American Journal of Medical Case Reports, 2021, Vol. 9, No. 2, 98-102
Available online at http://pubs.sciepub.com/ajmcr/9/2/3
Published by Science and Education Publishing
DOI:10.12691/ajmcr-9-2-3

Recurrent Pneumothoraces in a Patient with Emery Dreifuss Syndrome: A Case Report and Review of the Literature

Krunal H. Patel[1], Elina Shtridler[2], Violeta Capric[1], Sunny Paghdal[1], Samy I. McFarlane[1,*]

[1]Department of Internal Medicine, State University of New York, Downstate-Health Science University, Brooklyn, NY, USA - 11203
[2]Department of Emergency Medicine / Internal Medicine, State University of New York,
Downstate Health Science University, Brooklyn, NY, USA - 11203
*Corresponding author: smcfarlane@downstate.edu

Received November 05, 2020; Revised December 06, 2020; Accepted December 13, 2020

Abstract Emery Dreifuss Muscular Dystrophy (EDMD) is an inherited disorder which leads to progressive worsening of muscular function. In this report, we present a case of a 29 years old woman with EDMD who presented with sudden left anterior chest pain and was diagnosed with recurrent pneumothoraces. We will highlight how a patient with EDMD-related pneumothoraces can develop rapidly worsening ventilatory function resulting in acute hypercapnic respiratory failure. Patients with muscular dystrophies require a high level of acuity on part of the physician to predict. Physician should be on high alert when treating patients with EDMD and pneumothorax given the potential for rapid respiratory deterioration and the requirements of immediate ventilation support. Having the ability to predict the severity of respiratory involvement in patients with EDMD is a key for favorable outcomes, besides prognostication, it also allows physicians to develop an earlier interventional plan for management of potential respiratory failure. In this report, we also provide in-depth review regarding the approach to the assessment of respiratory function in patients with EDMD and the current literature on the management of respiratory complications seen in patients with EDMD, a highly vulnerable population.

Keywords: *Emery Dreifuss Muscular Dystrophy, EDMD, Muscular Dystrophies, recurrent pneumothorax*

Cite This Article: Krunal H. Patel, Elina Shtridler, Violeta Capric, Sunny Paghdal, and Samy I. McFarlane, "Recurrent Pneumothoraces in a Patient with Emery Dreifuss Syndrome: A Case Report and Review of the Literature." *American Journal of Medical Case Reports*, vol. 9, no. 2 (2021): 98-102. doi: 10.12691/ajmcr-9-2-3.

1. Introduction

EDMD is one of many inherited muscular dystrophies which results from mutations in several genes required for normal function of muscle. EDMD is relatively rare, 1 in 100,000 individuals affected, but not entirely scarce that the average physician will go without treating a patient with this disorder during their medical careers [1]. It is for this reason that we discuss the importance of the intricacies involved in managing such a complex disease. EDMD has several key symptoms most notably involving the cardiac, muscular, and skeletal organ systems [2]. Cardiac involvement includes arrhythmias such as heart block, tachycardia, and sudden cardiac death from ventricular fibrillation [3]. In addition patients can develop heart failure later in the disease course, cardiomyopathies, and syncope [4]. Muscle involvement leads to progressive weakness and wasting of arms and lower extremities (humeroperoneal distribution) [5]. Skeletal involvement such as contractures of the elbows and spine, as well as tendinopathy resulting in contractures of the ankles. Later in the disease course, contractures of the spine and lower extremity may become so severe that patients are no longer able to ambulate without significant help.

However, respiratory failure with patients with EDMD is relatively rare. The primary cause of death in patients with EDMD is primarily life threatening conduction blocks which can be avoided with a implantable cardiac defibrillator (ICD) [6]. Severe progression of central and peripheral contractures can lead to severe scoliosis which results in a restrictive lung pattern seen with pulmonary function testings. However, despite observing a restrictive pattern, recurrent pneumothoraces and respiratory failure is rarely observed. Here we will present a 27 year old female with a diagnosis of EDMD who presented with recurrent pneumothoraces and during her admission developed acute respiratory failure. We will discuss the pathophysiology underlying the respiratory failure and the measures that can be taken on part of the clinician to monitor EDMD patients while admitted in the hospital.

