



Original Article

A Year's Experience in an Intermediate Respiratory Care Unit

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ABSTRACT

Background: The aim of this study was to describe the characteristics and results of patients admitted to an intermediate respiratory care unit (IRCU).

Patients and methods: We performed a 12-month prospective observational study of all the patients admitted to our IRCU during the study period. We analysed sociodemographic and clinical variables, the APACHE-II score, blood gas parameters, hospital stay duration, mortality, and hospital readmission.

Results: We evaluated 190 patients (64.2% men), with a mean age of 69.4 years. A score of greater than 2 on the Charlson index was recorded in 43.2% of patients. The mean APACHE-II score was 16.3 in the accident and emergency department and 14.3 on entering the IRCU. Fifty percent of the patients were admitted to receive ventilation and, of these, only 6 (5.7%) were admitted to be disconnected from the ventilator. The mean duration of stay in the IRCU was 3.7 days. The readmission rate was 12.7%. Mortality was 12.6% during hospitalisation and 11.6% 90 days after discharge.

Conclusions: The patients admitted to our IRCU were elderly, with considerable comorbidity and high mortality, both during hospitalisation and 90 days after being discharged from hospital. The results revealed no statistically significant differences (mean length of stay, readmission, mortality) according to the type of care administered to the patients (ventilation compared to monitoring).

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Cuidados respiratorios intermedios: un año de experiencia

RESUMEN

Introducción: El objetivo del presente estudio es describir las características y resultados de los pacientes ingresados en una unidad de cuidados respiratorios intermedios (UCRI).

Pacientes y métodos: Se ha realizado un estudio prospectivo y observacional de un año de duración, en el que se estudió a todos los pacientes ingresados en nuestra UCRI durante ese período. Se analizaron variables sociodemográficas, clínicas, escala APACHE-II, evolución gasométrica, duración de la estancia hospitalaria, mortalidad y reingreso hospitalario.

Resultados: Evaluamos a 190 pacientes (un 64,2% varones), con una edad media de 69,4 años. El 43,2% tenía un índice de Charlson mayor de 2. El APACHE-II fue de 16,3 en el Servicio de Urgencias y de 14,3 al entrar en la UCRI. El 50% de los pacientes ingresó para recibir ventilación, y de ellos sólo 6 (5,7%) ingresaron para la desconexión del ventilador. La duración media de la estancia en la UCRI fue de 3,7 días. La tasa de reingresos fue del 12,7%. La mortalidad fue del 12,6% durante el episodio de hospitalización, y del 11,6% a los 90 días del alta.

Conclusiones: Los ingresados en nuestra UCRI son pacientes mayores, con importante comorbilidad y mortalidad elevada, tanto durante el episodio de hospitalización como a los 90 días del alta hospitalaria. No hemos encontrado diferencias estadísticamente significativas en los resultados (estancia media, reingresos, mortalidad) en función del tipo de cuidados (ventilación frente a seguimiento) administrados al paciente.

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Introduction

As opposed to the United States,¹ in Europe² pneumonologists have not become involved in health care for patients staging critical respiratory disease. In Spain, also, there has been a group of specialists particularly trained for intensive care units, which is why up until 2000 the presence of pneumonologists assisting patients with respiratory diseases in critical stages has practically been testimonial. According to data collected between 1999-2000 there was only one respiratory intermediate care unit (RICU)² in Spain. Interest has been growing since 2000 and during the last 2 years several follow-up units and RICUs have been set up in Spanish territory.²

Several medical attention levels have been defined for patients with respiratory diseases: conventional hospitalisation plant, follow-up units, intermediate care units, and intensive care units.²⁻⁴ Care provided at each one of these levels is as different as it is varied. In a recent European study² it was observed that 58% of patients admitted in a pneumonology intensive care unit (ICU) received invasive mechanical ventilation (IMV) and the other 23% non-invasive mechanical ventilation (NIMV), while the remaining 19% were only followed up. In the present study it was observed that the type of care for patients admitted to RICUs was different: IMV 31%, NIMV 32% and only 37% were followed up.² However, attention provided at ICU and RICUs vary from one country to another, or from region to region, depending on the resources available, the organisation and differences in health care systems.^{5,6} The percentage of patients who are only followed up and do not require aggressive measures is around 40% in an ICU^{7,8} and 82.7% in a general intermediate care unit.⁹ In a Spanish multicentre study¹⁰ only 29% of the patients admitted to ICU received ventilation, and of these only 3.9% received non-invasive mechanical ventilation.

Information on patients admitted to RICUs is very limited in Spain. The main objective of the present work has been to describe the characteristics of patients admitted to RICU, as well as care applied and results obtained.

Patients and Methods

Study Design

This work consists of a one-year-long prospective observational study (from 15 February 2007 to 14 February 2008), performed at the Hospital of Galdakao-Usánsolo, a general teaching hospital with 400 beds covering an area of 300,000 people.

