HOW DO MEDICAL STUDENTS AND FAMILY MEDICINE RESIDENTS USE INHALER DEVICES?

M. Entrenas Castillo[1], L.M. Entrenas Costa[1, 2].

[1]Pulmonology CMU, Hospital Universitario Reina Sofía, Córdoba, Spain. [2]Faculty of Medicine and Nursing, University of Córdoba.

Abstract:

Purpose: To check inhalation therapy techniques among fourth-year students of the Faculty of Medicine at the University of Córdoba and family and community medicine residents affiliated with the teaching unit of Córdoba.

Methods: Prospective study of two unselected groups. 80 participants were included: the first group was made up of 41 fourth-year students of the Faculty of Medicine at the University of Córdoba, while the second group consisted of 39 family and community medicine residents affiliated with the teaching unit of Córdoba. The use of a pressurized cartridge (MDI) as compared with a state-of-the-art dry-powder inhaler (Spiromax®) was analyzed, without either group having received any prior instruction regarding their handling. Inhalation Manager® showed whether the maneuver was adequate depending on how each device was handled and the pulmonary drug deposition obtained.

Results: In the group of students, 98% used an adequate technique with the state-of-the-art dry-powder inhaler, as compared with the 58% who used the pressurized cartridge correctly. The low pulmonary drug deposition obtained meant poor technique with both devices. The percentage of family and community medicine residents affiliated with the teaching unit of Córdoba which used Spiromax® correctly (97%) was considerably higher than that for the MDI (33%). The level of pulmonary drug deposition obtained in this group was not ideal either. Correct use of the pressurized cartridge in the group of students (58%) was significantly better than that of the group of residents (33%). The most common error in using the pressurized cartridge was breathing too early in both groups. The only error observed in using the dry-powder inhaler was exhaling instead of inhaling in both samples.

Key words: COPD, asthma, inhaler device, Inhalation Manager, medical student, GPs trainees, education.

¿CÓMO UTILIZAN LOS DISPOSITIVOS INHALADOS LOS ESTUDIANTES DE MEDICINA Y LOS RESIDENTES DE FAMILIA?

Resumen

Objetivo: Comprobar la técnica de la terapia inhalada en estudiantes de cuarto curso de la Facultad de Medicina de la Universidad de Córdoba y residentes de medicina familiar y comunitaria adscritos a la unidad docente de Córdoba.

Métodos: Estudio prospectivo de dos grupos no seleccionados. Se incluyeron 80 participantes: el primer grupo estaba formado por 41 estudiantes de cuarto curso de la Facultad de Medicina de la Universidad de Córdoba, mientras que el segundo grupo lo componían 39 residentes de medicina familiar y comunitaria adscritos a la unidad docente de Córdoba. Se analizó la utilización del cartucho presurizado (MDI) frente a un dispositivo de polvo seco de última generación (Spiromax®), sin que ningún grupo hubiera recibido instrucción previa alguna sobre su manejo. Inhalation Manager® muestra si la maniobra es adecuada en función del manejo de cada dispositivo así como del depósito pulmonar obtenido.

Resultados: En el grupo de los alumnos el 98% realizaron una técnica adecuada con el dispositivo de polvo seco de última generación, frente al 58% que utilizaron de forma correcta el cartucho presurizado. El escaso depósito pulmonar obtenido se traduce en una mala técnica de ambos dispositivos. El porcentaje de residentes de medicina familiar y comunitaria adscritos a la unidad docente de Córdoba que utilizó de forma correcta Spiromax® (97%), fue significativamente mayor que con el MDI (33%). El nivel de depósito pulmonar obtenido en este segundo grupo tampoco fue el idóneo. El uso correcto del cartucho presurizado en el grupo de estudiantes (58%) fue significativamente mejor que en el grupo de residentes (33%). El error más común en la utilización del cartucho presurizado fue realizar la inhalación de forma prematura en ambos grupos. El único error observado en el uso del cartucho de polvo seco fue exhalar en vez de inhalar en ambas muestras.

Palabras clave: EPOC, asma, dispositivo de inhalación, Inhalation Manager, estudiantes de medicina, médicos residentes, educación.

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Marta Entrenas Castillo
marenca@gmail.com

INTRODUCTION

Inhalation therapy plays a prominent role in guidelines for the treatment of asthma and COPD. The Spanish Guidelines on the Management of Asthma (GEMA)[1] and the Spanish COPD Guidelines (GesEPOC)[2] opt for this route as a choice in their different therapeutic schemes.

