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Original Article

Diagnosis of COPD in Hospitalised Patients

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ABSTRACT

Objective: To examine the quality of Chronic Obstructive Pulmonary Disease (COPD) diagnosis in hospitalised patients.
Material and methods: Retrospective multicentre cross-sectional audit review of the clinical histories of patients discharged with a diagnosis of COPD. The diagnosis of COPD was considered correct (DxC) in cases where the combination of a bronchial obstruction (FEV1/FVC< 70%) and smoking (> 10 pack years) could be documented. In the rest of the cases the diagnosis was considered deficient (DxD). A DxC in at least 60% of patients was required to be considered an acceptable quality healthcare diagnosis. Demographic data such as, smoking, spirometry, the specialist who discharged the patient (P: Pneumologist; MS: Medical Specialty; CS: Surgical Specialty), and healthcare level (hospital complexity; low [H1], intermediate [H2] and high [H3]).
Results: A total of 840 cases were analysed (718 males, 122 females); mean age (SD) 73 (10), from 10 hospitals (3 H1, 4 H2, 3 H3). A DxD was obtained in 597 (71.1%), due to either lack of spirometry (538, 64%) or smoking criteria (319, 38%), ($p < .001$). Only two of the ten hospitals complied with the criteria of an acceptable quality healthcare diagnosis. Significant differences ($p < .0001$) were seen on comparing DxC and DxD by healthcare level (DxC: 56.2% in H1, 29.9% in H2, 20.9% in H3), and by specialist (DxC: 47.6% en P, 24.6% in SP, 17.4% in MS). A multivariate analysis associated DxC with the male sex, H1 and pneumology reports.
Conclusions: 1. The quality healthcare for the diagnosis of COPD is deficient. 2. The lack of spirometry is the most common cause of DxD.

Calidad del diagnóstico de la enfermedad pulmonar obstructiva crónica en el ámbito hospitalario

Palabras clave:
Calidad asistencial
Diagnóstico de enfermedad pulmonar obstructiva crónica
Tabaquismo
Espirometría

RESUMEN

Objetivo: Conocer la calidad del diagnóstico de enfermedad pulmonar obstructiva crónica (EPOC) en pacientes hospitalizados.
Material y métodos: Auditoría multicéntrica transversal de revisión retrospectiva de historias clínicas en pacientes a los que se dio de alta con diagnóstico de EPOC. Se consideró diagnóstico correcto (DxC) de EPOC en los casos donde pudo documentarse la combinación de obstrucción bronquial volumen espiratorio forzado en el primer segundo/capacidad vital forzada (FEV_1/FVC < 70%) y tabaquismo (> 10 paquetes/año). En el resto de los casos se consideró diagnóstico deficiente (DxD). Se exigió un DxC en al menos el 60% de los

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pacientes para considerar una calidad asistencial diagnóstica aceptable. Se registraron los datos demográficos, el tabaquismo, la espirometría, el especialista que daba el alta (neumólogos [N], especialistas en Medicina Interna [EM] y especialistas quirúrgicos [EQ]) y el nivel asistencial (hospitales de baja complejidad [H1], hospitales de intermedia complejidad [H2] y hospitales de alta complejidad [H3]).
Resultados: Se analizaron 840 casos (718 hombres y 122 mujeres), edad media (desviación estándar) de 73 (10), procedentes de 10 hospitales (3 H1, 4 H2 y 3 H3). Se obtuvo un DxD en 597 pacientes (71,1%), motivado bien por falta de criterio espirométrico (538 [64%]) o tabáquico (319 [38%]) (p < 0,001). Sólo 2 de los 10 hospitales cumplían el criterio de calidad asistencial diagnóstica aceptable. Se observaron diferencias significativas (p < 0,0001) al comparar DxC y DxD por nivel asistencial (DxC: el 56,2% en H1, el 29,9% en H2 y el 20,9% en H3) y por especialista (DxC: el 47,6% por N, el 24,6% por EQ y el 17,4% por EM). Un análisis multivariado relacionó DxC con sexo masculino, H1 e informes neumológicos.
Conclusiones: 1) La calidad asistencial para el diagnóstico de EPOC en hospitales es deficiente y 2) la falta de espirometría es la causa más frecuente de DxD.