Our RICU, dependant on our pneumonology service, is in an independent area adjacent to our hospitalisation ward; it has 6 beds and multiple registration, i.e. ECG, cardiac frequency, blood pressure, oxygen saturation, and respiratory frequency. It is run by a pneumonologist in person in the morning shift and every other day during afternoon and evening. Cardiologists are in charge the remaining days. The nursing personnel are qualified and they comply with a protocol.

Population Studied

During the period under study, patients admitted to the RICU were exclusively included and had to previously comply with admission criteria.⁴

Variables Gathered

The information gathered was the following: *a)* socio-demographic variables; *b)* clinical variables, among these, dyspnoea, measured by MRC (Medical research council) scale¹¹ over a stable situation, before admission; *c)* co-existing chronic diseases, by Charlson index,¹² which examines patient's chronic diseases and correlates with death

risk; *d)* previous functional situation of patient, determined by ECOG scale (Eastern Cooperative Oncologic Group),¹³ scoring from 0 to 5 (the higher score, the higher the physical deterioration); and *e)* severity upon arriving at emergency care and upon admission to RICU, assessed by APACHE-II (Acute Physiology and Chronic Health Evaluation),¹⁴ which by evaluating 2 components (the first one gathering 12 physiological variables, and the second age and previous health status of patient) predicts mortality by a logistic regression formula.

Gasometry was additionally performed in those patients who received ventilation at the onset of NIMV and 1-2, 6, 12, and 24 hrs afterwards. Failure of NIMV was recorded together with its causes. In patients admitted for out-hospital pneumonia, severity was also assessed by Pneumonia Severity Index (PSI)¹⁵ and Severity Community Acquired Pneumonia (SCAP),¹⁶ which are prognosis scales.

Measuring Results

In order to evaluate the results, the following points were entered: *a)* stay duration at RICU and hospital; *b)* mortalities at RICU, hospital, and 90 days from admission date, and *c)* re-admission to hospital within 30 days following discharge. In order to know mortality and re-admission the patients or their families were contacted by telephone 90 days after hospital discharge. This information was verified using the Health Basque Service System/Osakidetza and official mortality records.

Statistical Analysis

Statistics means and standard deviations were used in descriptive for continuous variables, and frequencies and percentages for categories. To compare between patients receiving ventilation and those who were only followed up, student's t-test was used for continuous variables or Mann-Whitney U when normality could not be assumed, and χ^2 Test or Fisher's exact test for categories. Values were considered significant when $p < 0.05$. Computing application SAS System 9.1 was used for statistical treatment of data.

Results

During the period under study 190 patients were included (64.2% men), 69.4 ± 14.5 years mean age (\pm standard deviation). Charlson index score was higher than 2 for approximately 50% of the patients, and statistically significant differences were found between ventilated and follow-up patients ($p = 0.02$). The baseline functional situation, measured by ECOG scale, showed deterioration in 46% of the patients (table 1).

Of the 190 patients 17 were admitted twice and 3 of them 3 times, which results in 212 episodes, supposing 9.9% (212/2151) of the totality of patients admitted to the pneumonology unit during such period. 78.3% of the patients admitted to RICU presented with respiratory failure, and in 75.9% of them respiratory failure showed hypercapnia. Admission provenance was not a determining factor on the level of attention required ($p = 0.36$). However, statistically significant differences were observed in physiological parameters and APACHE-II measured on admission to RICU between the ventilated and follow-up patients ($p < 0.0001$). Respiratory frequency was the only indicator where no differences were found between the groups ($p = 0.47$) (table 2).

Table 3 shows diagnosis for cases admitted to RICU. 31.1% were admitted for an episode of exacerbation of chronic obstructive pulmonary disease (COPD). Baseline mean value of forced respiratory volume in the first second of these episodes was 864ml (35.7% over the theoretical value). 46 patients (21.7%) were admitted to RICU for pneumonia: community acquired pneumonia in 38 cases (82.6%),

Table 1
Characteristics of patients admitted depending on type of medical care required