Improper inhaler technique is equivalent to unconscious noncompliance with treatment[3], which much of the loss of asthma control is attributable to.

In an ideal clinical practice setting, a nursing professional should teach and check inhaler technique during each patient visit. However, clinical reality shows that, as there are no specific staff for this, it falls on the doctor to take on this task at the practice itself[4], while generally not having any additional time for it.

In previous works[5], we already pointed out that the lack of specific training on this matter during undergraduate education results in theoretical lack of knowledge for a large number of students who are about to begin their medical practice without having acquired this ability. But with the start of professional practice, there is also no guarantee that the resident will know proper inhaler technique[6].

The emergence of devices such as Inhalation Manager®[7], which records inspiratory parameters and is thus capable of objectively determining the suitability of inhaler technique for different devices with no observer variability, makes it possible to address the problem from a perspective that has not been analyzed to date.

The purpose of this work is to conduct a practical study of inhaler technique for devices among medical students and resident doctors in family and community medicine.

MATERIALS AND METHODS

From November 1 to 30, 2015, a prospective study was conducted among two unselected groups. The first group was made up of 41 fourth-year students of the Faculty of Medicine at the University of Córdoba, which is the year when they take up the subject of respiratory diseases, and the second group was comprised of 39 family and community medicine residents affiliated with the teaching unit of Córdoba, who were selected after giving their consent upon attending a training session given by the teaching unit. An exclusion criteria was having previously taken up another specialty.

Inhaler technique was analyzed consecutively in both groups, without having received any kind of prior instruction. First, while using the pressurized cartridge (MDI) and, afterwards, the state-of-the-art dry-powder inhaler (Spiromax®) through the Inhalation Manager® device. It consists of a pneumotachometer to which the device to be studied is attached using a specific adapter and which, through the right software, is capable of analyzing the start of the inhalation maneuver, the flows and their completion. For the MDI, it determines the exact moment when the device is activated. Information on the maneuver provided by the software not only includes suitability of inhaler technique, but also, upon measuring post-inspiratory apnea, provides data on maneuvers which facilitate pulmonary drug deposition[7]. For this study, handling of the device was considered to be correct when the report generated was considered to be good or optimal.

The results were expressed as absolute frequencies and percentages. To determine the differences, a comparison of percentages was made and the confidence interval (CI) was determined. Statistical significance was set at $p \leq 0.05$. The statistical package SPSS v. 8.0.

The results of this work are found within the framework for the assessment of a training project on inhalation therapy[8] which received approval from the hospital's Ethics Committee.

RESULTS

Students: records from 41 fourth-year students, (24 males, 58% and 17 females, 42%) were obtained. Figure 1 summarizes the handling of both devices in this group.

With regard to MDI, 24 students (58%) handled it properly while 17 (42%) handled it improperly. The reasons for improper handling were: pressing too early (n = 12), not pressing the device (n = 3) and poor coordination between pressing and breathing (n = 2) (Figure 2).

Pulmonary drug deposition could be compromised, at least from a theoretical perspective: in 24 cases, for not performing post-inspiratory apnea; in 23, as inspiratory flow was too fast; and in 2 cases, as inspiratory flow was insufficient (Figure 1).

It is worth pointing out that none of them were able to both handle the device properly and achieve proper pulmonary drug deposition, which would have ensured receiving an optimal dose with the MDI.

With regard to Spiromax®, 40 students (98%) handled it properly while only 1 (2%) handled it improperly (Figure 1). The only case of improper handling was for exhaling through the device (Figure 3).

Pulmonary drug deposition could be compromised in 40 cases for not performing post-inspiratory apnea and in 24 for not prolonging inspiration long enough (Figure 1).

In this case, there were also no students able to both handle the device properly and perform a maneuver that theoretically ensured proper pulmonary drug deposition.

The percentage of students who were able to use Spiromax® correctly without having received any prior instruction was significantly higher than for the pressurized cartridge (98%, CI: 93%-102% vs. 59% CI: 43%-74%, p <0.000001).

Residents: records from 39 resident doctors (25 males, 64% and 14 females, 36%). Figure 4 summarizes the handling of both devices in this group.

With regard to the MDI device, 13 doctors (33%) handled it properly while 26 (67%) handled it improperly. The reasons for improper handling were pressing too early (n = 16), poor coordination (n = 5), not pressing the device (n = 3) and pressing several times (n = 2) (Figure 2).