2. Case Presentation

A 29 year-old female with Emery-Dreifuss Muscular Dystrophy (EDMD), obstructive sleep apnea, scoliosis

with post cervical fusion, restrictive lung disease from scoliosis, atrial fibrillation post ablation, and complete atrio-ventricular (AV) block post permanent pacemaker (PPM) who presented with a chief complaint of sudden left anterior chest pain. Patient stated that in the morning she developed sudden onset left shoulder pain while sitting in the chair. The pain was described as pleuritic, constant, 10/10 in severity, sharp in quality, with radiation to the left anterior chest wall. The patient stated she had dyspnea, but all other 'review of symptoms' were negative. Negative for trauma or fall prior to presenting to the emergency room. Family history and social history were not significant. Surgical history significant for PPM 2 years prior, cardiac ablation for atrial fibrillation 1 year prior, and cervical spine fusion 10 years prior for worsening scoliosis from contractures. Patient had been previously admitted the month prior for similar symptoms, was found to have a significant pneumothorax and was treated with talc pleurodesis.

Physical exam on presentation was significant only for decreased - absent apical, and middle left lung sounds. No signs of accessory muscle use, no abdominal breathing, patient did not appear in respiratory distress, and was comfortable during this initial examination. Additionally the patient appeared to be severely cachexic appearing, and underweight for her age. Patient was normotensive, heart rate of 84, apyrexic, respiratory rate of 17, and saturating at 100% on room air.

Refer to Table 1 for laboratory data on admission, significant for mild hyperkalemia to [K+] 5.3, bicarbonate of [HCO3-] 29, pH of 7.26 on arterial blood gas (ABG), pO2 of 23 on ABG at room air, pCO2 of 84.4 on ABG at room air. Of note, the patient is chronically hypercapnic, on prior admission the patient had a baseline pCO2 of 79 on ABG at room air as well (Table 1).

Imaging was significant for moderate size left sided pneumothorax with contralateral tracheal deviation, adjacent compressive atelectasis were seen as well, a small apical right pneumothorax was observed too (Image 1). Patient was treated with placement of a small bore chest tube, also known as a Pigtail Catheter, using the Seldinger placement. The pigtail was then placed on wall suction to facilitate reabsorption of pneumothorax. Patient was initially placed on non-rebreather at 15 liter flow rate to maintain 100% FiO2 (fraction of inspired oxygen) to facilitate the reabsorption of the pneumothorax, and the patient was on continuous positive airway pressure (CPAP) at night for OSA.

The following day, hospital day #2, the patient was observed to be comfortable in bed, with the pigtail catheter set to wall suction, repeat portable chest x-ray showed no change in caliber of the pneumothoraces. Vitals were all within normal limits, when the patient was not on CPAP at night, the patient was instructed to be using the non-rebreather at 15 liters. Clinically the patient had no change in status on hospital day #2.

It wasn't until hospital day #3 that the patient's clinical status began to change. The morning of day #3 the patient was observed to be using accessory muscles of breathing and she appeared be tachypnic as well. During this time her vitals continued to remain within normal limits, the patient was saturating at 100% on room air. However the patient had not been compliant with her non-rebreather as it was irritating her nasal epithelium, once placed back on the face mask the patient normalized and was no longer observed to be using accessory muscles. She continued to saturate at 100% while on non-rebreather with strict instructions to maintain the use of the mask. Additionally this morning the patient appeared more somnolent than before, she stated she had not slept in >48 hours secondary to noise and discomfort from her environment. Her increased somnolence was inadvertently attributed to lack of sleep. Additionally, the decision was made not to utilize the BIPAP at this time as it may lead to worsening of the pneumothoraces and the patient was saturating at 100% on non-rebreather. The patient had also stated that she was unable to completely lie flat as this would cause worsening of her dyspnea. A bedside portable x-ray was obtained (Image 2) which showed improvement in the left sided pneumothorax when compared with the x-ray from admission. An hour later the status of the patient was assessed, it appeared that she was comfortable, did not demonstrate signs of respiratory distress, and was alert but still somnolent.

