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Case Report

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Oscillatory High Frequency Ventilation in severe Pediatric Acute Respiratory Distress Syndrome after to Fibrosis stage.

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Keywords

High frequency oscillatory ventilation, hypoxemia, Pediatric acute respiratory distress syndrome.

Abstract

Introduction: High frequency oscillatory ventilation (HFOV) is a ventilatory modality which has demonstrated to be useful in patients with Pediatric Acute Respiratory Distress Syndrome (PARDS) refractory to conventional mechanical ventilation (CMV). **Objetive:** To report the case of a pediatric patient with adequate response to treatment using HFOV even in late stages of the disease. **Conclusion**: There was considerable improvement in the oxygenation indexes after the start of the High Oscillation Ventilation, even after having started after the fibrotic phase.

Introduction

Pediatric Acute Respiratory Distress Syndrome (PARDS) is a common disease in Pediatric Intensive Care Units (PICU) around the world, is a serious entity with high mortality, being in pediatrics a diagnostic and therapeutic challenge.About 1 in every 100 children admitted to PICU meet criteria for PARDS, and pediatric-specific studies have shown an incidence of 1.4 to 9.5 cases per 100,000 per year. While the overall mortality from PARDS is around 30%. (1) High frequency oscillatory ventilation (HFOV) is a protective ventilatory strategy, since it optimizes alveolar recruitment and lung volume, in addition to improving oxygenation by applying high flow rates and frequencies of up to 900 cycles per minute with reduced tidal volumes (1- 2 ml / kg) as a result of minor differences in inspiratory and expiratory pressures, which produce a high and persistent medium pressure in the airway (2). HFOV seems to represent an important therapeutic option in the ventilatory support of children with respiratory insufficiency. Despite the increased use of HFOV in pediatric patients with acute respiratory failure, few studies have been published, as well as some prospective studies and randomized clinical trials in children with PARDS(3). HFOV has been used more frequently as rescue therapy in children with severe respiratory failure after failure of conventional mechanical ventilation (CMV) with pulmonary protection strategies. However, to date there is not enough evidence to support the moment of its use. When it is shown that HFOV is effective as rescue therapy, this mode of ventilation will become an extremely useful therapeutic option. (4)

Case Report

A 5-year-old male, who lives in Veracruz, Mexico, with Dravet Syndrome, goes to the Pediatric Emergency Department of the Naval Hospital of Veracruz, due to uncontrolled seizures, 24 hours after his admission he presents respiratory distress data and 88% desaturation, Acquired Pneumonia is diagnosed in the Community (Image 1) and antimicrobial management is initiated. Requiring advanced management of the airway at 72 hours and admission to the Pediatric Intensive Care Unit, Conventional Mechanical Ventilation is initiated requiring high ventilatory parameters, due to persistent hypoxemia and hypercarpnia, which is why the diagnosis of PARDS is integrated (Image 2). Pneumoprotection measures are attempted and an alveolar recruitment maneuver with partial improvement is performed. 24 hours later, he presents bilateral pneumothorax (image 3), so bilateral pleural probes are placed, persisting air leak; it was decided to place second bilateral pleural catheter. An air transfer is made to a third level Hospital. With persistence of bilateral pneumothorax and high oxygenation indexes of up to 44. Oscillation High Frequency Ventilation was initiated on day 23 of the diagnosis of PARDS, for 5 days. (image 4) Presenting satisfactory evolution in oxygenation indexes, and remission of Pneumothorax. HFOV is removed and conventional mechanical ventilation is reinitiated. Tracheostomy is performed at day 35, weaning from ventilatory support and removed on day 47. (image 5) Subsequently, he is withdrawn from the service and continues monitoring by Pediatric Neurology and Pneumology.

