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Original Article

Activity of an Intermediate Respiratory Care Unit Attached to a Respiratory Medicine Department

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ABSTRACT

Background and objective: With the development of noninvasive ventilation (NIV), patients with increasingly complex needs have been admitted to respiratory medicine departments. For this reason, such departments in Spain and throughout Europe have been adding specialized respiratory intermediate care units (RICUs) for monitoring and treating patients with severe respiratory diseases. The aim of the present study was to describe the activity of such a RICU. The description may be of use in facilitating the setting up of RICUs in other hospitals of the Spanish National Health Service.
Methods: A systematic record of activity carried out in the RICU of the Hospital Universitario Son Dureta between January and December 2006 was kept prospectively.
Results: Of 206 patients with a mean (SD) age of 65 (14) years admitted to the unit, 67% came from the emergency department, 14% from the respiratory medicine department, and 12% from the intensive care unit (ICU). The most common admission diagnoses were exacerbated chronic obstructive pulmonary disease (COPD) (n= 97, 47.1%), pneumonia (n=39, 18.9%), heart failure (n=17, 8.2%), and pulmonary vascular diseases (n=18, 8.7%). One hundred twenty-one patients (59%) required NIV. Mean length of stay in the RICU was 5 (5) days. Patients were discharged to the conventional respiratory ward in 79.1% of the cases; 7.8% required subsequent admission to the ICU, and 9.7% died. Of the patients with exacerbated COPD (mean age, 66.5 [10] years; mean length of stay, 4.6 [4.5] days), 67% required NIV, 7.2% required subsequent admission to the ICU, and 8.2% died.
Conclusions: The creation of a RICU by a respiratory medicine department is viable in Spain. Such units make it possible to treat a large number of patients with a low rate of therapeutic failures. Exacerbated COPD was the most common diagnosis on admission to our RICU, and the need for NIV the most common criterion for admission.

Actividad de una unidad de cuidados respiratorios intermedios dependiente de un servicio de neumología

Palabras clave:
Unidad de cuidados respiratorios intermedios
Ventilación no invasiva
EPOC

RESUMEN

Introducción: El desarrollo de la ventilación no invasiva (VNI) ha aumentado la complejidad de los pacientes ingresados en los servicios de neumología. Por ello, en España y Europa se están incorporando unidades especiales para el seguimiento y tratamiento de pacientes con enfermedades respiratorias graves: las unidades de cuidados respiratorios intermedios (UCRI). El objetivo del presente estudio ha sido describir la actividad de una UCRI dependiente de un servicio de neumología. Esta información puede ser un punto de

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referencia útil que facilite la implementación de las UCRI en otros hospitales del Sistema Nacional de Salud español.

Métodos: De enero a diciembre de 2006, ambos inclusive, se recogió de forma prospectiva y sistemática la actividad realizada en la UCRI del Hospital Universitario Son Dureta.

Resultados: Ingresaron 206 pacientes, cuya edad media (± desviación estándar) era de 65 ± 14 años. Los Servicios de Urgencias y Neumología y la Unidad de Cuidados Intensivos (UCI) aportaron, respectivamente, el 67, el 14 y el 12% de todos los ingresos. Los principales diagnósticos de ingreso fueron: agudización de la enfermedad pulmonar obstructiva crónica (EPOC, con 97 casos; 47%), neumonía (n = 39; 19%), insuficiencia cardíaca (n = 17; 8,2%) y enfermedades vasculares pulmonares (n = 18; 8,7%). Del total de pacientes, 121 (59%) precisaron VNI. La estancia media fue de 5 ± 5 días. El 79% recibió el alta a camas de hospitalización convencional del propio Servicio de Neumología, el 8% requirió ingreso posterior en la UCI y el 9,7% falleció. De los pacientes con agudización de la EPOC (edad media: 66,5 ± 10 años; estancia media: 4,6 ± 4,5 días), el 67% precisó VNI, el 7,2% requirió un ingreso posterior en la UCI y el 8,2% falleció.

Conclusiones: En nuestro país es viable la creación de una UCRI dependiente del Servicio de Neumología. Estas unidades permiten desarrollar una alta actividad asistencial con un bajo porcentaje de fracasos terapéuticos. La agudización de la EPOC fue el diagnóstico de ingreso más habitual en nuestra UCRI, y la necesidad de tratamiento con VNI, el criterio de ingreso más frecuente.