Table 1. Laboratory data. Notice the patient has chronic hypercapnia, which had worsened acutely evening of day #3

	Hospital Day			
Lab	Last Admission - 4 Months Prior	Admission - Day 1	Day 3 - Morning	Day 3 - Evening
Na+ (mmol/L)	134	139	142	138
K+ (mmol/L)	5.3	5.3	4	4.4
Cl- (mmol/L)	99	99	99	97
Bicarbonate (mmol/L)	27	29	34	37
Glucose (mg/dL)	65	106	71	213
BUN (mg/dL)	14	9	8	7
Creatine (mg/dL)	0.4	0.4	0.3	0.3
Ca2+ (mmol/L)	98	10.2	N/A	9.3
Mg2+ (mmol/L)	N/A	N/A	N/A	1.5
Phosphorus (mmol/L)	N/A	N/A	N/A	1.0
Blood Gas - pH	7.25 - venous	7.26 - venous	N/A	7.02 - arterial
Blood Gas - pO2 (mmHg)	23 - venous	15.6 - venous	N/A	281 - arterial
Blood Gas - pCO2 (mmHg)	79 - venous	84.4 - venous	N/A	163 - arterial

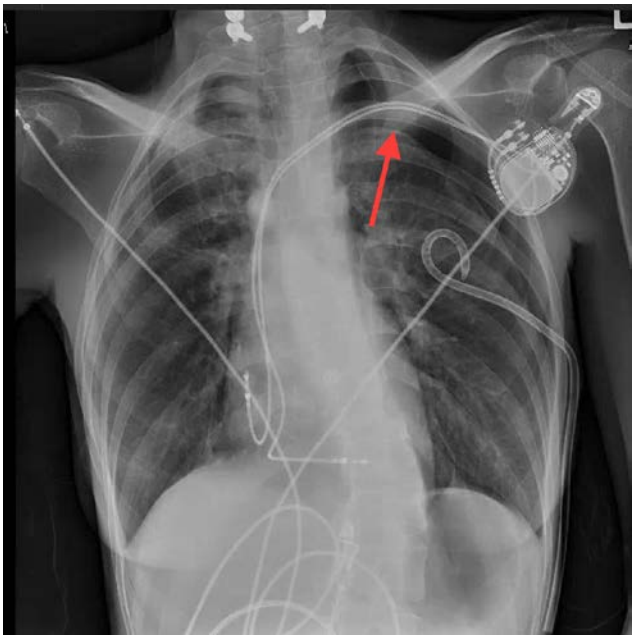

Image 1. Chest X-ray on admission. Refer to the red arrow showing moderate sized left apical - middle pneumothorax.

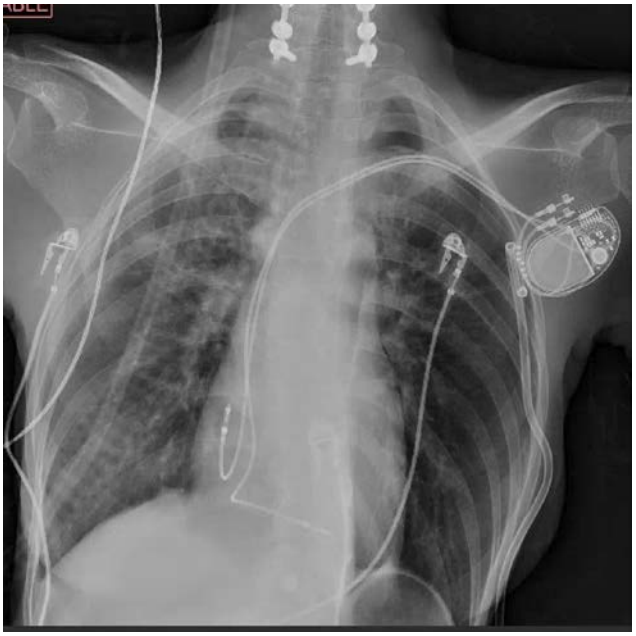

Image 2. Hospital day #3 shows improvement of the left apical pneumothorax

Overall it appeared that the patient was improving when compared to her status in the morning. It was not until much later in the day, during the night, that the patient had significant deterioration in her clinical status. Nursing staff had noticed the patient had significant changes in mental status, the patient was not alert or orientated to self, time, place. Rapid response code was initiated at this time. At this time the patient was already on BIPAP but continued to be altered. Based on the change of the patient's clinical status it was determined the patient should be intubated due to contraindication to BIPAP. An ABG was taken at this time (Table 1) significant for pCO2 of 163, pO2 of 281, pH 7.02, and a bicarbonate of 37. Patient was later transferred to the medical ICU for hypercapnic respiratory failure. Repeat imaging showed no changes in pneumothoraces when compared with previous imaging from earlier in the day.