Introduction

Recent studies[1,2] have revealed the growing impact of respiratory illnesses on public health, and in particular the continuing increase in morbidity and mortality due to chronic obstructive pulmonary disease (COPD). This reinforces the prediction that in 2020 this disease will constitute the third cause of death in the world.[3,4] Likewise, studies available in Spain show both the high prevalence of the disease and that it is an important social and economic burden.[5,6] For this reason, different scientific societies have promoted the development of norms of consensus and clinical practice guidelines in order to unify criteria, assemble as much available evidence as possible, and develop clear recommendations to try to achieve quality clinical practice.[7-11] In particular, referring to the diagnosis of COPD, these guidelines and recommendations place special emphasis on the important role of smoking and spirometry testing in its diagnosis. Indeed, one recent publication about healthcare quality standards in COPD[12] set these two variables as the key indicator for the correct diagnosis of the disease. However, several studies into the reality of healthcare for COPD patients show that in Spain and other developed countries there are wide variations between healthcare professionals themselves in terms of the treatment of this disease.[13-16] The studies highlight in particular that the number of spirometry tests performed for a correct diagnosis and follow-up is still very low,[17-19] which is connected with a high percentage of patients either wrongly labelled as suffering from COPD or with an inaccurate diagnosis.[20,21]

This study aims to find out how often the COPD diagnosis is made with acceptable quality criteria in hospital settings and usual clinical practice, and is backed up by a spirometry test and tobacco habit appropriate to this diagnosis. Furthermore, we propose to assess the possible differences in the diagnostic handling of these patients according to healthcare level and the type of medical specialist who performs the diagnosis at the time of discharge.

Materials and Methods

An audit was planned to review the way in which the diagnosis of COPD is established in hospital settings. A retrospective multi-centre cross-sectional study was designed and a review was made of the complete clinical histories in classic, paper format of all the patients discharged with either a main or secondary diagnosis of COPD. The patients were consecutively discharged from 10 hospitals of the public health network in the Autonomous Community of Valencia. Two winter months (November and December) were chosen, as during this time there is a high volume of patients admitted and discharged from hospital with this diagnosis. Patients being rehospitalised and those whose diagnosis of COPD was only probable were excluded from the study. All the hospitals had the necessary analytical, radiological and spirometric resources for the correct diagnosis and treatment of COPD patients.

A correct diagnosis (DxC) of COPD was considered to have been made when, after an exhaustive check of all the patient's medical history, both as an inpatient and an outpatient, it was possible to establish from the medical history that the patient consumed over 10 pack years and that they had previously undergone spirometry testing, showing bronchial obstruction (forced expiratory volume after 1 second/forced vital capacity [FEV1/FVC] < .7 prebronchodilation or postbronchodilation). If any of these criteria were missing, the COPD diagnosis was considered deficient (DxD).

In agreement with the recently published recommendations regarding quality healthcare standards in COPD,[12] obtaining a DxC in at least 60% of the patients was taken as the acceptable criterion of quality, and anything less was considered a deficient level of quality healthcare, both for each hospital and the overall sample.

The following variables were collected in each case: age, sex, history of smoking, spirometric parameters, and the specialist giving the COPD diagnosis at the time of discharge, differentiated between pneumologists (P), other specialists in internal medicine (IM) or surgical specialists (SS). Finally, the healthcare level was recorded. In this respect, 3 groups were considered, classified in accordance with a modification of the design of the Spanish Health System,[22] which divides hospitals into 5 groups, depending on variables such as staffing, services offered and teaching activity, complexity and intensity. To be precise, in group 1 the Spanish Health System includes small, local hospitals with between 87 (25th percentile [P]) and 214 (P75) beds; in group 2 there are basic general hospitals with a number of beds ranging from 111 (P25) to 231; in group 3, there are area hospitals with between 365 (P25) and 570 (P75) beds; group 4 includes big hospitals with between 625 (P25) and 834 (P75) beds; and finally, group 5 includes big hospitals with over 834 beds, hospital complexes and reference hospitals. In our study, the low complexity hospitals corresponded with group 1 of this classification, groups 2 and 3 were joined to form an intermediate complexity group of hospitals and groups 4 and 5 formed the high complexity group of hospitals.

Statistical Analysis

After an initial descriptive study, the different variables were compared on the basis of the presence or absence of DxC, using the Chi square test for qualitative data or the Student T test for quantitative date. These were expressed as mean values with the standard deviation between brackets. Statistical significance was established as $p \leq .05$. To compare proportions between the 3 healthcare levels, a chi square test with Bonferroni adjustment was used and a one way analysis of variance was performed to compare the mean values of the different groups. The variables showing significant statistical differences in the one way ANOVA were included in a multivariate binary logistic regression model, where the dependent variable was the presence or absence of DxC. The variables with various categories were transformed into dummy variables. A logistic regression model

was performed using a step by step forward selection of variables. For the statistical analysis of the data, we used the SPSS program for Windows, version 10 (SPSS Inc; Chicago, IL).