Introduction

With few exceptions, a typical respiratory medicine department in Spain does not include specific units for the treatment of critical respiratory patients. The ongoing development of noninvasive ventilation (NIV), however, has allowed pulmonologists to manage more complex patients, and this in turn has generated needs that had previously been limited to the critical care setting. For this reason, respiratory medicine departments in Spain and many other European countries are beginning to add specialized respiratory intermediate care units (RICUs) for the monitoring and treatment of patients with severe respiratory diseases. The RICU was recently defined by a working group of the Spanish Society of Pulmonary and Thoracic Surgery (SEPAR)[1] as an area for monitoring and treating patients with acute or exacerbated chronic respiratory failure caused primarily by a respiratory disease. The main argument in favor of such units is based on the observation that many patients admitted to intensive care units (ICUs) do not require invasive ventilation,[1] yet the management of these patients is still too complex for adequate care to be provided on a conventional ward.[2-5]

Nevertheless, in 2002 there were only 42 RICUs in all of Europe, and of these only 1 belonged to the Spanish National Health Service.[6] Despite the theoretical bases for their creation, then, such units have not become widespread. To the best of our knowledge, no studies have been published describing the characteristics and experience of any Spanish RICU. The aim of this study was to describe the activity of the RICU attached to the respiratory medicine department of the Hospital Universitario Son Dureta in Palma de Mallorca, Spain. This description may be of use in facilitating the setting up of RICUs in other hospitals of the Spanish National Health Service.

Methods

Setting

The Hospital Universitario Son Dureta belongs to the Balearic Islands Health Service (Ib-Salut) and is the referral hospital for a population of 955 045 people who live on the islands (data from January 1, 2004; source: www.ine.es). It has 910 beds, 24 of which are permanently allocated to the respiratory medicine department. Of these 24 beds, 20 are on the conventional ward and 4 in the RICU.

The RICU of the hospital's respiratory medicine department was inaugurated in December 2005. It is located on the respiratory floor and contains 4 beds with no partitions between them. Each bed has its own cardiorespiratory monitor for the continuous noninvasive recording of heart rate, respiratory frequency, and arterial oxygen saturation, as well as for monitoring arterial pressure if necessary. The unit is also equipped with 4 respirators for NIV, 3 positive pressure devices, and 1 volumetric device.

The RICU also has its own nursing station staffed by 1 nurse and 1nursing assistant per shift (workdays and weekends/holidays) who belong to the respiratory medicine department's staff. The nurse-to-patient ratio is 1:4. A physiotherapist, who is not part of the RICU staff, becomes involved only if the physician in charge of the unit requests one from the rehabilitation department. The physician in charge is a pulmonologist who belongs to the respiratory medicine department and works exclusively in the RICU. Medical supervision during evenings, nights, weekends, and holidays is the responsibility of the pulmonologist on duty. Criteria for admission to the Hospital Universitario Son Dureta's RICU are shown in Table 1.

Table 1
Criteria for Admission to the Respiratory Intermediate Care Unit of the Hospital Universitario Son Dureta

1. Need for NIV (pH<7.35 with $PaCO_2$>45 mm Hg and/or PaO_2/FiO_2<250 white breathing FiO_2 of 1.0) due to:
Exacerbated COPD
Acute cardiogenic pulmonary edema
Acute noncardiogenic pulmonary edema
Severe pneumonia
Pneumonia in immunocompromised patients
Restrictive diseases: neuromuscular disease, rib cage deformity, interstitial lung disease, and morbid obesity
2. Need for continuous monitoring, treatment with special drugs (vasoactive agents, prostacyclins, etc), or intensive respiratory physiotherapy due to:
Pulmonary embolism with hemodynamic instability
Pulmonary hypertension
Extensive atelectasis caused by a mucus plug
Massive hemoptysis
Includes patients with diseases in 1 who do not require NIV or CPAP, except those diagnosed with acute cardiogenic pulmonary edema
3. Need for continuous monitoring, special treatment (NIV, vasoactive drugs, etc), or care (respiratory physiotherapy, weaning from a tracheostomy, etc) following transfer from the ICU
4. Need for continuous monitoring, special treatment (NIV, vasoactive drugs, etc), or respiratory physiotherapy following thoracic surgery
5. Need for high-risk respiratory endoscopic procedures

Abbreviations: COPD, chronic obstructive pulmonary disease; CPAP, continuous positive airway pressure; ICU, intensive care unit; NIV, noninvasive ventilation; PaO_2/FiO_2, ratio of PaO_2 to the fraction of inspired air; OSAHS, obstructive sleep apnea-hypopnea syndrome.