Patient was successfully extubated on hospital day #5, ICU day #2, and transferred back to the step down unit (SDU) for further observation.

3. Discussion

Performing a retrospective analysis of the events on the morning of hospital day 3 several symptoms were likely served as ominous warning signs which were overlooked due to the intricacies of EDMD. Patients with muscular dystrophies when experiencing acute worsening of their diaphragmatic function will complain of worsening orthopnea when lying supine and / or bending forward [7]. This rare observance was seen in our patient when she stated she had worsening breathlessness when lying supine. This symptom of orthopnea was inadvertently attributed to her pneumothorax and presence of a chest tube. Additionally the patient appeared to be alert but lethargic this morning, when asked for further details she had stated she had not slept in over 48 hours due to discomfort, and noise pollution. Her increased level of somnolence was more likely an early sign of acute worsening in hypercapnia. Patients with EDMD with severe contractures and scoliosis will have a restrictive lung pattern resulting in chronic hypercapnia which our patient had. Patients will compensate over time however any acute worsening of their chronic hypercapnia can result in respiratory failure. This can be observed clinically as headaches, altered mental status, decreased concentration, and blurred vision from papilloedema [8]. In our patient she had increased somnolence which was inadvertently attributed to lack of sleep. Later in the course of the day as the hypercapnia worsened, pCO2 of 163, the patient began showing signs of altered mental status.

Patients with muscular dystrophies such as EDMD do not classically present with sign and symptoms associated with respiratory failure. Classically patients with impending respiratory failure will present with symptoms such as difficulty breathing, use of accessory muscles, confusion, lethargy / fatigue, and tachypnea [9]. Our patient prior to her experiencing respiratory failure had shown certain telltale signs such as, lethargy, use of accessory muscles, and fatigue. However, the fact that the patient remained saturating at 100% on room air, and use of accessory muscles improved with supplemental oxygen can lead even the most experienced physicians astray. The patient herself had instructed the primary team that her somnolence was likely to not sleeping in over 48 hours. In patients with EDMD the clinician should have a low threshold to perform further investigatory measures such as arterial blood gas, imaging, or the more aggressive use of NIPPV even in the setting of pneumothoraces if hypercapnia is suspected.

Diaphragmatic failure in an attempt to maintain normal alveolar ventilation will result in increased arterial CO2 (PaCO2) [10]. Non-invasive measures can be used before reverting to invasive arterial blood gas sampling to measure PaCO2. Such measures are trans-cutaneous, and end tidal CO2 sensors to monitor CO2 levels.

Non-invasive measurement of capnography should also be utilized when available in patients with significant pulmonary involvement secondary to muscular dystrophy such as pneumothorax [11]. Non-invasive capnography is not entirely reflective of the PaCO2 however studies have shown non-invasive capnography tends to overestimate the actual PaCO2 [12]. Normally patients with EDMD will attempt to maintain a normal PaCO2 as physiologically possible, thus an increase in CO2 whether thru non-invasive or blood gas, signals impending failure requiring urgent intervention [13]. Additional non-invasive measures of respiratory status can be made using simple bedside spirometry [14]. Worsening diaphragmatic function can be detected early utilizing tidal volume, and forced vital capacity (FVC) changes [15]. This however, requires knowledge of the patients baseline values, and monitoring of daily values to trend for any changes.

