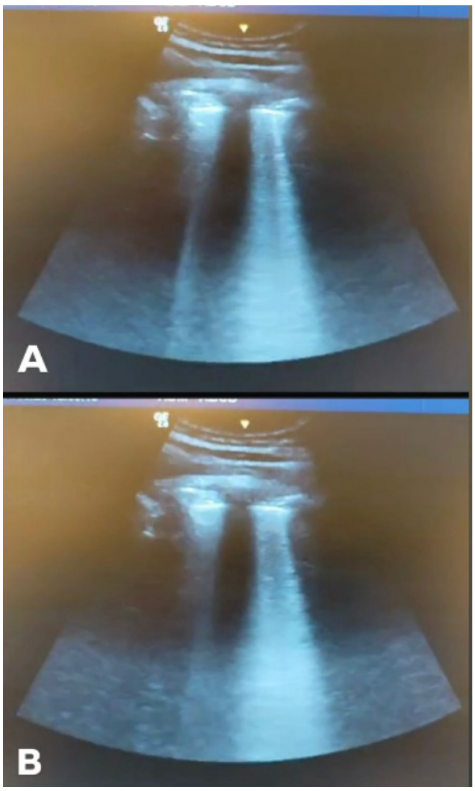

Figure 1. (A) and (B) Images showing the presence of multiple coalescent B-lines, with interspersed areas of preserved A-lines, forming a "ground-glass" pattern, characteristic of Negative Pressure Pulmonary Edema.

Figure 2. Lung ultrasound showing an interstitial pattern in the upper lung fields, with visible B-lines, suggestive of apical involvement in the context of negative pressure pulmonary edema.

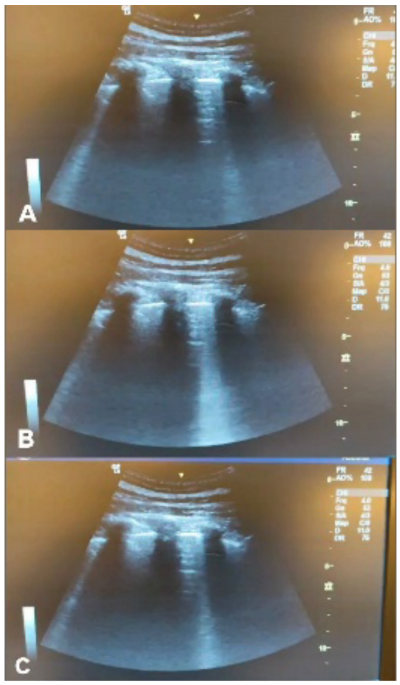

Figure 3 – Apical pattern after interventions. (A), (B), and (C) – Serial images of the pulmonary apices after clinical interventions, showing a reduction in the number and coalescence of B-lines, with the initial reappearance of A-lines, consistent with improvement of alveolar edema.

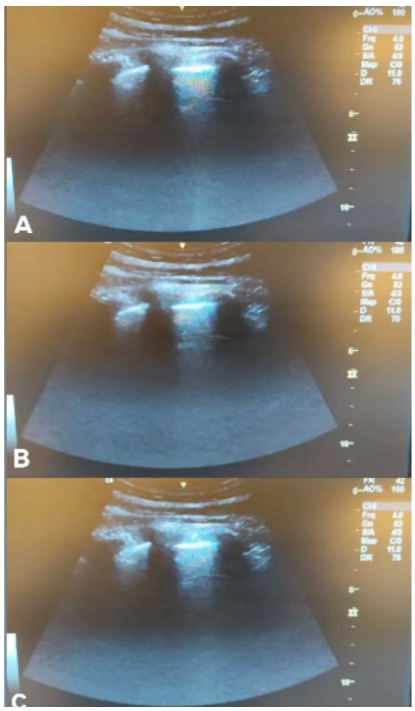

Figure 4. (A), (B), and (C) Lung ultrasound images demonstrating a recovery pattern, with predominance of A-lines and few residual B-lines, indicative of progressive resorption of interstitial edema.

DISCUSSION

Negative pressure pulmonary edema (NPPE) is a rare but serious complication that is often underdiagnosed in the immediate postoperative period. Its pathophysiology is associated with acute upper airway obstruction, with laryngospasm being the most common triggering event[1]. During obstruction, inspiratory efforts against the occluded airway generate extreme negative intrathoracic pressures, resulting in increased capillary hydrostatic pressure and alveolar transudation[2]. Although the condition is most often associated with patients who have risk factors, it can occur even in young, healthy individuals[3].

We report the case of a 28-year-old female patient, without relevant comorbidities, who underwent mastopexy with scar revision under combined anesthesia. The procedure was uneventful, and the patient was extubated at an adequate level of consciousness, obeying simple commands and with good chest expansion. However, during transfer to the post-anesthesia care unit (PACU), the patient developed sudden desaturation, requiring ventilatory support with a face mask. Despite regaining consciousness, she remained with respiratory difficulty, requiring repeated airway clearance maneuvers, and persistent hypoxemia, even with nasal cannula oxygen.