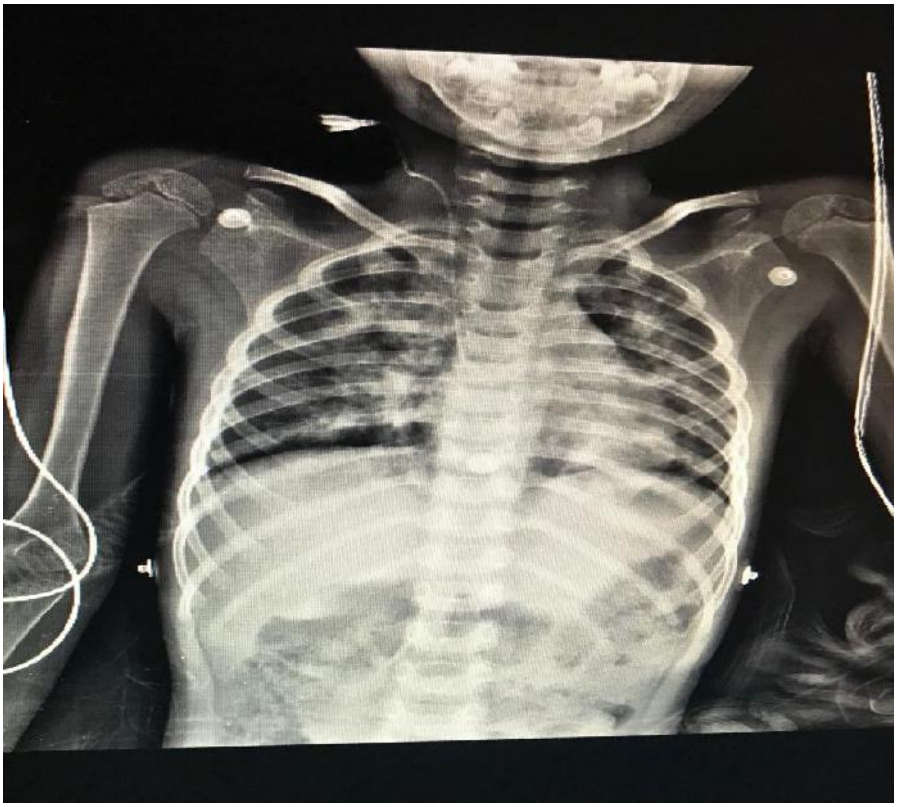


IMAGE 1.- X-ray of Antero Posterior (AP) Thorax.
Alveolar occupation pattern of right basal predominance. (Micronodular images with undefined edges.) Radiography in the emergency department upon patient's admission

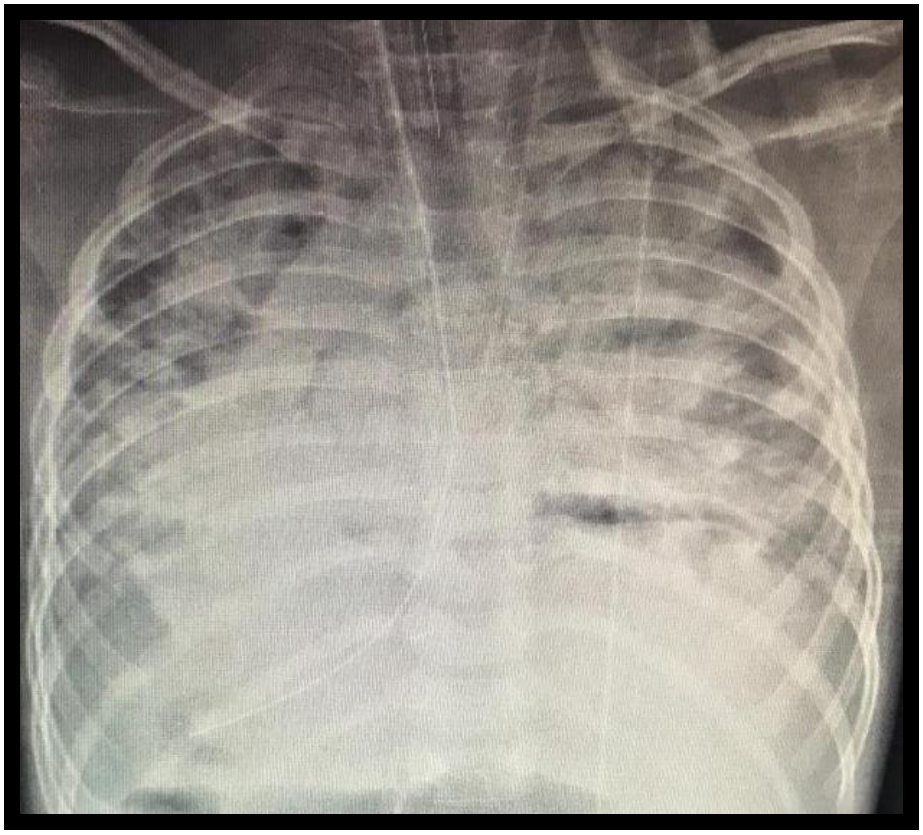


IMAGE 2.-X-ray AP Thorax
Increase in micronodular infiltrates of bilateral undefined margins, compatible with PARDS.