Characteristics	Care		Total	P
	Follow-up	Ventilation		
No. of patients	92 (48.4%)	98 (51.6%)	190 (100%)	
Mean age (years)	70.4 ± 12.7	68.5 ± 16.2	69.4 ± 14.5	0.03
Sex males	65 (70.7%)	57 (58.2%)	122 (64.2%)	0.07
Baseline dyspnoea (MRC scale)				< 0.0001
I	6 (7.0%)	35 (41.7%)	41 (24.1%)	
II	15 (17.4%)	12 (14.3%)	27 (15.9%)	
III	31 (36.1%)	20 (23.8%)	51 (30.0%)	
IV-V	34 (37.0%)	17 (17.3%)	51 (26.8%)	
Charlson index				0.02
0	2 (2.2%)	15 (15.3%)	17 (9.0%)	
1	23 (25.0%)	22 (22.6%)	45 (23.7%)	
2	24 (26.1%)	22 (22.5%)	46 (24.2%)	
= 3	43 (46.7%)	39 (39.8%)	82 (43.2%)	
Comorbidities				
Chronic lung disease	72 (78.3%)	44 (44.9%)	116 (61.1%)	< 0.0001
High blood pressure	54 (58.7%)	57 (58.2%)	111 (58.4%)	0.94
Congestive cardiac failure	36 (39.1%)	26 (26.5%)	62 (32.6%)	0.64
Diabetes Mellitus	24 (26.1%)	29 (29.6%)	53 (27.9%)	0.45
Cerebrovascular disease. Other hemiplegias	10 (10.1%)	15 (15.3%)	25 (13.2%)	0.12
Acute myocardial infarction	4 (4.4%)	9 (9.2%)	13 (6.8%)	0.18
Peptic disease	4 (4.4%)	9 (9.2%)	13 (6.8%)	0.18
Others*	11 (12.0%)	15 (15.3%)	26 (13.7%)	0.53
Baseline situation (ECOG%)				0.15
0	35 (44.9%)	53 (62.4%)	88 (54.0%)	
1	19 (24.4%)	13 (15.3%)	32 (19.6%)	
2	8 (10.3%)	10 (11.7%)	18 (11.8%)	
3	13 (16.7%)	7 (8.2%)	20 (12.3%)	
4	3 (3.9%)	2 (2.6%)	5 (9%)	

Numeric variables express number and percentage for the totality of patients admitted (n = 190). Age is presented as mean ± standard deviation.

ECOG: Eastern Cooperative Oncologic Group; MRC: Medical Research Council.

*Peripheral vascular disease (n = 5), dementia (n = 3), hepatic disease (n = 3), renal disease (n = 5), rheumatologic disease (n = 1), acquired immunodeficiency syndrome (n = 1) and malignity (n = 8).

nosocomial pneumonia in 6 cases (12.5%) and pneumonia in immunodepressed patient in 2 cases (4.3%). Upon admission to RICU 73.7% of community acquired pneumonia cases were considered severe, with a score higher than 9 in the SCAP scale.¹⁶

50% of the patients were admitted to RICU to receive NIMV (table 2). 17.1% of them were included in the chronic-ventilation-at-home programme and 6.6% had received NIMV or IMV in earlier admissions. Of the 106 ventilated cases only 6 (5.7%) were admitted to RICU from the reanimation ICU for ventilator disconnection, one of them with tracheostomy. NIMV was started at RICU in 47.1% of the cases and at the emergency unit in 46.1%.

Figure 1 shows gasometric evolution of episodes undergoing NIMV. This treatment failed in 15 cases (14.2%): 3 due to non-compliance, 1 due to intolerance, and 11 due to deterioration of base process (of these, only 2 were admitted to ICU requiring orotracheal intubation). In 27 ventilated patients (25.5%) pH at onset of ventilation was inferior to 7.25, and mortality in this group was 18%.

28.4% of the patients included had complications: arrhythmias in 19 cases (10.1%), shock in 10 (5.3%), acute renal failure in 5 (2.7%), coagulopathy in 3 (1.6%), angina or myocardial infarction in 2 (1.1%), nosocomial infection in 2 (1.1%), gastrointestinal haemorrhage in 2 (1.1%), and other complications (anaemia, hyperglycemic decompensation, metabolic alkalosis, diarrhoea) in 14 (7.4%).

The outcomes from the episodes that required admission to RICU were the following (table 2): stay duration at the unit was 3.6 ± 2.5 days (in ventilated patients: 3.7 ± 2.4; in follow-up patients: 3.5 ± 2.6) and hospital admission was 7.0 days (ventilated: 8.5 ± 8.1; follow-up: 5.8 ± 36.1). Admission rate at 30 days was 12.7%; half were re-admitted to RICU and the other half to the general pneumonology ward. No statistically significant differences were found between ventilated and follow-up patients with relation to hospital stay, re-admission rate and mortality.

Table 4 lists death causes in patients admitted to RICU. Table 5 describes variables with statistically significant differences according to survival. When analysing hospitalisation period, age, patient provenance, prior functional situation (measured by ECOG), APACHE-II score on admission to RICU, neurological situation (measured by Glasgow scale) and pH statistically significant differences appeared between living and deceased patients. When evaluating vital status 90 days after hospital discharge, the parameters associated with mortality were related to patient's baseline situation before admission (age, baseline dyspnoea, baseline functional situation), but also with APACHE-II and Glasgow score upon admission to RICU.

Discussion

Our study shows that a considerable proportion of patients admitted to hospital for respiratory disorders meets criteria to be treated at RICU. Of the totality of cases admitted to the pneumonology unit, 9.9% were admitted to RICU and, of these, 50% required NIMV treatment. Hospital mortality in cases admitted to RICU (13.2%) was much lower than theoretical mortality estimated by APACHE-II (21%) in said patients. This is a prospective study carried out at a RICU in Spain, where not only clinical data of the episode under study were gathered but also data relative to baseline situation of patients, which were additionally controlled during a period of 90 days after hospital discharge.