Study Design

This was a prospective observational study. A systematic record of the activity carried out in the RICU between January and December 2006 was kept prospectively. The following variables were obtained: total number of admissions; age, sex, and admission source for each patient; main admission diagnoses; arterial blood gas values on admission; need for NIV; length of stay in the RICU; discharge destination; and number of treatment failures (ie, the number of patients who either required transfer to the ICU or died in the unit).

Results are presented as means (SD) or absolute values and percentage of total.

Results

During the study period, 1494 patients were admitted to our respiratory medicine department. Of these, 206 (13.8% of the total; mean age, 65 [14] years) were admitted to the RICU (Table 2). Sixty-seven percent (n=138) came from the emergency department, 14% (n=29) from the respiratory ward, and 12% (n=25) from the ICU. The most common admission diagnosis was exacerbated chronic obstructive pulmonary disease (COPD) (n=97, 47.1%), followed by pneumonia (n=39, 18.9%), and heart failure (n=17, 8.2%); 18 patients had pulmonary vascular diseases (pulmonary thromboembolism, 10 [4.9%]; pulmonary arterial hypertension, 8 [3.9%]). One hundred twenty-one patients (59%) were admitted because they required NIV (Figure). The mean length of stay in the RICU was 5 (5) days. Patients were discharged to the conventional respiratory ward in 79.1% of the cases, 7.8% needed to be admitted to the UCI—these were mainly patients with exacerbated COPD (n=7) and severe pneumonia (n=3)—and 9.7% (n=20) died—also mainly patients with exacerbated COPD (n=8) or severe pneumonia (n=7). Of the 20 patients who died, 18 were admitted with a do-not-resuscitate/do-not-intubate order, and with NIV as the only ventilatory support option.

Given that exacerbated COPD was the most common diagnosis on admission to the RICU, it is worth looking at the data on this disease in greater detail. During 2006, 631 patients were admitted to the Hospital Universitario Son Dureta with a diagnosis of exacerbated COPD; 466 (74%) of them were admitted to the respiratory medicine department. Of these 466 patients, 20.8% (n=97); mean age, 66.5 [10.2] years) were admitted to the RICU (Table 3). Sixty-seven percent (n=65) of these patients required NIV (arterial blood gas values on admission to the RICU: pH, 7.25 [0.09]; PaO_2, 52.4 [19.15] mm Hg; $PaCO_2$, 70.62 [13.59] mm Hg) and the mean length of stay in the RICU was 4.6 [4.5] days. While most (80.4%) were discharged to the respiratory medicine department, 7.2% (n=7) required ICU admission due to progressive worsening (arterial blood gas values on admission of these patients to the RICU: pH, 7.23 [0.07]; PaO_2, 62.96 [42.37] mm Hg; $PaCO_2$, 80.35 [9.67] mm Hg) and 8.2% (n=8) died. Of the 8 patients who died, 7 had been admitted with a do-not-resuscitate/do-not-intubate order and with NIV as the only ventilatory support option.