Results

846 patients were included in the study and 6 (0.7%) were excluded. Three did not have a clinical history or it was incomplete and the other 3 cases were due to inclusion errors. The group of 840 patients was formed of 718 men (85%) and 122 women (15%) with an average age of 73 (SD: 10) (range 29-99). Table 1 shows the baseline characteristics of these patients and their provenance.

Baseline spirometry data was available for 383 patients, while only 235 patients also had post-bronchodilator spirometry readings. A DxC was obtained in 243 cases (28.9%) and a DxD in 597 (71.1%). This figure for DxD was due to the following: 457 patients not undergoing a spirometry test (54.4%); 81 patients had non-obstructive spirometry results (9.6%), no history of smoking 278 patients (33.1%), medical history; 41 patients (4.9%) did not fulfil the necessary smoking criteria for the diagnosis of COPD. 260 patients (31%) lacked either the spirometry criterion or that related to having a tobacco habit. The patients with DxD were older (75 [SD: 10] versus 71 [9] years of age; p < .001) and the majority were female (89% versus 68%; p < .001) (table 2).

Table 1
Baseline Characteristics of the Patients

	Overall	H1	H2	H3	P
Hospitals, n	10	3	4	3	
Patients, n (%)	840	105 (12.5)	334 (39.8)	401 (47.7)	
Age	73 ± 10	72 ± 11	74 ± 10	74 ± 10	NS
Males n (%)	718 (85)	98 (93)	292 (87)	328 (82)	.002
FEV_1, ml	1,385 ± 565	1,330 ± 489	1,351 ± 597	1,573 ± 567	NS
Discharge reports by a P, n (%)	313 (37.3)	39 (37.1)	117 (35)	157 (39.1)	NS
Discharge reports by other IM, n (%)	470 (55.9)	48 (45.7)	190 (56.9)	232 (57.8)	NS
Discharge reports by a SS, n (%)	57 (6.8)	18 (17.1)	27 (8.1)	12 (3)	

IM: specialists in internal medicine; SS: Surgical specialists; FEV1: forced expiratory volume in first second; H1: low complexity hospitals; H2 intermediate complexity hospitals; H3: high complexity hospitals; P: pneumologists; NS: no statistical significance.

Table 2
Bivariate Analysis. Influence of Different Variables on the Quality of the Diagnosis

	DxC of COPD	DxD of COPD	P
Patients, n (%)	243 (28.9)	597 (71.1)	
Age	71 ± 9	75 ± 10	< .001
Males, n (%)	230 (94)	488 (82)	< .001
Female, n (%)	13 (6)	109 (18)	< .001
Type of Hospital, n (%)			< .001
H1 (n = 105)	59 (56.2)	46 (43.8)	
H2 (n = 334)	100 (29.9)	234 (70.1)	
H3 (n = 401)	84 (20.9)	317 (79.1)	
Type of report, n (%)			< .001
Discharge reports by P, (n = 313)	148 (47.3)	165 (52.7)	
Discharge reports by IM, (n = 470)	81 (17.2)	389 (82.8)	
Discharge reports by SS, (n = 57)	14 (24.6)	43 (75.4)	

DxC: correct diagnosis; DxD: Deficient diagnosis; IM: specialists in Internal Medicine; COPD: chronic obstruction pulmonary disease; SS: surgical specialists; H1: low complexity hospitals; H2 intermediate complexity hospitals; H3: high complexity hospitals; P: pneumologists.

Table 3
Correct and Deficient Diagnoses of COPD by Healthcare Level

	Overall	H1	H2	H3	P
Hospitals, n	10	3	4	3	
Patients, n (%)	840	105 (12.5)	334 (39.8)	401 (47.7)	
DxC COPD, n (%)					
N	148 (47.6)	31 (79.5)	51 (44.0)	66 (42.3)	
IM	81 (17.4)	20 (41.7)	44 (23.3)	17 (7.4)	< .001
SS	14 (24.6)	8 (44.4)	5 (18.5)	1 (8.3)	
DxD COPD, n (%)					
No spirometry	457 (54.4)	28 (26.7)	178 (53.3)	251 (62.6)	< .001
FEV_1/FVC > 70	81 (9.6)	10 (10)	39 (12)	32 (8)	.209
No smoking data	278 (33.1)	18 (17.1)	95 (28.4)	165 (41.1)	< .001
Non-smokers	41 (4.9)	4 (4.7)	12 (3.6)	25 (6.2)	.036

DxC: correct diagnosis; DxD: deficient diagnosis; IM: specialists in Internal Medicine; COPD: chronic obstruction pulmonary disease; SS: surgical specialists; FEV1/FVC: forced expired volume in 1 second/forced vital capacity; H1: low complexity hospitals; H2 intermediate complexity hospitals; H3: high complexity hospitals; P: pneumologists.