It becomes difficult to compare our findings against those obtained by other studies due to the scarce information available. Furthermore, our RICU is in a hospital caring acute cases and for this reason it cannot be compared with intermediate units of ventilator disconnection¹⁷ or units in rehabilitation hospitals.¹⁸

As is the case with other studies,^{19,20} most of our patients came from emergencies (63.0%) and, to a lesser extent, from general

Table 2
Characteristics of and outcomes from different episodes (n = 212), depending on attention required

Characteristics	Care			P
	Follow-up	Ventilation	Total	
No. of patients	106 (50.0%)	106 (50.0%)	212 (100%)	
Provenance				0.36
Emergencies	71 (67.62%)	62 (58.49%)	133 (63.03%)	
Pneumology	19 (18.10%)	31 (29.25%)	50 (23.70%)	
ICU-Reanimation	3 (2.8%)	3 (2.8%)	6 (2.8%)	
Other service	12 (11.3%)	10 (6.3%)	22 (10.4%)	
APACHE-II in Emergencies	18.6 ± 4.8	14.11 ± 5.14	16.4 ± 5.5	< 0.0001
Variables on admission to RICU				
APACHE-II	16.5 ± 5.2	12.1 ± 5.3	14.4 ± 5.7	< 0.0001
pH	7.34 ± 0.1	7.42 ± 0.1	7.4 ± 0.09	< 0.0001
PaCO ₂	61.5 ± 11.9	45.5 ± 11.1	55.7 ± 13.9	< 0.0001
PaO ₂	59.5 ± 26.1	70.3 ± 22.9	64.4 ± 25.6	< 0.0001
Respiratory frequency	25.0 ± 6.9	24.3 ± 6.0	24.6 ± 6.4	0.47
Glasgow	14.3 ± 1.9	14.8 ± 1.3	14.6 ± 1.7	0.0503
Mean stay				
RICU	3.7 ± 2.4	3.5 ± 2.6	3.6 ± 2.5	0.21
Hospital	8.5 ± 8.1	5.6 ± 36.1	7.0 ± 26.1	0.70
Re-admitted at 30 days	13 (12.3%)	14 (13.2%)	27 (12.7%)	0.83
In Pneumology	6 (5.7%)	8 (7.9%)	14 (6.9%)	
At RICU	7 (6.6%)	6 (5.9%)	13 (6.4%)	
Mortality*				
At RICU	6 (6.5%)	4 (4.1%)	10 (5.3%)	0.41
Intra-hospital	12 (13.0%)	12 (12.2%)	24 (12.6%)	0.86
At 90 days after hospital discharge	11 (11.9%)	11 (11.2%)	22 (11.6%)	0.88

Data are expressed in numbers and percentages, or as mean ± standard deviation.

APACHE-II Acute Physiology and Chronic Health Evaluation;¹⁴ PaCO₂: carbon dioxide arterial pressure; PaO₂: oxygen arterial pressure; ICU: Intensive Care Unit; RICU: Respiratory Intermediate Care Unit.

* Mortality is assessed over totality of patients (n = 190).

Table 3
Diagnoses of episodes (n = 212) requiring admission to Respiratory Intermediate Care Unit, depending on attention required

Characteristics	Level of attention		
	Ventilation	Follow-up	Total
No. of patients	106 (50.0%)	106 (50.0%)	212 (100%)
COPD	51 (48.1%)	15 (14.2%)	66 (31.1%)
Pneumonia	12 (11.3%)	34 (32%)	46 (21.7%)
Obesity-hypoventilation syndrome	14 (13.2%)	1 (0.9%)	15 (7.1%)
Pulmonary thromboembolism	0	20 (18.9%)	20 (9.4%)
Acute pulmonary oedema	8 (7.5%)	3 (2.8%)	11 (5.1%)
Thoracogenic disease	8 (7.5%)	0	8 (3.8%)
Interstitial disease	2 (1.9%)	6 (5.7%)	8 (3.8%)
Asthma	4 (3.8%)	3 (2.8%)	7 (3.3%)
Massive haemoptysis	0	6 (5.7%)	6 (2.8%)
Costal fractures	1 (0.9%)	3 (2.8%)	4 (1.9%)
Neuromuscular disease	2 (1.9%)	2 (1.9%)	4 (1.9%)
Pulmonary hypertension	0	4 (3.8%)	4 (1.9%)
Post surgical complications:	2 (1.9%)	0	2 (0.9%)
Pleural effusion	0	2 (1.9%)	2 (0.9%)
Others*	2 (1.9%)	7 (5.6%)	9 (4.2%)

Statistically significant differences were found between diagnoses of episodes requiring non-invasive ventilation and those undergoing follow-up (p < 0.0001).

COPD: chronic obstructive pulmonary disease.

