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Brief report

Prognostic value of nocturnal pulse oximetry in patients with heart failure☆

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ABSTRACT

Introduction and objectives: To analyze the prognostic value of nocturnal hypoxaemia measured with portable nocturnal pulse-oximetry in patients hospitalized due to heart failure and its relation to mortality and hospital readmission.

Methods: We included 38 patients who were admitted consecutively to our unit with the diagnosis of decompensated heart failure.

Pulse-oximetry was considered positive for hypoxaemia when more than 10 desaturations per hour were recorded during sleep.

Follow-up was performed for 30.3 (standard deviation [SD] 14.2) months, the main objective being a combined endpoint of all-cause mortality and hospital readmission due to heart failure.

Results: The average age was 70.7 (SD 10.7) years, 63.3% were males.

Pulse-oximetry was considered positive for hypoxaemia in 27 (71%) patients.

Patients with positive pulse-oximetry had the most frequent endpoint (9.1% [1] vs. 61.5% [16], $p = 0.003$).

After multivariate analysis, continuous nocturnal hypoxaemia was related to the combined endpoint (HR = 8.37, 1.19–68.4, $p = 0.03$).

Discussion: Patients hospitalized for heart failure and nocturnal hypoxaemia measured with portable pulse-oximeter have an increased risk of hospital readmission and death.

Valor pronóstico de la pulsioximetría nocturna en pacientes con insuficiencia cardiaca

Palabras clave:
Trastornos respiratorios del sueño
Insuficiencia cardiaca
Hipoxemia nocturna
Factores relacionados con el pronóstico

RESUMEN

Introducción y objetivos: Analizar el valor pronóstico de la hipoxemia nocturna, evaluada mediante pulsioximetría nocturna portátil, en pacientes ingresados por insuficiencia cardiaca y su relación con la mortalidad y el reingreso hospitalario.

Métodos: Incluimos a 38 pacientes ingresados de manera consecutiva en nuestra unidad con el diagnóstico de insuficiencia cardiaca descompensada.

La pulsioximetría se consideró positiva para hipoxemia cuando se registraron más de 10 desaturaciones a la hora durante el sueño.

Se realizó seguimiento durante 30,3 (desviación estándar [DE] 14,2) meses, el objetivo principal fue un *endpoint* combinado de mortalidad por cualquier causa y reingreso por insuficiencia cardiaca.

Resultados: La edad media fue de 70,7 (DE 10,7) años; el 63,3% eran varones.

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La pulsioximetría fue considerada positiva para hipoxemia en 27 (71%) pacientes.

Los pacientes con una pulsioximetría positiva presentaron con mayor frecuencia el *endpoint* combinado (9.1% [1] vs. 61,5% [16]; p = 0,003).

Tras el análisis multivariable, la hipoxemia nocturna continuó estando relacionada con el *endpoint* combinado (HR = 8,37; 1,19-68,4; p = 0,03).

Discusión: Los pacientes ingresados por insuficiencia cardiaca e hipoxemia nocturna medida con pulsioxímetro portátil presentan un riesgo aumentado de reingreso y muerte.

Introduction

Heart failure (HF) is a growing health problem in our country, affecting more than 1,300,000 Spaniards.[1] In addition, it is a disease with a significant healthcare expenditure and accounts for 2% of hospital emergencies in our environment.

On the other hand, sleep-disordered breathing (SDB) is a very common comorbidity in patients with HF,[2] which are usually underdiagnosed. There are many studies that have analyzed their impact on these patients[3] and most of them agree that it is a bad prognostic factor.[4] Recent studies show nocturnal hypoxaemia (NH) as a parameter strongly related to mortality,[5] although has not yet been studied in depth.

Portable overnight pulse oximetry (OPO) is a simple, non-invasive and easily accessible test that can help us study NH of patients with HF.[6]

Our objective is to analyze the influence on the prognosis and readmissions of HF patients with NH using OPO.