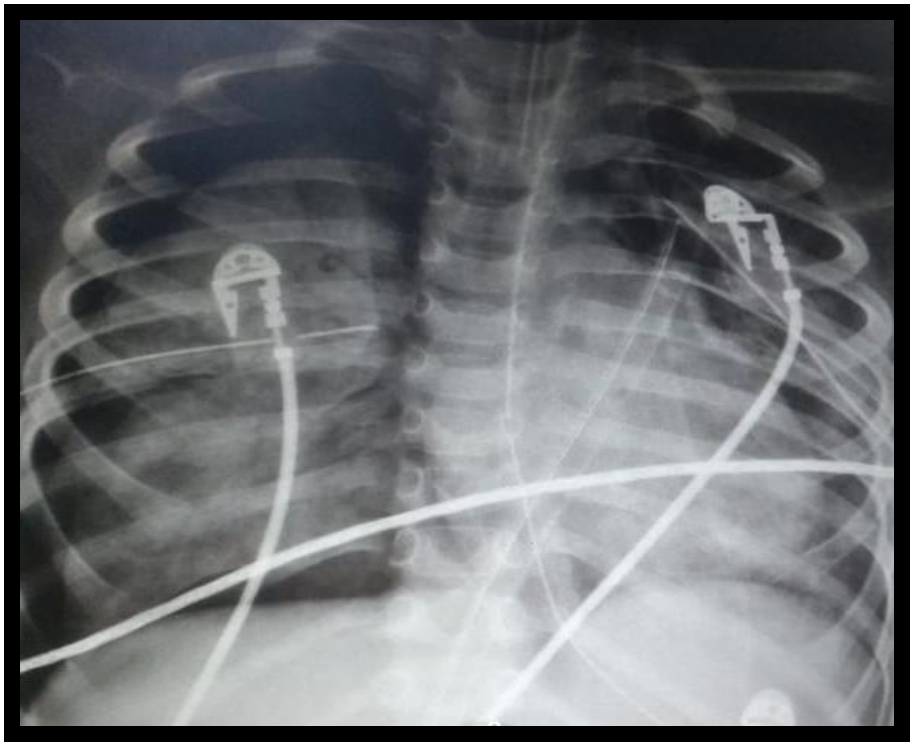


IMAGE 3.- **X-ray AP Thorax**
Decrease in volume of lung parenchyma with presence of air densities in pleural space in relation to Pneumothorax