* Pneumothorax (n = 1), alveolar haemorrhages due to vasculitis (n = 2), central cause of hypoventilation (n = 1), thoracic aneurysm rupture (n = 1), pulmonary aspergillosis (n = 1) and hemothorax (n = 3).

hospital wards (23.7%). The patients admitted to our unit averaged 70 years of age, slightly over the age described by other authors,^{19,20} and associated co-morbidities percentage was high, 81% of the cases. Their severity upon admission to RICU measured by APACHE-II scored 14.4 ± 5.7. Although we have no published data available regarding this point, it seems reasonable to assume that our patients' severity was lower than that observed by Confalonieri et al²¹ in patients admitted to pneumology ICU (APACHE-II: 18 ± 6), which corresponded to a theoretical mortality of approximately 25%.

Indeed, patients admitted to RICU differ from those admitted to ICU: the former are more advanced in age, showing less severity during the episode, with more associated co-morbidities and more advanced chronic diseases.¹⁹

Approximately 50% of our patients were admitted for follow-up and the other 50% for NIMV; of these last ones only 5.8% were admitted for ventilator disconnection. The number of our ventilated patients is somewhat inferior to that of Balaguer et al²⁰ (59%) and contrasts with Elpern et al,²² who showed a much larger proportion of patients treated with invasive ventilation (78%). This difference is probably justified as their data date back from 1991, when NIMV was scarcely used. Care administered at our RICU differs from that described in the 1999 European census,² according to which 31% of patients admitted to RICUs were treated with IMV, 32% with NIMV, and 37% were followed up. Neither did health care described in the European census regarding pneumology ICUs coincides with data published in an Italian census of pneumology ICUs.²¹ All these differences show but huge variability between the type of attention provided at ICU and RICU, and they are likely to be related to the resources available, organisation models, and distinct health care systems in different countries. Although a priori the percentage of patients admitted for follow-up to our unit may appear high, according to Frutos et al¹⁰ 71% of patients admitted to Spanish ICUs were exclusively followed up, and at a general intermediate care unit Junker et al⁹ described 82.7% of admissions for follow-up purposes.

It is remarkable that care during our patients' stay at RICU was of a mean 3.6 days, much lower than that recorded in other studies, which is around a mean of 5 to 26.6 days.^{19,20,22} In a 1991 publication by Elpern et al²² mean stay was 26.6 days and 78% of the cases received IMV. In a study by Bertolini et al¹⁹ stay duration at RICU was 8 days; their cases, however, were exclusively acute on chronic COPD and evidenced characteristics different from ours: 6.2% of their patients had a tracheostomy cannula against only 0.5% tracheostomised patients in our study, which would account for a longer hospital stay for patients in their study.

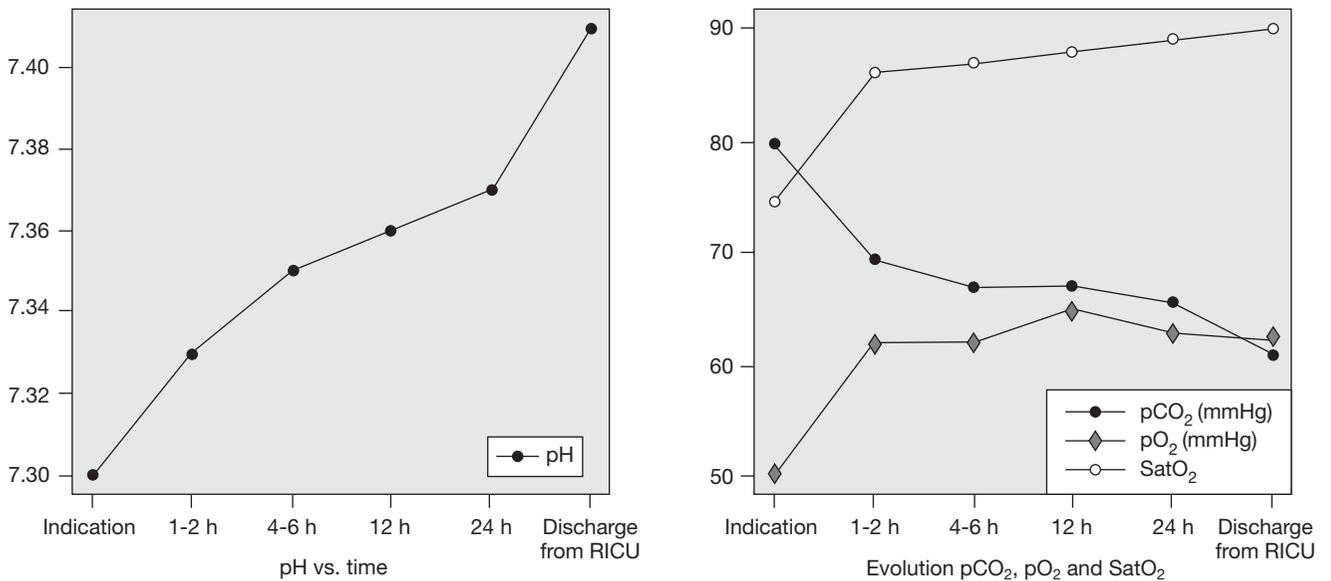


Figure 1. Gasometric evolution of ventilated patients during their stay at Respiratory Intermediate Care Unit (RICU). ApCO₂: carbon dioxide arterial pressure; PaO₂: oxygen arterial pressure; SaO₂: oxygen arterial saturation.