Comparing the quality of the diagnosis by healthcare level, it was seen (table 3) to have an inverse relationship with the degree of accuracy of the diagnosis. It was also observed that only 2 (20%) of the 10 hospitals participating in the study reached the minimum (60%) fulfilment threshold for quality healthcare for the diagnosis to be considered acceptable, as established in the COPD healthcare quality standards[12] (table 4).

Significant differences were also found with regard to the doctor who discharged the patients. The highest percentage of DxC was for the pneumologists (47.3%), followed by the surgical specialists (24.6%) and the specialists in internal medicine (17.2%) ($p < .001$). Once again, the lack of spirometry criteria was more common than the lack of smoking criteria as a cause of DxD, but significant differences ($p < .001$) were observed between the different specialists for both criteria. Analyzing these data by healthcare level, we found that it was still the P group who had the best results at all hospital levels, and also that the low complexity hospitals achieved a higher percentage of acceptable diagnoses in all the specialist groups studied ($p \leq .001$) (table 3).

Table 5 includes the results of the multivariate analysis and shows that male patients with COPD are three times more likely to receive a CxD, and this rises to 4 times if he is discharged by a pneumologist and 6 times if the patient is in a small hospital.

Discussion

This study reveals that COPD diagnosis in hospital settings does not meet the acceptable minimum standard of quality healthcare. Only 2 hospitals reached a level of compliance above 60%, the figure considered to be of acceptable quality for the diagnosis of COPD. In the remaining hospitals, the quality of the COPD diagnosis is deficient, and the lack of spirometry criteria is a more common reason for this than the lack of the smoking-related criteria. These findings are more striking for women, only 11% of whom received a DxC. Furthermore, it is proven that there are vast differences in the ways that this disease is diagnosed amongst the various specialists and levels of healthcare. Pneumologists and small hospitals diagnose COPD with greater certainty than other specialists and hospitals Furthermore, it is observed that there are big differences in dealing with the diagnosis of this disease between the different specialists and healthcare levels. Pneumologists and small hospitals diagnose COPD with greater accuracy than other specialists or hospitals, but even so the percentage of DxC of COPD is only around 50%. The acceptable threshold of quality healthcare standards for COPD diagnosis is only reached in small hospitals and when discharge reports are made by a pneumologist.

Our data show a lower figure for DxC of COPD than that of other authors, who show reliable diagnosis levels of 63% (13), 36% (20) or 50% (21), for example. However, it must be pointed out that in our case, the accurate diagnostic criteria included both variables (smoking and bronchial obstruction), while in other studies the detection of bronchial construction alone was considered to be in agreement with the diagnosis of COPD, which could in part explain the discrepancy observed with our data. Another point to consider is the differences in the designs of the studies themselves. In our case, a retrospective study was carried out given that the intention was to audit, from a sample of patients discharged from hospital by any speciality, to what extent the COPD diagnosis specified in the discharge report corresponded with observation in the clinical history of a DxC of the disease. In contrast, those mentioned before were prospective studies in which the aim was to confirm the validity of the clinical diagnosis of COPD by performing spirometry testing. Furthermore, it is also worth mentioning the variability in the spirometric criteria chosen to confirm bronchial obstruction. While in the more recent studies a postbronchodilator FEV1/FVC ratio below 70% has been used in the study by De Miguel at al.,[13] which was prior to the publication of the Global Initiative for Chronic Obstructive Lung Disease (GOLD),[8] the baseline FEV1/FVC ratio was used. Our study was a retrospective review of clinical histories in which it was possible to find old spirometry tests which were performed prior to the recent recommendations to consider bronchial obstruction after bronchodilator administration as the spirometric criterion for the diagnosis of COPD.[6-11] Thus, we decided to accept as valid bronchial obstruction diagnosed both by baseline spirometry

Table 4
Quality of Healthcare in COPD Diagnosis

Hospital	Type of Hospital	Patients included	Accurate diagnosis, n (%)
1	H1	46	24 (52.2)
2	H1	25	9 (36)
3	H1	34	26 (76.5)[a]
4	H2	82	11 (13.4)
5	H2	52	13 (25)
6	H2	97	51 (52.6)
7	H2	103	25 (24.3)
8	H3	162	50 (30.9)
9	H3	40	24 (60)[a]
10	H3	199	10 (5)

COPD: chronic obstruction pulmonary disease; H1: low complexity hospitals; H2 intermediate complexity hospitals; H3: high complexity hospitals.
[a]Hospitals with acceptable quality level for COPD diagnosis.

