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Medical Personnel and Patient Skill in the Use of Metered Dose Inhalers: A Multicentric Study

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Key Words

Metered dose inhalers, misuse
Inhalation technique
Errors in aerosol inhalation inhaler devices

Abstract

The objective was to evaluate the correctness of the inhalation technique in a nationwide sample of patients and medical personnel, in order to define targeted educational goals. A total of 1,640 volunteers (746 patients, 466 nurses and 428 physicians) were evaluated. Only 9% of patients, 15% of nurses and 28% of physicians showed a correct inhalation technique. Physicians performed significantly better (mean score 77 ± 23) than nurses (71 ± 22) and patients (62 ± 26). Scores in general practitioners and pediatricians were significantly lower than those of chest physicians and allergists. In conclusion, proper use of metered dose inhalers (MDI) in patients and medical personnel is still faulty. Despite the physician's awareness of the importance of a correct inhalation technique in the use of MDI, this study shows severe deficiencies, showing the need for substantial changes in educational efforts, and particularly addressed to general practitioners.

Introduction

The proper use of metered dose inhalers (MDI) is a very important aspect of the patient's treatment involving aerosol therapy and clinical consequences following inadequate inhalation technique have been observed [1–3]. As

early as 20 years ago, several studies showed deficiencies in patients and health care personnel in the use of inhaler devices [4–6]. Despite awareness of the problem and the educational efforts addressed to both patients and professionals to improve this, incorrect use of inhalers is still frequently observed [7–9] even with the more recent devices, which are easier to handle [10, 11].

Although the inhalation technique of MDI has been widely studied, the data available to date are scanty and for the most part limited to single centers of Anglo-Saxon areas. Since cultural differences can exist, we designed a multicentric study to evaluate the use of MDI in a large sample of patients and health care personnel of Spain, in order to design a nationwide educational program to improve the inhalation technique for MDI.

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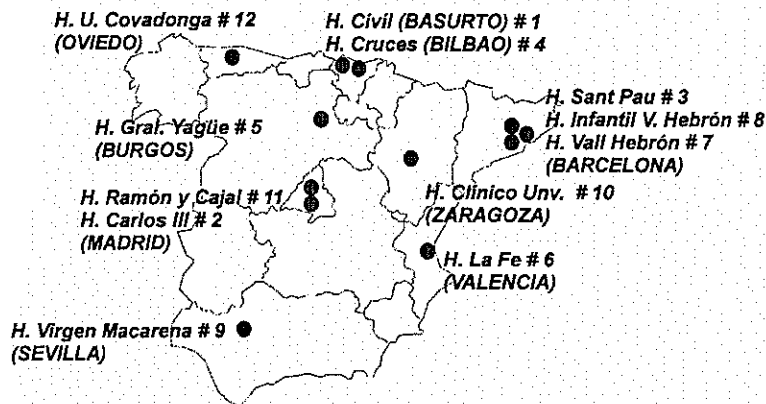


Fig. 1. Geographical distribution of the 12 centers participating in the study.

Table 1. Steps and score used to investigate ability on inhalation technique with MDI (percentage of subjects who performed each step correctly)

Step	Points by step	Patients %	Nurses %	Physicians %
1 Remove cap and shake inhaler	5	80	84	86
2 Performance of a deep exhalation	5	58	71	80
3 Insert mouthpiece into the mouth	10	88	94	92
4 Begin slow inspiration	15	66	80	83
5 Coordinate firing into the inspiration	15	57	57	70
6 Fire the canister once only	15	73	79	85
7 Continue deep, slow inspiration	15	58	68	76
8 Hold the breath (5–10 s)	15	44	56	65
9 Wait a few seconds before repeating the maneuver	5	63	76	75

Methods

Study design: Multicentric and descriptive study on the use of MDI by patients, nurses and physicians. To evaluate the correctness of inhalation technique in a nationwide sample.

Subjects: A total of 1,640 subjects divided into three different groups: 746 patients (all under MDI treatment), 466 nurses and 428 physicians (all involved with respiratory patients care) were interviewed. All were recruited from 12 health care centers in 9 Spanish cities spread around the country (fig. 1). The group of physicians consisted of 128 chest physicians, 52 allergists, 42 pediatricians, 92 general practitioners and 114 from other specialties (mainly internal or general medicine).

Protocol: Participants received no previous information on the intent or content of the interview. Upon the interviewer's request, subjects performed a practical demonstration of their inhalation technique with a placebo MDI (obtained from Glaxo-Wellcome Ltd). In each of the 12 centers involved, only one investigator interviewed the participants. Investigators were previously trained in the same way on the details of a correct inhalation maneuver by the principal

investigator. A correct maneuver [2, 12] consisted of 9 steps (table 1). Each item was given a number of points according to its relative importance (table 1), to add up to a maximum total of 100 points for a 'correct' inhalation technique. Results are shown as percentage of subjects with 100 points (correct maneuver) and mean score observed by group.

Statistical analysis: Differences between groups in demonstration scores were assessed by the Kruskal-Wallis test. Where statistically significant differences existed, specific pairwise comparisons were made with the Tukey's studentized range test and χ^2 test. Associations were analyzed by Pearson's correlation. For all tests, significance was assumed at $p < 0.05$.