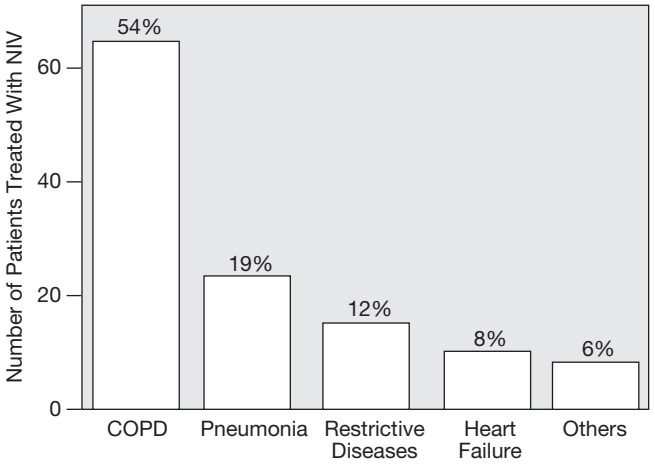

Figure. Distribution of patients admitted to the Respiratory Intermediate Care Unit who required noninvasive ventilation (NIV). NIV was required by a total of 121 patients, distributed according to the following diagnoses: exacerbated chronic obstructive pulmonary disease (COPD) (n=65, 54%), severe pneumonia (n=23, 19%), restrictive diseases (n=15, 12%), heart failure (n=10, 8%), and others (n=8, 7%).

Table 2
Characteristics of Patients Admitted to the Respiratory Intermediate Care Unit[a]

Total no. of admissions	206
Age, y	65 (14)
Sex	
Men	126 (61%)
Women	80 (39%)
Admission source	
Emergency department	138 (67%)
Respiratory ward	29 (14%)
ICU	25 (12%)
Other departments	14 (7%)
Main admission diagnosis	
Exacerbated COPD	97 (47.1%)
Severe community-acquired pneumonia	39 (18.9%)
Heart failure	17 (8.2%)
Pulmonary thromboembolism	10 (4.9%)
Pulmonary arterial hypertension	8 (3.9%)
Severe asthma exacerbation	8 (3.9%)
Morbid obesity	8 (3.9%)
Diffuse interstitial disease	7 (3.4%)
Bronchiectasis	4 (1.9%)
Hemoptysis	2 (1.0%)
Others	6 (2.9%)
Patients requiring NIV on admission	121 (59%)
Destination	
Discharge to respiratory ward	163 (79.1%)
Discharge to other departments	7 (3.4%)
Transfer to ICU	16 (7.8%)
Deaths	20 (9.7%)

[a]Data are presented as mean (SD) or number of patients (%).

Table 2
Characteristics of Patients With Exacerbated Chronic Obstructive Pulmonary Disease (COPD)[a]

No. of patients with exacerbated COPD	97
Age, y	66.5 (10.2)
Sex	
Men	83 (85.6%)
Women	14 (14.4%)
Arterial blood gas values on admission	
pH	7.30 (0.10)
PaO_2, mm Hg	57.9 (21.6)
$PaCO_2$, mm Hg	62.9 (17.2)
Patients requiring NIV on admission	65 (67%)
Destination	
Discharge to respiratory ward	78 (80.4%)
Discharge to other departments	7 (7.2%)
Transfer to ICU due to poor evolution	4 (4.1%)
Deaths	8 (8.3%)

[a]Data are presented as mean (SD) or number of patients (%).

Discussion

Our findings showed that *a)* the creation of a RICU by a respiratory medicine department is viable in Spain, *b)* RICUs make it possible to treat a large number of patients with a low rate of therapeutic failures, c*)* exacerbated COPD was the main admission diagnosis, and *d)* the need for NIV was the most frequent reason for admission to the RICU.

It has been shown that as many as 40% of patients in medical ICUs and 30% of those in surgical ICUs are admitted only for continuous monitoring and not for specific therapeutic interventions. It has also been observed that it is possible to reduce costs and improve the use of general ICUs by using RICUs for transferring patients from the ICU or for admitting patients needing an intermediate level of critical care from emergency departments.[3] Furthermore, RICUs make it possible to improve monitoring and provide a higher nurse-to-patient ratio than is found on a conventional hospital ward,[1] and thus can help prevent situations of insufficient care for patients with severe disease who are not admitted to a general ICU.[3-5]