Pulmonary drug deposition was compromised, at least from a theoretical perspective, in 13 cases for not performing post-inspiratory apnea and in 11 as inspiratory flow was too fast (Figure 4).

None were able to both handle the device properly and achieve proper pulmonary drug deposition (Figure 4).

With regard to Spiromax®, it was properly handled in 38 cases (97%) while it was improperly handled in 1 (3%) case (Figure 4). As with the group of students, this was for exhaling through the device.

Pulmonary drug deposition could be compromised in 37 cases for not performing post-inspiratory apnea and in 18 for not prolonging inspiration long enough (Figure 1).

None were able to both handle the device properly and achieve proper pulmonary drug deposition.

The percentage of resident doctors who were able to use Spiromax® correctly was significantly higher than for the pressurized cartridge (97%, CI: 92%-102% vs. 33% CI: 19%-48%, p <0.000001).

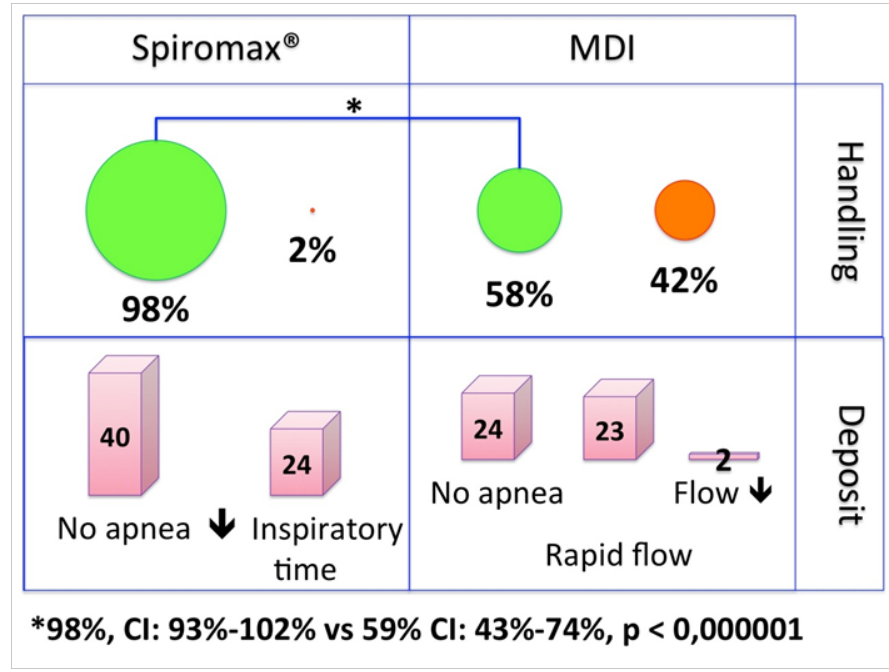

Figure 1: Students. The figure shows the results obtained by the students in handling both devices (Spiromax® and MDI). The columns indicate the results for each of the devices. In the top row, and separated according to device, the percentages are shown for each group that properly or improperly handled each device. The size of each circle is proportional to the value. In the bottom row and separated according to device, the reasons that can interfere with proper pulmonary drug deposition are shown.

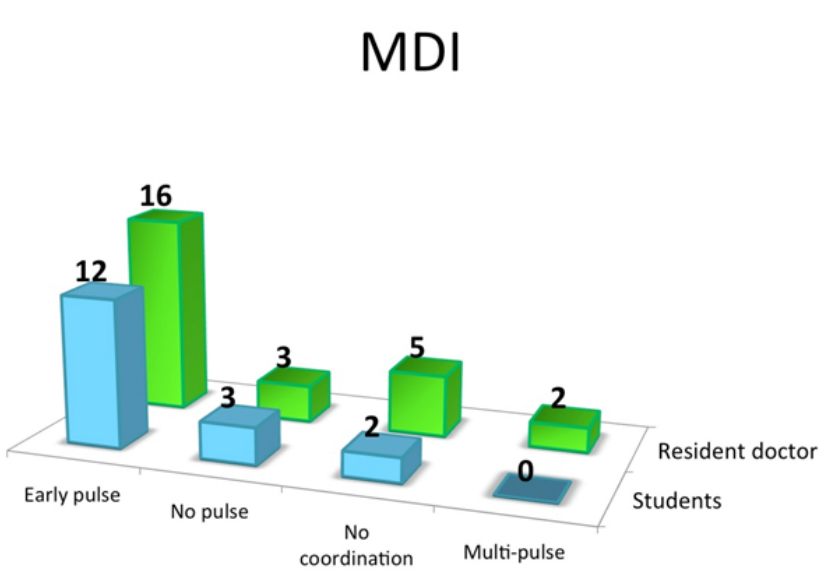

Figure 2: Errors made in handling MDI by both groups.

