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Case Report

Sueiro's and Hoover's Signs. Coincidence or Causality?

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Abstract

The paradoxical inspiratory movement on the lateral margin of the inferior ribs is a classic sign of the chronic obstructive pulmonary disease (COPD) and it is known as Hoover´s sign. Its presence is related to a worse prognosis in COPD patients in terms of dyspnea and exacerbations. On the other hand, the Sueiro's sign is defined by the diastasis recti abdominis with dynamic herniation of the abdominal content when we ask the patient for sitting up from the supine position, which justifies a worse ventilatory mechanics. We have had the opportunity to study a COPD patient where Hoover and Sueiro's signs coexisted. We discuss the relation between them and the possibility that Sueiro's sign may contribute to a greater expression of Hoover's sign.

Keywords: *Sueiro's Signs; Hoover's Signs; Chronic Obstructive Pulmonary Disease (COPD)*

Introduction

The paradoxical inspiratory movement on the lateral margin of the inferior ribs, described by Hoover [1] in 1920, is a classic sign of the chronic obstructive pulmonary disease (COPD), just as we can read on classic books of Pneumology and Internal Medicine [2]. It's an easily obtainable sign with a high interobserver concordance [3]. It has a sensitivity and specificity up to 58% and 86% respectively [3]. Its presence is related to a worse prognosis in COPD patients in terms of dyspnea and exacerbations [4]. There are other exploratory signs that we can find at the patient's bedside. One example is the Sueiro's [5] sign, defined by the diastasis recti abdominis with dynamic herniation of the abdominal content when we ask the patient for sitting up from the supine position, which justifies a worse ventilatory mechanics. We present the case noteworthy by its semiological singularity of a patient with COPD where Hoover and Sueiro's signs coexist and we discuss the possible relation between them.

Case Report

Our patient is a man, 80 years old, former-smoker (25 packs-year) with the next medical history: hypertension, diabetes, COPD (stage 4, group D according to the GOLD classification) on treatment with vilanterol, umeclidium bromide and domiciliary oxygen therapy. He arrived to the Emergency Department of our hospital with worsening of the habitual dyspnea since three days ago, cough and non-purulent sputum. He denied chest pain, palpitations, a decrease on urine output or any other accompanying symptoms. Physical examination spotlighted somnolence, cyanotic lips and inspiratory retraction of the inferior ribs (Hoover sign, figure 1). Hemodynamically stable, oxygen saturation 82% (while the patient was breathing ambient air), respiratory rate of 28 breaths per minute, no fever. The body mass index (BMI) was 27. There was no evidence of heart murmurs. Pulmonary auscultation revealed dispersed expiratory wheezing on both lung fields. Abdominal exploration did not show any signs of peritonism, masses or visceromegaly but we could appreciate dynamic herniation of the abdominal content when the patient performed maneuvers that increased intraabdominal pressure, especially when he tried to sit

up from supine position (Sueiro's sign, figure 2). The electrocardiogram showed sinus rhythm at 90 beats per minute without alterations in cardiac repolarization. The chest x-ray showed normal cardiothoracic ratio with no pulmonary infiltrates. In respect of laboratory data: glucose 216 mg/dL, creatinine 1.08 mg/dL, sodium 134 mEq/L, potassium 4.9 mEq/L, chloride 93 mEq/L, C-reactive protein 289.5 mg/L, Troponin I 0 ng/mL, BNP 123.6 pg/mL, white cell count per microliter 26300 with 83% neutrophils; arterial blood gasses (Venturi Mask, fraction of inspired oxygen 35%): pH 7.20, $PaCO_2$ 100 mmHg, PaO_2 75 mmHg, bicarbonate 40 mEq/L.

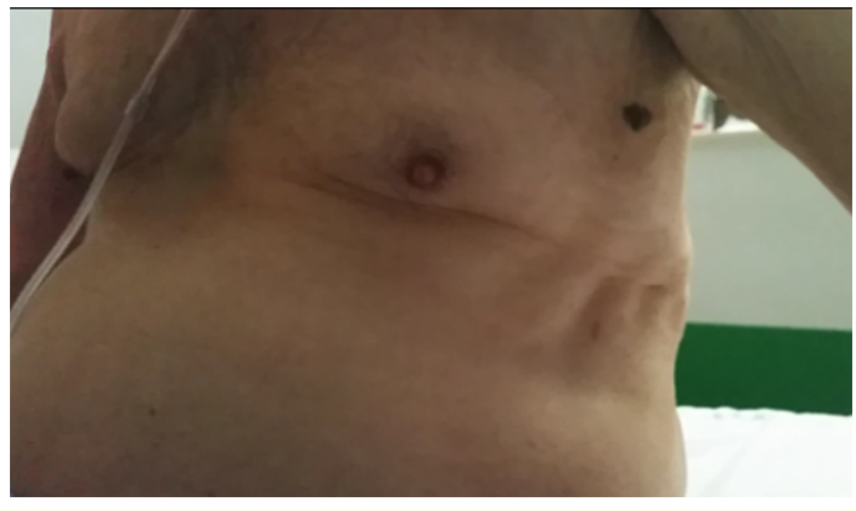

Figure 1: *Mechanical dysfunction in COPD. Hoover's sign (during inspiration).*

Figure 2: *Sueiro's sign. Dynamic herniation on abdominal midline when making maneuvers that increase intrabdominal pressure.*