Results

Demographic data of the study population are grouped in table 2. Figure 2 shows the performance of MDI inhalation technique by groups. Physicians showed a signifi-

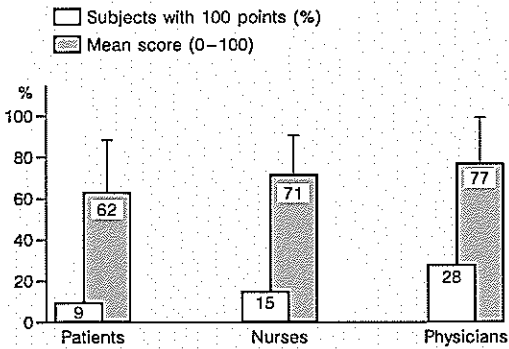


Fig. 2. Inhalation technique analyzed as percentage of subjects with 100 points (open bars) and mean score with standard deviation (shaded bars) observed in patients, nurses and physicians. Differences between groups were significant.

cantly ($p = 0.0001$) better mean score (77 ± 23) than nurses (71 ± 22) and patients (62 ± 26), while nurses did significantly better than patients. Table 1 shows the percentage of subjects who performed each step correctly. The most frequent errors observed in all groups were absence of postinspiratory apnea and lack of coordination between inspiration and MDI firing. Patients performed these two steps significantly worse than nurses and physicians ($p = 0.000$), and nurses worse than physicians ($p = 0.000$).

Table 3 shows the performance of MDI inhalation technique by groups observed in the 12 different centers. Mean score of the inhalation technique and percentage of subjects with 100 points for each group of physicians analyzed are included in figure 3. Chest physicians and allergists showed significantly better means than other groups ($p = 0.0001$). No differences were found between chest physicians and allergists.

Discussion

The main result of this multicentric study is the verification of improper use of MDI by both patients and medical personnel in our population. The most frequent errors observed in the inhalation technique were poor coordination between actuating the MDI and inhalation, and the

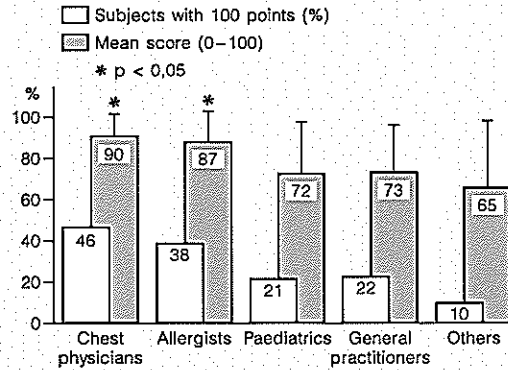


Fig. 3. Results of inhalation technique analyzed by percentage of subjects with 100 points (open bars) and mean score with standard deviation (shaded bars) observed in subgroups of physicians. * $p < 0,05$ Significant in respect to other groups. No differences were found between chest physicians and allergists.

Table 2. Demographic data of groups analyzed

	Patients	Nurses	Physicians
Number, %	746 (46)	466 (28)	428 (26)
Age, years, mean (SD)	36 (8)	36 (9)	43 (22)
Gender, % (m/f)	52/48	13/87	57/43
Years using MDI, mean (SD)	7 (5)	-	-

Table 3. Mean score by groups observed in the 12 health care centers involved (mean values and SD in parentheses)

Center	Patients	Nurses	Physicians
1	75.5 (25)	79 (25)	89 (16)
2	48.4 (27)	64.1 (23)	74.4 (23)
3	54.1 (28)	76.6 (25)	84.4 (23)
4	64.8 (22)	76.4 (20)	78.4 (27)
5	57.3 (27)	79 (19)	79.7 (18)
6	64.8 (24)	65.3 (17)	81.8 (15)
7	65.6 (25)	55.8 (25)	52.7 (28)
8	64.2 (23)	69.1 (19)	76.8 (22)
9	56.5 (27)	73.1 (21)	70.5 (25)
10	72.8 (25)	73.3 (25)	70.5 (25)
11	65.2 (23)	64.5 (15)	80.6 (14)
12	65.7 (27)	80.7 (16)	77 (18)

absence of postinspiratory apnea. Interestingly enough, these are precisely the most critical steps in the inhalation maneuver [13].

Even though our results are similar to former observations [5–9, 14], this study shows some peculiarities that are worth noting. First of all, our work was carried out in several centers at the same time and involved the largest population sample studied to date. Secondly, the most frequent errors observed differed from those in other studies. For example, our subjects did shake the canister correctly before inhalation, while this step was the most frequent error in other studies [6]. Geographic differences could reveal local cultural aspects which should be taken into account when planning educational strategies. Furthermore, it is of interest that scores in general practitioners and pediatricians were lower than those of chest physicians and allergists. Consequently, since the level of knowledge differs according to the speciality of the physician, this should also be considered when setting up educational programs.

Incorrect MDI use by both patients and professionals is a universal phenomenon. The poor inhalation tech-

nique observed around the world and the persistence of the same results over time, show that the problem is not satisfactorily solved and indicates the need for establishing new educational strategies for both patients and professionals. Furthermore, our results point out that MDI training programs for physicians must include not only specialists, but in particular general practitioners.

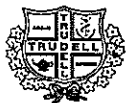
In summary, patient and medical personnel skill in the use of metered aerosols in our country is limited. Despite physicians' awareness of the inhalation technique, our study shows serious deficiencies, particularly in the most determinant aspects of the inhalation maneuver. Future educational programs must be specially focused on improving the errors most frequently observed in this study.

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Patient Population: 1640 volunteers - 746 patients, 466 nurses, 428 physicians

Key Words: inhaler technique

Comments: Only 9% of patients, 15% of nurses and 28% of physicians showed correct inhalation technique using pMDI.

Study Summary

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