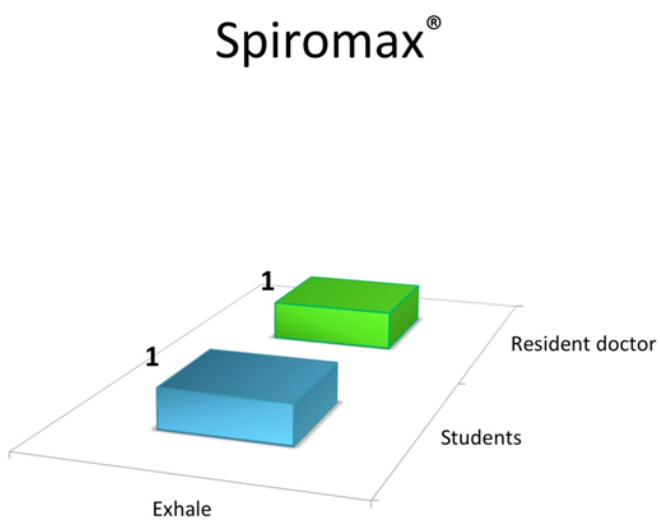

Figure 3: Errors made in handling Spiromax® by both groups.

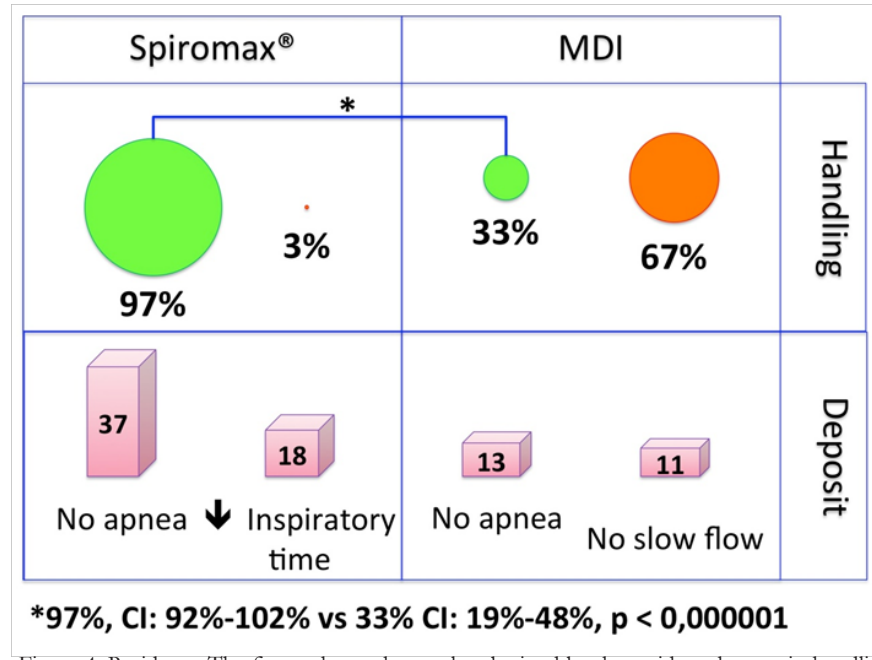

Figure 4: Residents. The figure shows the results obtained by the resident doctors in handling both devices (Spiromax® and MDI). The columns indicate the results for each of the devices. In the top row, and separated according to device, the percentages are shown for each group that properly or improperly handled each device. The size of each circle is proportional to the value. In the bottom row and separated according to device, the reasons that can interfere with proper pulmonary drug deposition are shown.

DISCUSSION

The results from our work clearly show inhaler device handling errors, which already appear in medical literature, while providing a dual perspective. The students, who did not receive any prior instruction, can be representative of a population of young patients to whom a device is prescribed, but with the additional element of—in a few years—being the ones who will have to prescribe medication that they do not know how to use, as there is no specific training for this during undergraduate education. These results are consistent with previously published data on both medical students[9] and pharmacy students[10].

In the case of the resident doctors, and in view of the results that were

obtained, we should not assume that the lessons learned during their residency will be enough to ensure knowledge of inhaler technique.

