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Original Contribution

Nasal flaring as a clinical sign of respiratory acidosis in patients with dyspnea

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ABSTRACT

Objective: To determine whether the presence of nasal flaring is a clinical sign of respiratory acidosis in patients attending emergency departments for acute dyspnea.
Methods: Single-center, prospective, observational study of patients aged over 15 requiring urgent attention for dyspnea, classified as level II or III according to the Andorran Triage Program and who underwent arterial blood gas test on arrival at the emergency department. The presence of nasal flaring was evaluated by two observers. Demographic and clinical variables, signs of respiratory difficulty, vital signs, arterial blood gases and clinical outcome (hospitalization and mortality) were recorded. Bivariate and multivariate analyses were performed using logistic regression models.
Results: The sample comprised 212 patients, mean age 78 years (SD = 12.8), of whom 49.5% were women. Acidosis was recorded in 21.2%. Factors significantly associated with the presence of acidosis in the bivariate analysis were the need for pre-hospital medical care, triage level II, signs of respiratory distress, presence of nasal flaring, poor oxygenation, hypercapnia, low bicarbonates and greater need for noninvasive ventilation. Nasal flaring had a positive likelihood ratio for acidosis of 4.6 (95% CI 2.9–7.4). In the multivariate analysis, triage level II (aOR 5.16; 95% CI: 1.91 to 13.98), the need for oxygen therapy (aOR 2.60; 95% CI: 1.13–5.96) and presence of nasal flaring (aOR 6.32; 95% CI: 2.78–14.41) were maintained as factors independently associated with acidosis.
Conclusions: Nasal flaring is a clinical sign of severity in patients requiring urgent care for acute dyspnea, which has a strong association with acidosis and hypercapnia.

1. Introduction

The medical literature [1,2] considers nasal flaring (NF) in the context of acute dyspnea as one of the classic signs of respiratory distress which correlate with the severity of respiratory failure.

Little is known about the physiology of the muscles that dilate the wings of the nose and the effects that this dilation has on the upper airway. Several studies in healthy subjects [3,4,5] have shown that the dilation of the wings of the nose obtains a significant reduction (up to 30%) in nasal airway resistance, which may represent >40% of the total airway resistance. Therefore, NF is of great clinical importance in breastfed infants, who necessarily breathe through the nose. Indeed, NF is a clinical sign of respiratory distress [6,7] and in this situation it reduces both nasal and total airway resistance. Regarding the trigger of the reflex dilation of the wings of the nose, several studies in healthy subjects [8,9,10,11] have shown that hypercapnia or increased respiratory load can stimulate their muscle activity.

In 2009, Mas et al. [12] sought to determine whether the presence of NF in patients with dyspnea was associated with severe respiratory failure. The study included 43 patients, of whom 16.3% had NF. The presence of this sign was not indicative of severe respiratory failure; it was significantly associated with tachypnea and acidosis, but not with hypercapnia. Zorrilla et al. [13] recently conducted a single-center study which aimed primarily to assess NF as an independent predictor of mortality in patients with dyspnea consulting either hospital or pre-hospital emergency departments, and found that probability of death was three

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times higher in patients who developed this clinical sign. The objective of the present study was to determine whether NF is independently associated with acidosis, and whether acidosis is related to the presence of hypercapnia.

2. Method

2.1. Design and participants

Observational, prospective, single-center study of patients with dyspnea seen consecutively at our hospital's emergency department (ED) or treated at home by the Prehospital Emergency Medical Services and subsequently transferred to our ED. Inclusion criteria were: age over 15, level II or III in the Andorran Triage Program (e-PAT v 4.0.), agreement between the two observers attending the patient regarding the presence or absence of NF, and provision of informed consent to participate in the study. The Andorran Triage Model (MAT) [14,15] is a nurse system prioritization of care structured in 5 levels of attention priority, being level I clinical situations that need for immediate resuscitation, level II immediate life risk, level III potential life risk and levels IV and V situations without potential life risk. It is equipped with a clinical decision aid program (e-PAT web-page support program), evaluated and validated with continuous help and anamnestic registration of triage. Patients in whom no inter-rater agreement was obtained or in whom the presence of NF was not evaluated were excluded, as were those who did not undergo an arterial blood gas test (whether or not they had NF) in their preliminary assessment.

The presence of NF was defined as the dilation of the wings of the nose during inspiration in a patient with dyspnea [1]. The care team, comprising a physician and nurse, assessed the presence or absence of NF, either together or individually. The presence of NF was accepted only when there was agreement between the two observers.