Table 4
Mortality causes in patients admitted to Respiratory Intermediate Care Unit

Hospital mortality		
Causes	N = 24	%
Pneumonia	7	29.2
Chronic obstructive pulmonary disease	4	16.6
Haemoptysis	4	4.2
Acute pulmonary oedema	2	8.3
OHS	2	8.3
Obesity-hypoventilation syndrome	1	4.2
Residual tuberculosis	1	4.2
Interstitial disease	1	4.2
Neuromuscular disease	1	4.2
Acute myocardial infarction	1	4.2
Thoracic aneurysm rupture	1	4.2
Cerebellar meningioma	1	4.2
Hepatic encephalopathy	1	4.2
Mortality at 90 days after hospital discharge		
Causes	N = 22%	%
Chronic obstructive pulmonary disease	6	27.3
Interstitial disease	4	18.2
Lateral amyotrophic sclerosis	2	9.1
Hemothorax	1	4.5
Acute pulmonary oedema	1	4.5
Asthma	1	4.5
Not known	7	31.8

Balaguer et al²⁰ described a mean stay of 5.5 days, much closer to ours, and of a similar sample size, as well. Such small variation may be explained by small differences in our patients' characteristics: lower mean age, higher percentage of patients with COPD admitted for decompensation, and a smaller number of admissions for pneumonia.

NIMV failure rate varies according to patient diagnosis: 19-28% of ventilated patients for COPD exacerbation^{23,24} against 49% of ventilated patients for other cause.²⁵ Globally, our percentage of failure was 14.5%, lower than the rate showed by Scala et al²⁶ (28.8%) in a study performed at a respiratory follow-up unit with patients suffering acute on chronic COPD, but with larger conscious deterioration at ventilation onset than in our cases. Scala et al²⁶ also observed that only one third of patients with NIMV failure received

IMV. These differences could be attributed to baseline situation deterioration in some patients, which might have counselled against more aggressive therapeutic measures.

Mortality in patients with acute respiratory failure treated with NIMV varies depending on levels of attention and on where treatment was provided (22-40% in an ICU^{24,27} and 10-23% in a conventional hospitalisation ward^{23,28}), probably due to different characteristics and severity of patients rather than structural characteristics and site of application. At a respiratory follow-up unit, Ortega et al²⁹ observed a global hospital mortality of 15.9% in patients treated with NIMV for acute respiratory failure caused by COPD, acute lung oedema, or obesity-hypoventilation syndrome. This rate is somewhat higher than ours (13.2%), which may be due to our data including all patients admitted to RICU and not only those presenting with acute respiratory failure. We found discrepancy between actual and theoretical mortality expected according to APACHE-II (21%). Aggarwall et al³⁰ already informed in their study of models predicting mortality, such as APACHE-II, that these did not match observed mortality at their pneumonology ICU, arguing that the prediction model was obtained in an Anglo-Saxon population, different from their own, with 47% medical patients of whom only 10% presented with respiratory failure. It is necessary to pursue further research with new models predicting severity that adjust better to our pneumological patients.

Mortality in our patients 90 days after hospital discharge was also significant (11.6%). This figure is similar to that described by Vitacca et al,³¹ although a priori their patients had been admitted to a RICU located in a rehabilitation centre and 43% of them were tracheostomised. Our figure is not comparable with 35% global mortality informed by Scala et al,²⁶ given that their work was performed in patients selected for acute on chronic COPD and conscience level deterioration.

Our study should be interpreted bearing in mind certain limitations. Firstly, being ventilator disconnection one of the most widely agreed indications to be admitted to RICU, the number of such cases included in our study is very low (5.6%). Doubtless enough, it is about an improvement area related to improved coordination with intensive care units, and anaesthesia and reanimation units. Secondly, our RICU is run by a pneumonologist in the morning who is also present 50% of the time when on call. The other 50% of call

Table 5
Differences between patient characteristics (n = 190) depending on survival during hospital stay and 90 days after discharge