Overall, it can be estimated that half of patients with asthma[11] or COPD[12] do not undergo inhalation therapy. But if we also add the factor of improper handling of the device, we can understand the situation of these two diseases as the improper use of inhaler devices is associated with a loss of asthma and COPD control[13], which leads to an increase in the consumption of resources, and consequently, health expenditure[14]. In our setting, in a series of asthma and COPD patients who were studied for compliance with medication, both groups had a high rate of noncompliance. But upon analyzing the unconscious type of noncompliance, which is caused by improper handling of the device, we found that this was the case for 31.2% of COPD patients and for 22.8% of asthma patients[15]. Regardless of the considerations about socio-demographic differences between patients with one disease or the other, we can affirm that overall, one out of every three COPD patients, as well as one out of every four asthma patients, handles the device improperly. If we also consider that the only factor capable of rectifying errors in taking inhaled medication is supervision by health professionals[14], we can understand the importance of providing proper instruction.

In an attempt to remedy these defects, inhaler devices that seek to improve pulmonary drug deposition have been gradually developed[16] and the different scientific societies have published guidelines and recommendations to improve inhaler technique[17]. These stress the importance of proper instruction in handling the device which, aside from delivering a higher percentage of dispensed medication to the airway (the further the better), seeks to minimize oropharyngeal drug deposition, which tends to cause most of the significant side effects of these drugs and which in practice encourages its disuse.

But to impart knowledge, one has to have it first, and examples abound in literature which clearly show a deficient level of knowledge, in both theory and practice, on inhaler devices by the professionals directly involved in the education of patients. In an assessment of the steps necessary to handle the device according to the guidelines, Madueño-Caro et al. found that the pressurized cartridge, the pressurized cartridge with holding chamber or spacer, Turbuhaler® and Accuhaler® were properly handled by only 9.7% of practicing primary care doctors, 4.8% of resident doctors in family and community medicine, and by none of the undergraduate medical students[6].

When transferring this knowledge to the patient, the ideal situation would be to have specific staff for this, perhaps a nursing consultation. In our setting, and despite the fact that nearly 90% of the primary care doctors say that they have placebo inhaler devices at their practice to teach patients how to use them, 60% of them do not have any staff to do this, so it must be assumed that this is done by the primary care doctor themselves during visits[4].

This study, in contrast to previous works that focused on theoretical knowledge, took an objective look at how the different devices were handled, as Inhalation Manager® made it possible to measure something that is normally difficult to subjectively evaluate such as the press-and-breathe action for MDI devices, which determines pulmonary drug deposition. When choosing the devices to study, we had to select one, as there are numerous types available on the market today, which, in general, can be classified into pressurized cartridges (MDI) and dry-powder inhalers[17]. For the latter type, we opted for one that simplified inhaler technique to three steps (open-breathe-close) to try to see whether doing away with maneuvers in the inhalation technique would improve its handling. The choice of Spiromax® was decided as it had the required adapter for the pneumotachometer of Inhalation Manager®.

In view of the results and in a real clinical practice setting, it is foreseeable that training in inhaler devices will continue, at the very least, at its current poor level. In the undergraduate course, there is no subject that provides regulated education on inhalation therapy and device handling, which is why it would be important to add this subject to the program curriculum.

Future primary care doctors also do not seem to demonstrate optimal knowledge of the technique that they will have to teach in real-life visits shortly, which is why we should consider specific training for the residents, particularly for those who will manage these diseases as they will be the ones who will have to teach patients.

It has yet to be demonstrated whether using state-of-the-art dry-powder inhalers, which simplify handling by reducing the number of steps necessary for breathing (open-breathe-close) and release the appropriate dose under almost any circumstance of use[18] is a solution to the problem. In our study, both groups achieved a significant number of correct maneuvers as compared to the MDI. But it is very important to point out that neither group, with either of the two inhalers used, was able to perform maneuvers that ensured optimal pulmonary drug deposition, particularly post-inspiratory apnea. This data shows that teaching future educators of patients how to handle devices

cannot be neglected to ensure that they convey this knowledge properly. The maneuver does not just involve simple inhalation/exhalation; the patients themselves have to perform inspiratory apnea to ensure pulmonary drug deposition and, although technological development of devices has been able to solve certain problems with handling, a certain level of collaboration from the patient is still necessary, which makes proper instruction of the maneuver absolutely essential.

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