Patients

Patients admitted to our service for HF from May 2013 to January 2014 were included (102 patients). HF was defined according to the clinical practice guidelines in force at the time of the start of the study.[7] The exclusion criteria were:

Age over 85 years (8 excluded patients), life expectancy less than 6 months due to causes other than heart disease (5 excluded patients), valvular disease pending intervention, myocarditis, acute coronary syndrome in the last month (23 excluded patients), severe mental illness (4 excluded patients) and previous diagnosis of SDB (18 excluded patients).

Of them, 44 met the criteria. In collaboration with Respiratory Medicine, 38 finally underwent OPO, who agreed to be included in our study.

A 3 i Konica Minolta model was used for the OPO, a week after discharge, which was considered positive in those patients with 10 or more desaturations per hour of at least 3% of the saturation immediately before. Subsequently, they were referred to Respiratory Medicine for a SDB study.

Mortality from any cause and hospital readmissions due to worsening of HF during the follow-up of both groups were analyzed. The main objective was a composite *endpoint* of readmission for HF and mortality. Re-admission for HF was defined as a worsening of the patient's baseline symptoms, accompanied by evidence of fluid retention such as increased oedema or pulmonary congestion evaluated clinically or radiologically that would require significant changes in the patient's treatment for his/her improvement, such as intravenous diuretics, positive ionotropic drugs or ventilatory support.

A Student's *t*-test was used to compare means and a chi^2 test to compare qualitative variables. Subsequently, the time to event was analyzed by the Kaplan–Meier test and the differences between both groups were studied by the log-rank test. Those variables with *p* value lower than 0.20 were selected to build the multivariate Cox regression model.

The mean follow-up was 30.3 (14.2) months.

Results

38 patients were included in the study, with 70.7 years (10.7); 63.3% were male. Of these, 27 (71%) had NH, compared to 11 (29%) who did not have it.

The baseline characteristics of both groups are shown in Table 1: they were similar among them, although there was a tendency to worse functional class and a higher brain natriuretic peptide (BNP) in patients with NH.

Statistically significant differences were found in the composite *endpoint* of mortality and readmission (Table 2), according to whether patients presented NH or not (9.1 vs. 61.5%, $p = 0.003$). These differences were mainly at the expense of a greater number of readmissions in the group of patients with NH.

Fig. 1 shows the Kaplan–Meier curves of the composite *endpoint*. The statistically significant difference assessed by the log-rank test was $p = 0.01$.

Table 3 shows the variables related to showing the composite *endpoint*. We selected those variables with *p* value lower than 0.20 to build the Cox regression model.

Finally, the relationship between showing the composite *endpoint* and the different variables was analyzed using Cox's regression model (Table 4). This relationship was maintained with the NH. Also, showing the composite *endpoint* was related to having higher creatinine levels. On the other hand, neither the ischaemic aetiology ($p = 0.19$) nor the functional class ($p = 0.32$) became part of the model.

Of the 38 patients in our study, 18 were diagnosed after being studied for SDB in Respiratory Medicine and undergoing a polysomnographic study: 4 with central sleep apnoea, 10 with obstructive sleep apnoea and 4 with *overlap* (Obstructive sleep apnoea + COPD). Of patients with obstructive sleep apnoea and *overlap*, 11 were classified as serious and the rest as moderate. Of the 18 patients diagnosed with SDB, 16 were treated with CPAP, with a subsequent therapeutic compliance of 72.2%. The correlation between NH measured by OPO and the polysomnography was good. In this second test, only 2 of the patients studied had a desaturation Apnoea–Hypopnea Index (AHI) of less than 10.

There were no statistically significant differences with respect to hospital readmissions in the SDB group according to whether they had treatment or not (62.5% vs. 40%, $p = 0.63$).

Discussion

Our study shows that a parameter scarcely studied so far in patients with HF, that is, NH, is related to the risk of readmission and shows a trend towards higher mortality.

In this sense, the OPO is shown as an accessible and easily interpretable tool in order to help us to select those patients with HF and a worse prognosis.

HF is the first cause of hospitalization in people over 65 years of age in our environment.[8] Hospital readmissions are a major problem that not only have a high cost but also entail an increase in