Variables	Hospital mortality		P	Mortality at 90 days		P
	Alive	Deceased		Alive	Deceased	
No. of patients	166 (87.4%)	24 (12.6%)		144 (75.8%)	46 (24.2%)	
Mean age (years)	68.0 ± 14.6	78.8 ± 10.4	0.0002	66.8 ± 14.5	77.5 ± 11.3	< 0.0001
Patient provenance			< 0.001			0.0017
Emergencies	116 (70.3%)	4 (16.7%)		101 (70.6%)	19 (41.3%)	
Pneumology	27 (16.4%)	17 (70.8%)		23 (16.1%)	21 (45.7%)	
Intensive	5 (3.0%)	0 (0%)		4 (2.8%)	1 (2.17%)	
Other services	15 (9.1%)	3 (12.5%)		15 (10.5%)	5 (10.87%)	
Baseline dyspnoea (MRC scale)			0.57			0.07
I	38 (25.0%)	3 (16.67%)		37 (28.2%)	4 (10.3%)	
II	24 (15.8%)	3 (16.79)		21 (16.0%)	6 (15.4%)	
III	46 (30.3%)	5 (27.8%)		40 (30.5%)	11 (18.2%)	
IV	39 (25.6%)	5 (27.8%)		29 (22.1%)	15 (38.5%)	
V	5 (3.3%)	2 (11.1%)		4 (3.1%)	3 (7.7%)	
Baseline situation (ECOG)			0.0008			< 0.0001
0	85 (58.6%)	3 (16.7%)		80 (64.5%)	8 (20.5%)	
1	28 (19.3%)	4 (22.2%)		23 (18.6%)	9 (23.1%)	
2	12 (8.3%)	6 (33.3%)		8 (6.45%)	10 (25.6%)	
3	17 (11.7%)	3 (16.7%)		11 (8.9%)	9 (23.1%)	
4	3 (2.1%)	2 (11.1%)		2 (1.2%)	3 (7.7%)	
Parameters on admission at RICU						
APACHE-II	13.6 ± 5.3	18.4 ± 7.5	0.02	13.2 ± 5.2	17.2 ± 6.5	0.003
Glasgow	14.7 ± 0.9	13.0 ± 3.9	0.03	14.8 ± 0.8	13.7 ± 3.1	0.02
PH	7.38	7.34	0.005	7.38 ± 0.08	7.37 ± 0.07	0.16

Values are expressed as number (percentage) and as mean ± standard deviation.

APACHE-II Acute Physiology and Chronic Health Evaluation;¹⁴ ECOG: Eastern Cooperative Oncologic Group; MRC: Medical Research Council; RICU: Respiratory Intermediate Care Unit.

Other variables evaluated were not statistically significant: Charlson index, APACHE-II in emergencies, other physiological variables upon admission to RICU, such as carbon dioxide and oxygen arterial pressure and respiratory frequency.

time it is run by a cardiologist trained in NIMV techniques. Finally, it is important to consider that type of patients and medical attention provided by critical and intermediate care units are not as yet wholly defined³²: they vary from one country to another or from region to region depending on the resources available, organisation and health systems, as noted by Chiner et al³³ regarding NIMV practice. Consequently, our data may not be extrapolated to other European or even Spanish RICUs.

To conclude, our study shows that a considerable proportion of patients admitted to hospital for respiratory disorders meet the criteria to be received at RICU. Our cases consist of patients advanced in age, with high associated morbidity, that suffer from respiratory failure and have high mortality expected according to the severity scales available. Practically half of them are admitted for follow-up while the other half is to receive ventilation, and a low percentage of failure is observed amongst ventilated patients. We have not found statistically significant differences in the results (mean stay, re-admission, and mortality) depending on the type of attention provided to the patient.