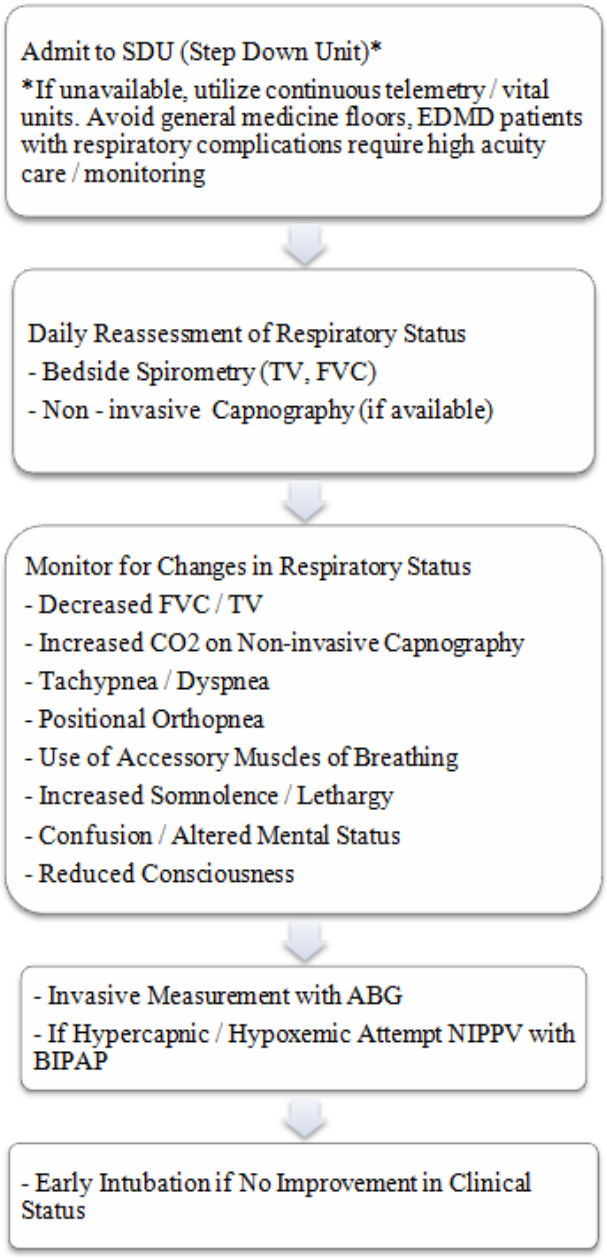

Figure 1. Inpatient management of EDMD patients who present with respiratory involvement such as pneumothoraces

An argument can also be made that patients with muscular dystrophies such as EDMD who present with several pneumothoraces should require a higher level of care (Figure 1). Step Down Units (SDU's) can provide this intermediate level of care which is a balance between the Intensive Care Unit (ICU) and the general medicine floors. SDU's can be utilized in these patients for regular monitoring but do not initially meet ICU level admission on presentation. Alternatively hospitals without SDU's can utilize general medicine floors with cardiac telemetry as these patients usually will have continuous pulse-oximetry monitoring, as well as regular contact via nursing staff.

4. Conclusion

Worsening respiratory failure in patients with EDMD can be a major cause of morbidity and mortality in this cohort of patients. The progression of EDMD is associated initially with gradual loss of diaphragmatic strength. Worsening spinal contractures and scoliosis can lead to rapidly decompensated respiratory function in these patients [16]. Several non-invasive measures can be used to monitor acute changes such as bedside spirometry, and non-invasive capnography monitoring [17]. Additionally patients with EDMD do not present with hypoxemic respiratory failure, rather hypercapnic respiratory failure which the physician should be aware of when dealing with patients with muscular dystrophies. Patients can maintain 100% saturations on room air in the presence of worsening hypercapnia [18]. This requires the clinician to have a high level of acuity when treating EDMD patients, and a low threshold for further investigative measures. Arterial blood gasses should be used liberally when concerned for possible worsening hypercapnia. Once alveolar hypoventilation is diagnosed, NIPPV should be used with a low threshold for invasive ventilation when warranted even in the setting of pneumothoraces.

It is important to keep both the physician and caregivers aware of patients with EDMD having a high propensity to develop acute hypercapnic respiratory failure. This allows all parties involved to understand the underlying progression of their respiratory condition, to recognize early signs and symptoms of impending failure, and to be aware of the investigatory modalities available to them for further investigation.

Acknowledgements

This work is supported, in part, by the efforts of Dr. Moro O. Salifu MD, MPH, MBA, MACP, Professor and Chairman of Medicine through NIMHD Grant number S21MD012474.

References

[1] Puckelwartz M, McNally EM. Emery-Dreifuss muscular dystrophy. Handb Clin Neurol. 2011; 101: 155-166.

[2] Emery AE. Emery-Dreifuss muscular dystrophy - a 40 year retrospective. Neuromuscul Disord. 2000; 10(4-5): 228-232.

[3] Bonne G, Quijano-Roy S. Emery-Dreifuss muscular dystrophy, laminopathies, and other nuclear envelopathies. Handb Clin Neurol 2013; 113: 1367.