The study was approved by our hospital's Ethics Committee for Clinical Research. It was conducted in accordance with international ethical guidelines for research involving humans, based on the principles of the Declaration of Helsinki.

2.2. Baseline assessment

Subjects were enrolled in the study and followed up between October 1, 2011 and March 31, 2012. At the baseline assessment, demographic variables were recorded: age, sex, initial care in the emergency department or by the Prehospital Emengency Medical Services, level II or III triage, and clinical variables; presence of nasal flaring, suprasternal retractions, intercostal retractions and abdominal breathing. Comorbidity was assessed using the Charlson index [16]. This index contains 19 categories. Each comorbidity category has an associated weight (from 1 to 6), based on the adjusted relative risk of one-year mortality, and the sum of all the weights results in a single comorbidity score for a patient. Scores of 0–1 were taken to indicate absence of comorbidity, scores of 2 low comorbidity, and scores of 3 or more high comorbidity. Vital signs included in the initial assessment were arterial oxygen saturation (SaO_2) measured with pulse oximetry, the inspired oxygen fraction (FiO_2) at the time of the assessment in the ED, respiratory rate (RR), accepting 24 breaths per minute as the upper normal limit [17], heart rate (HR), taking a rate of above 100 beats/min as indicating tachycardia, systolic blood pressure, taking values ≥140 mm Hg as indicating hypertension, diastolic blood pressure, taking values ≥90 mm Hg as indicating hypertension, and axillary temperature. The variables recorded by arterial blood gases were: pH, with figures below 7.35 considered as acidosis; arterial oxygen pressure (PaO_2),

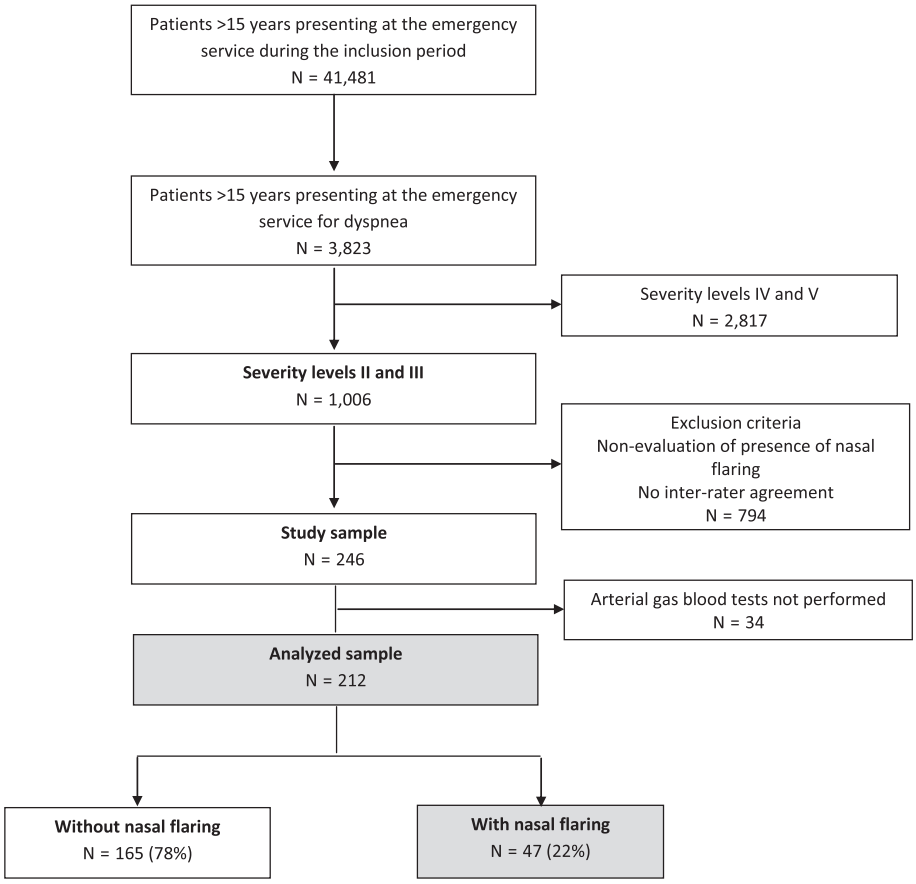

Fig. 1. Flowchart of the screening process, recruitment and assessment of nasal flaring.