References

- Petty TL, Lakshminarayan S, Sahn SA, Zwillich CW, Nett LM. Intensive respiratory care unit. Review of ten's years experience. *JAMA*. 1975;233:34-7.
- Corrado A, Roussos C, Ambrosino N, Confalonieri M, Cuvelier A, Elliott M, European Respiratory Society Task Force on epidemiology of respiratory intermediate care in Europe. Respiratory intermediate care units: a European survey. *Eur Resp J*. 2002;20:1343-50.
- Nava S, Confalonieri M, Rampulla C. Intermediate respiratory intensive care units in Europe: a European perspective. *Thorax*. 1998;53:798-802.
- Torres A, Ferrer M, Blanquer JB, Calle M, Casolive V, Echave JM, et al. Unidades de cuidados respiratorios intermedios, Definición y características. *Arch Bronconeumol*. 2005;41:505-12.
- Rosenthal GE, Sirio CA, Shepardson LB, Harper DL, Rotondi AJ, Cooper GS. Use of intensive care units for patients with low severity of illness. *Arch Intern Med*. 1998;158:1144-51.
- Ridley SA. Intermediate care, possibilities, requirements and solutions. *Anaesthesia*. 1998;53:654-64.
- Henning RJ, McClish D, Daly B, Rearman H, Franklin C, Jackson D. Clinical characteristics and resource utilization of ICU patients: implications for organization of intensive care. *Crit Care Med*. 1987;15:264-9.
- Oye RK, Bellamy PE. Patterns of resource consumption in medical intensive care. *Chest*. 1991;99:685-9.
- Junker C, Zimmerman J, Alzola C, Draper E, Wagner D. A multicenter description of intermediate care patients. Comparison with ICU low risk monitor patients. *Chest*. 2002;121:1253-61.
- Frutos F, Alía I, Lorenzo MR, García J, Nolla M, Ibáñez J, et al. Utilización de la ventilación mecánica en 72 unidades de cuidados intensivos de España. *Med Intensiva*. 2003;27:1-12.
- Medical Research Council's Committee on environmental and occupational setting. Questionnaire on respiratory symptoms. London: MRC; 1986.
- Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chron Dis*. 1987;40:373-83.
- Oken MM, Creech RH, Tormey DC, Horton J, Davis TE, McFadden ET, et al. Toxicity and response criteria of the Eastern Cooperative Oncology Group. *Am J Clin Oncol*. 1982;5:649-55.
- Knaus WA, Drapper DP, Zimmerman JE. APACHE II: a severity of disease classification system. *Crit Care Med*. 1985;13:818-29.
- España PP, Capelastegui A, Gorordo I, Esteban C, Oribe M, Ortega M, et al. Development and validation of a clinical prediction rule for severe community-acquired pneumonia. *Am J Respir Crit Care Med*. 2006;174:1249-56.
- Fine MJ, Auble TE, Yealy DM, Hanusa BH, Weissfeld LA, Singer DE, et al. A prediction rule to identify low-risk patients with community-acquired pneumonia. *N Engl J Med*. 1997;336:243-50.
- Pilcher DV, Bailey MJ, Treacher DF, Hamid S, Williams AJ, Davidson AC. Outcomes cost and long term survival of patients referred to a regional weaning centre. *Thorax*. 2005;60:187-92.
- Ceriana P, Delmastro M, Rampulla C, Nava S. Demographics and clinical outcomes of patients admitted to a respiratory intensive care unit localized in a rehabilitation center. *Respir Care*. 2003;48:670-6.
- Bertolini B, Confalonieri M, Rossi C, Rossi G, Simini B, Gorini M, et al. Cost of COPD. Differences between intensive care unit and respiratory intermediate care unit. *Respir Med*. 2005;99:894-900.
- Balaguer C, Sala E, Carrera M, Palou A, De Borja F, Bover J, et al. Actividad de una unidad de cuidados respiratorios intermedios (UCRI) dependiente de un servicio de neumología durante el primer año de funcionamiento. *Arch Bronconeumol*. 2008;44:177.
- Confalonieri M, Gorini M, Mollica C, Corrado A. Respiratory intensive care units in Italy: a national census and prospective cohort study. *Thorax*. 2001;56:373-8.
- Elpern E, Silver M, Rosen R, Bone R. The non-invasive respiratory care unit. Patterns of use and financial implications. *Chest*. 1991;99:205-8.
- Plant PK, Owen JL, Elliot MW. Early use of non-invasive ventilation for acute exacerbations of chronic obstructive pulmonary disease on general, respiratory wards: a multicentre randomised controlled trial. *Lancet*. 2000;355:1931-3.
- Brochard L, Mancebo J, Wysocki M, Lofaso Conti G, Rauss A, Simonneau G, et al. Non invasive ventilation for acute exacerbations of chronic obstructive pulmonary disease. *N Engl J Med*. 1995;333:817-33.

25. Phua J, Kong K, Lee KJ, Shen L, Lim TK. Non-invasive ventilation in hypercapnic acute respiratory failure due to chronic obstructive pulmonary disease vs. other conditions: effectiveness and predictors of failure. *Intensive Care Med.* 2005;31: 533-9.
26. Scala R, Naldi M, Archinucci I, Coniglio G, Nava S. Non-invasive positive pressure ventilation in patients with acute exacerbations of COPD and varying levels of consciousness. *Chest.* 2005;128:1657-66.
27. Carlucci A, Richard JC, Wysocki M, Lepage E, Brochard L, the SRLF collaborative group on mechanical ventilation.. Noninvasive versus conventional mechanical ventilation. *Am J Respir Crit Care Med.* 2001;163:874-80.
28. Paus-Jenssen E, Reis JK, Cockcroft DW, Lamframboise K, Ward H. The use of non-invasive ventilation in acute respiratory failure at tertiary care center. *Chest.* 2004;126:165-72.
29. Ortega A, Peces-Barba G, Fernández I, Chumbi R, Cubero N, González N. Evolución comparativa con ventilación no invasiva de pacientes con EPOC, síndrome de hipoventilación-obesidad e insuficiencia cardíaca congestiva ingresados en una unidad de monitorización respiratoria. *Arch Bronconeumol.* 2006;42:423-9.
30. Aggarwal A, Sarkar P, Gupta D, Jindal K. Performance of standard severity scoring systems for outcome prediction in patients admitted to a respiratory intensive care unit in North India. *Respirology.* 2006;11:196-204.
31. Vitacca M, Bianchi L, Barbano L, Ziliani M, Ambrosino N. Effects of acute on chronic respiratory failure on hypercapnia and 3-month survival. *Chest.* 2005;128:1209-15.
32. Sala E. Unidades de cuidados intermedios en neumología. *Arch Bronconeumol.* 2008;44:1-2.
33. Chiner E, Llombart M, Martínez-García MA, Fernández-Cambreñas E, Navarro R, Cervera L. Ventilación mecánica no invasiva en la Comunidad Valenciana: de la teoría a la práctica. *Arch Bronconeumol.* 2009;45:118-22.