This clinical presentation is suggestive of early NPPE, probably caused by transient upper airway obstruction that led to vigorous inspiratory effort and generation of extreme negative intrathoracic pressures, a mechanism described in Müller's maneuver[4]. Although the patient had no comorbidities, the acute airway obstruction and dysregulated ventilatory response were determining factors in the development of the complication. The literature suggests that NPPE typically manifests within the first minutes after obstruction, although it may also occur up to 2–3 hours after extubation[5]. Clinical findings such as crackles, rhonchi, and frothy pink secretions are indicative of this condition, associated with refractory hypoxemia that does not adequately respond to oxygen via nasal cannula[6].

The proper management of NPPE involves early implementation of noninvasive ventilatory support, such as CPAP or BiPAP, which may lead to rapid clinical improvement and avoid the need for reintubation or hemodynamic support[7]. A retrospective study involving 15 patients with NPPE treated eight with noninvasive ventilation and demonstrated significant improvement in the PaO_2/FiO_2 ratio (from 132 ± 30 to 282 ± 77 mmHg) in less than 24 hours, without major complications or need for intubation[7]. These findings support that early initiation of CPAP/BiPAP, with patent airways and a cooperative patient, should be considered the initial intervention of choice[7].

In addition, evidence indicates that early recognition of NPPE associated with monitored vigilance is crucial. A systematic review showed that rapid detection and effective management drastically reduced mortality from 11–40% in initial reports, to 2–5% in contemporary cohorts[8]. The application of continuous post-extubation SpO_2 monitoring protocols, especially in high-risk surgeries, can identify edema in its early stages and prevent worsening, even in young patients without risk factors[8].

This case reinforces the importance of considering NPPE as a differential diagnosis, even in surgeries considered low anesthetic risk, such as aesthetic procedures. The occurrence of sudden postoperative hypoxemia, especially when associated with airway obstruction, should raise suspicion for this complication. Careful extubation strategies, intensive monitoring

during transport to the PACU, and early recognition of clinical signs are essential to avoid adverse outcomes[8].

Furthermore, the findings of this case corroborate previous studies indicating that even young and healthy individuals may develop severe respiratory complications after stimuli that cause laryngeal obstruction or forced ventilation against resistance[8]. Thus, it is essential to carry out effective risk factor screening, adequately prepare the healthcare team, and establish extubation protocols that minimize the risk of complications such as NPPE.

CONCLUSION

The present case report highlights the occurrence of NPPE as a potentially severe post-extubation complication, even in young and healthy patients undergoing low-risk anesthetic procedures. Partial airway obstruction after extubation was sufficient to trigger an NPPE episode, confirming the pathophysiology associated with extreme negative intrathoracic pressures. Early identification of the condition and the immediate use of noninvasive ventilatory support were crucial for the favorable outcome, without the need for reintubation or hemodynamic support. This case reinforces the importance of strict vigilance in the post-extubation period, continuous monitoring during transport to the PACU, and proper training of the team for the recognition and management of often neglected conditions such as NPPE.

REFERENCES

1. Lemyze M, Mallat J. Understanding negative pressure pulmonary edema. Intensive Care Med. 2014 Aug;40(8):1140-3.

2. Bhaskar B, Fraser JF. Negative pressure pulmonary edema revisited: Pathophysiology and review of management. Saudi J Anaesth. 2011 Jul;5(3):308-13.

3. Caballero-Lozada A, Giraldo A, Benitez J, Naranjo O, Zorrilla-Vaca C, Zorrilla-Vaca A. Bedside ultrasound for early diagnosis and follow-up of postoperative negative pressure pulmonary oedema: case reports and literature review. Anaesthesiol Intensive Ther. 2019;51(3):253-256.

4. Ma J, Liu T, Wang Q, Xia X, Guo Z, Feng Q, Zhou Y, Yuan H. Negative pressure pulmonary edema (Review). Exp Ther Med. 2023 Aug 4;26(3):455.

5. Faria FM, Ximenes PI, Elmiro GS, Gardengli G. Edema agudo de pulmão por pressão negativa pós-extubação em rinoplastia: relato de caso. Rev Cient CEREM-GO. 2023;4(11):21–4.

6. Ma J, Liu T, Wang Q, Xia X, Guo Z, Feng Q, Zhou Y, Yuan H. Negative pressure pulmonary edema (Review). Exp Ther Med. 2023 Aug 4;26(3):455.

7. Furuichi M, Takeda S, Akada S, Onodera H, Yoshida Y, Nakazato K, Sakamoto A. Noninvasive positive pressure ventilation in patients with perioperative negative pressure pulmonary edema. J Anesth. 2010 Jun;24(3):464-8.

8. Din-Lovinescu C, Trivedi U, Zhang K, Barinsky GL, Grube JG, Eloy JA, Hsueh WD. Systematic Review of Negative Pressure Pulmonary Edema in Otolaryngology Procedures. Ann Otol Rhinol Laryngol. 2021 Mar;130(3):245-253.

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