Table 5
Influence of Different Variables on the Quality of Diagnosis

	Raw			Adjusted		
	OR	CI 95%-OR	P	OR	CI 95%-OR	P
Age (years)	0.97	0.95–0.97	< .001	0.96	0.94–0.98	< .001
Sex, male	3.87	2.13–7.03	< .001	3.13	1.62–6.04	.001
Type of report			< .001			< .001
Discharge reports by other IM	–	–		–	–	
Discharge reports by SS	1.55	0.81–2.96		0.77	0.37–1.57	
Discharge reports by P	4.32	3.11–5.98		4.34	3.04–6.20	
Healthcare level			< .001			< .001
H3	–	–		–	–	
H2	1.61	1.15–2.26		1.85	1.27–2.68	
H1	4.84	3.07–7.62		6.14	3.64–10.34	

Raw and adjusted analyses.
IM: specialists in Internal Medicine; SS: surgical specialists; H1: low complexity hospitals; H2 intermediate complexity hospitals; H3: high complexity hospitals; CI: confidence interval: P: pneumologists; OR: odds ratio.

and post-bronchodilator values. We did not want to invalidate a correct COPD diagnosis, made at a time in the patient's past, prior to current recommendations. However, despite this favourable stance, which could overestimate the degree of accuracy of COPD diagnosis, the conclusive results obtained in our study do not invalidate the disappointing conclusion with regard to the deficient quality healthcare for the diagnosis of COPD. However, we look forward to seeing the results of an extensive, ambitious study which is being carried out at present. The AUDIPOC study is a nationwide audit into the ways hospitals handle COPD exacerbation and which is likely to extend and clarify some of the aspects commented here.

A potential bias in our study could be attributed to the possibility that some patients' DxC of COPD were made in primary care. However, there is conclusive data in the medical literature establishing the limited and inadequate use of spirometers in primary care,[13-15,17,21] and this negative assessment applies to our country too.[13,17,23] A recent study in Navarra[23] concluded that spirometers were underused in primary care (despite them being readily available); recommendations for their correct use were not followed; the professionals performing spirometry had not received appropriate training, and in 40% of cases functional diagnoses were made incorrectly. No similar study has been published for the Autonomous Community of Valencia, but this is normal in healthcare areas corresponding to the hospitals participating in this study, so much so that this could have affected our results.

One of the most surprising findings in this study is that a greater proportion of DxC is proven in small hospitals. The fact that there is an inverse relation between the grade of diagnostic accuracy and the level of healthcare provided is also alarming. However, analysing the quality of the care given to COPD patients by the type of hospital and availability of resources, the smallest hospitals have the worst indicators of quality healthcare and even mortality, results which differ from our data. According to the authors,[24-26] this is due to a smaller number of doctors (OR: 1.5), less patients being treated by a P (OR: 1.8) and other aspects in the centre related with organisation and resource availability. In our study, even the smallest hospitals had pneumologists, but other data connected with the management or quality of healthcare were not collected. These would have helped us to perform a more in-depth analysis of this paradoxical finding, which should undoubtedly encourage other studies to be carried out with a design focused on explaining these aspects.

Our study also reveals differences in the quality of COPD diagnosis according to sex, with a greater tendency for DxD to be given to women. Despite the limitation in our study caused by the relatively low number of women in our sample, the reduced compliance with quality healthcare standards in this group contributes to reinforcing the facts already stated in the literature that there are important sex-related differences and bias when dealing with COPD, regarding both diagnosis[27,28] and treatment and prognosis.[29,30]

In summary, our study contributes to the evidence that, even in hospital settings, COPD diagnosis is not performed with acceptable criteria of quality. An accurate diagnosis is only given to one third of patients, and in these cases there is a significant and independent association with the diagnosis being given in a small hospital (7 times more likely), by a pneumologist (2.7 times) as well as with the patient being younger and male (2 times). These data are even more alarming if we consider that there should be records of smoking on any clinical history and that spirometry is accessible, cheap, easy to perform and non-iatrogenic. The test can also be performed with quality criteria, even by the patient's own GP, thanks to the extensive electronic and computer resources of modern technology.[31,32] Therefore, it is disheartening to see that in two thirds of COPD patients discharged by different specialists, or in even 47% of these discharged by a pneumologist, it is not possible to uphold this diagnosis with suitable records about smoking and a simple spirometric curve.

Conflict of Interest

The authors affirm that they have no conflicts of interest.

Annex. COPD Group of the Valencia Pneumology Society (by order of contribution)

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