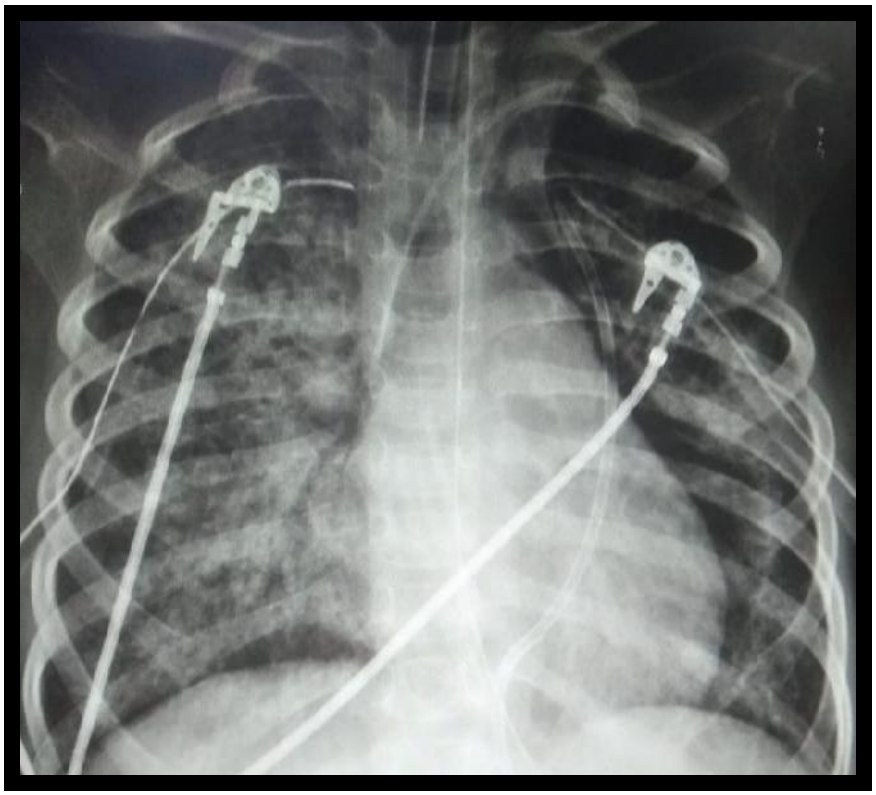


IMAGE 4.- **X-ray AP Thorax**
Decrease of air densities with reexpansion of lung parenchyma after onset of HFOV.

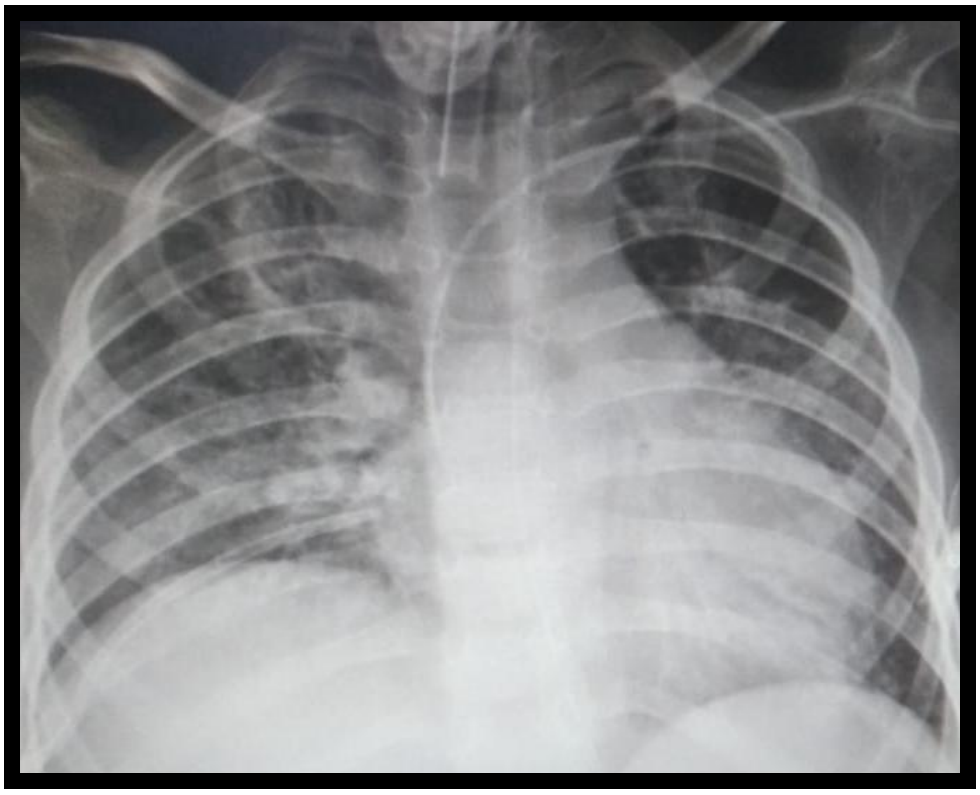
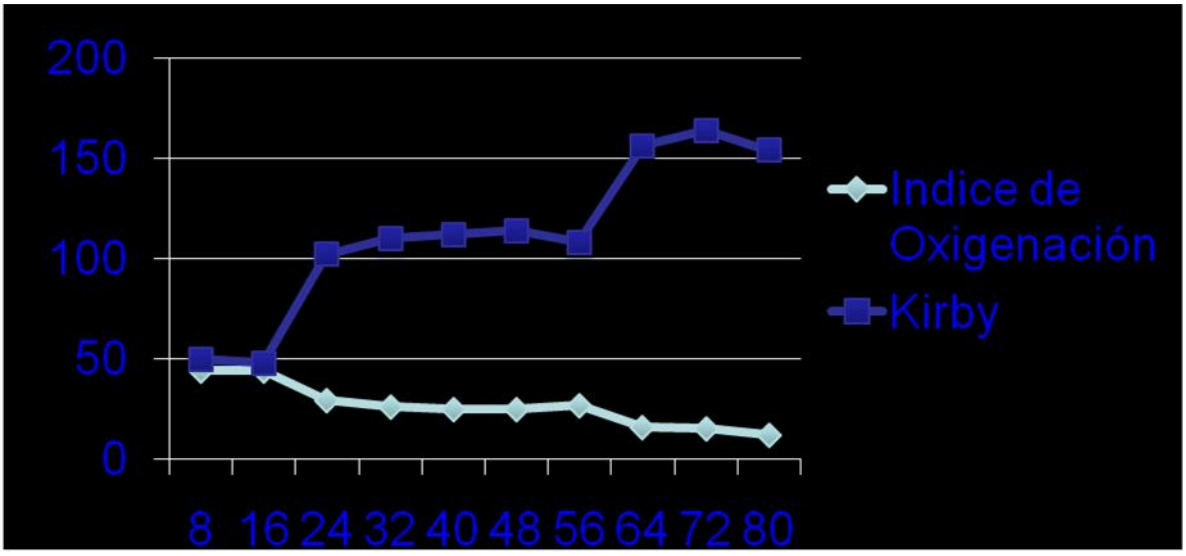