[4] Yates JR. 43rd ENMC International Workshop on Emery-Dreifuss Muscular Dystrophy, 22 June 1996, Naarden, The Netherlands. Neuromuscul Disord. 1997; 7(1): 67-69.

[5] Shahrizaila N, Kinnear WJ, Wills AJ. Respiratory involvement in inherited primary muscle conditions. J Neurol Neurosurg Psychiatry. 2006; 77(10): 1108-1115.

[6] Choo-Kang, L. R., Ogunlesi, F. O., McGrath-Morrow, S. A., Crawford, T. O., & Marcus, C. L. (2002). Recurrent pneumothoraces associated with nocturnal noninvasive ventilation in a patient with muscular dystrophy. Pediatric Pulmonology, 34(1), 73-78.

[7] Zhang Q, Bethmann C, Worth NF, et al. Nesprin-1 and -2 are involved in the pathogenesis of Emery Dreifuss muscular dystrophy and are critical for nuclear envelope integrity. Hum Mol Genet 2007; 16:2816.

[8] Haberlová J. Evaluation and Treatment of Myopathies. Eur J Hum Genet. 2015; 23(10): 1433.

[9] Yates JR, Warner JP, Smith JA, et al. Emery-Dreifuss muscular dystrophy: linkage to markers in distal Xq28. J Med Genet 1993; 30: 108.

[10] Liang WC, Mitsuhashi H, Keduka E, et al. TMEM43 mutations in Emery-Dreifuss muscular dystrophy-related myopathy. Ann Neurol 2011; 69: 1005.

[11] Quijano-Roy S, Mbieleu B, Bönnemann CG, et al. De novo LMNA mutations cause a new form of congenital muscular dystrophy. Ann Neurol 2008; 64: 177.

[12] Megan Puckelwartz, Elizabeth m. McNally, Chapter 12 - Emery-Dreifuss muscular dystrophy, Editor(s): Robert C. Griggs, Anthony A. Amato, Handbook of Clinical Neurology, Elsevier, Volume 101, 2011, Pages 155-166.

[13] Bolliger D, Steiner LA, Kasper J, Aziz OA, Filipovic M, Seeberger MD. The accuracy of non-invasive carbon dioxide monitoring: a clinical evaluation of two transcutaneous systems. Anaesthesia. 2007; 62(4): 394-399.

[14] Andrea Bianchi, Pierluigi Giuseppe Manti, Federica Lucini, Chiara Lanzuolo, Mechanotransduction, nuclear architecture and epigenetics in Emery Dreifuss Muscular Dystrophy: tous pour un, un pour tous, Nucleus, 9, 1, (321-335), (2018).

[15] Gilchrist JM, Leshner RT. Autosomal Dominant Humeroperoneal Myopathy. Arch Neurol. 1986; 43(7): 734-735.

[16] Hopkins, L.C., Jackson, J.A. and Elsas, L.J. (1981), Emery-dreifuss humeroperoneal muscular dystorphy: An X-linked myopathy with unusual contractures and bradycardia. Ann Neurol., 10: 230-237.

[17] Hacer Durmus, Piraye Serdaroglu-Oflazer, Feza Deymeer, Emery-Dreifuss Muscular Dystrophy, Neuromuscular Disorders of Infancy, Childhood, and Adolescence, (667-678), (2015).

[18] Homma K, Nagata E, Hanano H, et al. A Young Patient with Emery-Dreifuss Muscular Dystrophy Treated with Endovascular Therapy for Cardioembolic Stroke: A Case Report. Tokai J Exp Clin Med. 2018; 43(3): 103-105. Published 2018 Sep 20.

[19] LoMauro A, D'Angelo MG, Aliverti A. Assessment and management of respiratory function in patients with Duchenne muscular dystrophy: current and emerging options. Ther Clin Risk Manag. 2015; 11: 1475-1488. Published 2015 Sep 28.

[20] Simonds AK, Muntoni F, Heather S, Fielding S. Impact of nasal ventilation on survival in hypercapnic Duchenne muscular dystrophy. Thorax. 1998; 53(11): 949-952.

[21] Leger P, Bedicam JM, Cornette A, et al. Nasal intermittent positive pressure ventilation. Long-term follow-up in patients with severe chronic respiratory insufficiency. Chest. 1994; 105(1): 100-105.