The patient was diagnosed of COPD exacerbation and secondary global respiratory failure. Non-invasive mechanical ventilation was initiated; he received treatment with inhaled bronchodilators, antibiotics, systemic steroids and controlled oxygen therapy. The patient presented a favorable evolution and medical discharge was indicated along the seventh day after hospitalization. A patient's spirometry realized after medical discharge showed the following results: FVC 1810mL (60.9%), FEV1 560 mL (25.6%), FEV1/FVC 31.1%, TLC 5940 mL (141%), RV 2670 mL (217%), RV/TLC 45%, Rawtot 0.30 KPa (l/s) (272%). It was informed as a severe obstruction, accompanied by hyperinflation and air-trapping with an increase on total airway resistances.

Discussion

After the attention given to this patient who exhibited Sueiro's and Hoover's signs, we wondered about the impact that the abdominal wall distortion could made on ventilation capacity and, therefore, the possibility that Sueiro's sign may contribute to a greater expression of Hoover's sign.

Sueiro's sign (SS) consists on the herniation of abdominal content through diastasis recti when the patient tries to sit up from supine position. It's a sign that can be observed frequently in COPD patients who exhibit a characteristic phenotype of truncal obesity, short neck and an increase in the rib cage diameter at its lower portion [5].

Hoover's sign (HS) alludes to the retraction on the lateral margin of inferior ribs during the inspiratory phase. It has also been related to a specific model of COPD patient with more BMI [4,6], less oxygen saturation [7], smaller FEV1 values [6], more dynamic hyperinflation [6] and respiratory inefficiency [8]. It's associated to a higher level of dyspnea [4,7], exacerbations [4,6] and the need for hospitalization [7]. Despite the facility of HS observation, its high interobserver agreement [3] and its utility for the identification of a subgroup of patients with worse outcome, HS routine evaluation is poorly extended on clinical practice. Various mechanisms have been proposed to give an explanation to this paradoxical phenomenon; it outstands the one proposed by Hoover [1], who attributed it to the disappearance of the diaphragmatic apposition zone to the ribe cage and the consequent radial alignment of diaphragmatic fibers which pull the ribs inward when contracting. Although it is an attractive hypothesis, imaging studies of patients with Hoover sign have shown a decrease on the diaphragm zone of apposition but not its disappearance, so it does not seem to be its main mechanism [9,10]. Several researchers agree on the importance of abdominal support in the inspiratory physiology and the generation of the lateral-cranial movement of the lower ribs in the healthy subject [11]. The peculiar anatomical disposition of the diaphragm is the responsible of the resulting direction of the force that it creates. On the one hand, the insertional force is applied by the diaphragmatic attachments to the lower ribs and it generates a vector in cranial direction. On the other hand, when the diaphragm descends, it increases the intraabdominal compartment pressure; the force of apposition is due to the transmission of this pressure through the zone of apposition to the inferior ribs, which are pushed laterally [11,12]. Hypothetically, a decrease on the diaphragmatic zone of apposition would reduce this latter force according to a mathematical model designed by Wilson [13], which suggests that the pathophysiological mechanism of HS is an increase on abdominal compliance with an important increase of pulmonary resistances.

In this way and with SS as an expression of the increment of the abdominal compartment compliance, we present the case of a patient diagnosed with COPD as a clinical model of the possible mechanisms which may explain the inefficient ventilation on patients with HS. Probably, ventilation impairment on COPD go further away than a simple obstruction to airflow and it may implicate extrapulmonary elements such as diastasis recti, alterations on diaphragmatic physiology. Anecdotally, we highlight De troyer., *et al.* (2015) [14] work done on dogs in which abdominal support was given with a custom-made wooden; as a result, they find an increase in intraabdominal pressure, transdiaphragmatic pressure and the cranial-lateral movement of the inferior ribs.

Conclusion

In conclusion, our results show that ventilation impairment on COPD go further away than a simple obstruction to airflow and it may implicate extrapulmonary elements such as diastasis recti and alterations on diaphragmatic physiology. Could the abdomen be a new horizon of ventilation therapy in patients with this COPD phenotype? New studies are necessary.

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