SEPAR guidelines[1] state that the objectives of a RICU should be *a)* cardiorespiratory monitoring and/or NIV treatment for respiratory failure, *b)* continuous monitoring of patients following thoracic surgery or tracheostomy, and *c)* the treatment of critically ill patients whose weaning from invasive ventilation is difficult. However, no guidelines on how to organize RICUs have been established,[6-9] as they need to be adapted to the specific needs and characteristics of each hospital. Three models have been proposed: *a)* the independent model (independent of both the respiratory medicine department and the ICU), *b)* the parallel model (RICU adjacent to the ICU), and c*)* the integrated model (integrated into the ICU or the respiratory ward).[9] Each model has advantages and disadvantages, but to date there have been no studies comparing them. The choice of the most appropriate model, therefore, will be determined by the capabilities of each hospital. The RICU we describe is integrated into our hospital's respiratory medicine department. This allows for continuity of patient care within a single department and facilitates transfers between the hospital ward and the RICU in accordance with changes in patients' clinical situations. A RICU also allows for greater flexibility, integration, and the ongoing training of the respiratory medicine department's medical, nursing, and physical therapy staff.

The main justification for these units is the need to apply NIV,[1] for which the most common indication is the treatment of acute respiratory failure or chronic exacerbated COPD. A study carried out in the United Kingdom showed that around 20% of patients hospitalized for exacerbated COPD presented respiratory acidosis and that 80% of these (72 patients/250 000 inhabitants/y) could benefit from NIV.[10] In exacerbated COPD, it is generally recommended that NIV be administered in appropriate settings, mainly in ICUs.[11] In patients with less severe disease (arterial pH on admission between 7.30 and 7.35), however, NIV can also be administered on the hospital ward, although this increases the care burden for the nursing staff.[2] A recent guideline points out that with appropriate monitoring, patients with an arterial pH between 7.25 and 7.30 who do not require immediate orotracheal intubation can be cared for in RICUs, while patients with a pH less than 7.25 should be admitted to the ICU.[12] To date, however, no comparative studies have been published demonstrating that ICUs are a better setting than RICUs for treating patients with such pH values. In the present study, patients with exacerbated COPD and a mean pH less than 7.26 were treated satisfactorily, although the subgroup of patients (approximately 7.2% of those with exacerbated COPD receiving NIV) with more severe respiratory acidosis upon admission to the RICU (mean pH, <7.24) required invasive ventilation and ICU admission. These results indicate that patients with exacerbated COPD and mean pH values less than 7.26 can be treated in a RICU within a respiratory medicine department with a failure rate similar to that observed in other studies carried out in an ICU.[13,14] Nevertheless, these data do not come from a randomized study, and can therefore not be generalized.

The patients in this study who derived the greatest benefit from the RICU were those with exacerbated COPD. However, 52.9% (n=109) were admitted to the RICU with other diagnoses. RICUs may thus also be appropriate for the treatment of patients with other diseases: *a)* diseases other than COPD in which NIV is indicated (acute respiratory failure, mainly in immunocompromised patients with pneumonia, and patients with acute cardiogenic pulmonary edema) or acute exacerbations of chronic respiratory failure (especially restrictive diseases), and *b)* severe diseases that require continuous monitoring, but not NIV (severe pneumonia, acute asthma, life-threatening hemoptysis, pulmonary embolism, etc).[1] A recent study showed that as many as 21.5% of patients were admitted to RICUs and high dependency units in Europe with a do-not-resuscitate/do-not-intubate order and with NIV as the only ventilatory support option.[15] Unlike ICUs, then, RICUs make it possible to admit patients with severe disease who require monitoring and NIV, but in whom neither invasive ventilation nor advanced life support measures are to be used. In our study, 18 (90%) of the 20 (9.7%) patients who died had been admitted with a do-not-resuscitate/do-not-intubate order and with NIV as the only ventilatory support option.

The present study has certain limitations to mention: *a)* it was an observational study and we thus could not establish causal relationships between the variables, *b)* we did not compare the results obtained in the RICU with those of a conventional hospital ward or ICU, and *c)* the admission criteria described in Table 1 were not strictly adhered to during the months when health care demand in the hospital was greatest. During these months some patients who did not meet the strict admission criteria were admitted to the RICU in order to help relieve emergency department overcrowding. In some hospitals, then, transferring patients out of the emergency department has priority over adherence to criteria for admission to some units. In such circumstances, the normal activity of a RICU may be modified, if only slightly.

In summary, our description of the activity of a RICU attached to a respiratory medicine department can be of use in stimulating the creation of other such units in hospitals of the Spanish National Health Cares Service.

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