IMAGE 5.- **X-ray AP Thorax**
Radiographic control to the discharge of the UTIP hospital. Pulmonary fibrosis secondary to ARDS.

pH	pCo2	pO2	SatO2	PMVA
7.22	71.6	50	76%	22
7.19	113.6	48	74%	23
7.30	61	102	96%	30
7.36	61	99	96%	29
7.37	60	90	95%	29
7.42	59	81	92%	29
7.50	41	65	92%	30
7.48	38	78	94%	25
7.50	32	82	95%	25
7.39	31	77	92%	20

Graph 1. Arterial Gasometries during High-Frequency Oscillation Ventilation.



Graph 2. Evolution of the Oxygenation and Kirby Index in the first 8 hours of the beginning of the High Oscillation Frequency Ventilation

Discussion

Acute respiratory distress syndrome is an acute and complex disease of a devastating nature, with a high morbidity and mortality in both adult (40%) (5) and infant (26%) (6) population, lacking effective pharmacological therapy and specific treatment. It is characterized for being an entity with diffuse pulmonary involvement, of an inflammatory nature, with an increase in the permeability of the alveolocapillary membrane and variable degrees of interstitial edema, with gravitational collapse of the air spaces and alveolar instability caused by the dysfunction of the surfactant system, alveolar occupation with protein deposit and presence of detritus(7,8) Clinically, it is characterized by the presence of hypoxemia caused by lower pulmonary compliance, increased shunt and increased physiological dead space.

HFOV was described by J. H. Emerson in 1952. It is characterized by the use of small Vt, usually smaller than the anatomical dead space, with rapid respiratory frequencies (> 1 Hz) (9). This therapeutic modality has been shown to be useful in the rescue of patients with severe hypoxemia, hypercapnia of difficult handling and air leak refractory to conventional VM (10,11,12,13). The main limitation of this strategy is the poor monitoring of pulmonary function. More studies are needed to better define its role in the treatment of children with ARDS, given that its real usefulness is strongly questioned at present.

There is no evidence that HFOV is better than VMC, basically because in most studies HFOV has been used as a "rescue" strategy, however, the greatest benefits seem to be obtained when it starts early.

Conclusion

The literature describes better results in the use of High Frequency Oscillatory Ventilation as rescue therapy in pediatric patients diagnosed with ARDS in the early stages of the disease, but it could be considered the use of HFOV in advanced stages of the disease, being able to achieve a decrease in mortality. However, more studies are needed in the pediatric population to define the exact role of HFOV in the treatment of acute hypoxemic respiratory failure

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