Communications

Faulty Use of Canister Nebulizers for Asthma

David Appel, MD
Bronx, New York

Patients with asthma frequently use canister nebulizers in order to take beta-adrenergic agonists and beclomethasone in aerosolized form. This mode of treatment is convenient, effective, generally well tolerated, and safe. Success, however, depends upon a proper technique of simultaneous canister activation and deep inhalation. This author, as well as others,[1-3] has noted that in many patients with asthma the technique of canister nebulizer use is faulty. The following study attempts to learn what proportion of patients with asthma use canister nebulizers incorrectly and why they do so.

Methods

All patients studied were referred by physicians or nurses in the primary care medical clinic of North Central Bronx Hospital to the pulmonary function laboratory for routine pulmonary function testing. The basis for selection into the study was that the request slip for pulmonary function tests indicated the patient had asthma (physician diagnosis), was using a canister nebulizer, but had not taken bronchodilator within four hours prior to testing. Seventy-five consecutive patients were studied. The patients, the referring physicians, and nurses were unaware a study was being conducted, and knowledge of such a study was kept from the medical community to avoid influencing the results. No patient was studied, however, unless the primary care nurse or physician requested pulmonary function tests, and all the tests performed were the routine tests normally performed in the laboratory. An outline of the study protocol follows:

Part I (first week): All patients

1. Questionnaire (author)
2. Pulmonary function testing (lung volumes, flow rates, single-breath carbon monoxide diffusing capacity) (technician)
3. Patient demonstrates usage of canister nebulizer (author)
4. Repeat pulmonary function testing (flow rates) (technician)
5. Repeat pulmonary function testing (flow rates) (technician)
6. Physician administers isoproterenol by canister nebulizer to patient (one puff at five-minute intervals, two times)
7. Repeat pulmonary function testing (flow rates) (technician)
8. Training session for those patients not using canister nebulizer correctly (author)

From the Department of Medicine, North Central Bronx-Montefiore Hospitals, and the Pulmonary Division of the Department of Medicine, Albert Einstein College of Medicine, Bronx, New York. Requests for reprints should be addressed to Dr. David Appel, North Central Bronx Hospital, 3424 Kossuth Avenue, Room 10C-07, Bronx, NY 10467.

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Part II (second week): Patients with improper technique

Steps 2 through 8 repeated

Part III (third week): All patients in part II

All pulmonary function testing was performed by the technician in the absence of the author and without knowledge regarding the patient's technique in using the canister nebulizer. The author did not know the pulmonary function results until completion of step 7. In step 3, patients were asked to "take two puffs of the Isuprel just as you would if at home," and following observation of their use of the canister nebulizer, the author predicted whether or not a bronchodilator response would occur. Following step 7, the data were analysed, and the patient's performance was assessed. Patients were judged to be using the canister nebulizer correctly if obstruction of airflow was significantly improved following self-administration of the canister nebulizer or if no obstruction was noted initially but the inhalational technique appeared correct. When obstruction of airflow was not improved following patient administration of the canister nebulizer but improved following physician administration of it, the technique was considered faulty. Patients using the canister correctly were not retested. All others underwent 20 minutes of training in the use of the canister nebulizer and were brought back for retesting 7 and 14 days later as outlined above.

A 20 percent improvement in two of the following was considered a significant bronchodilator response: forced expiratory volume in 1 second, midmaximal expiratory flow rate, and peak expiratory flow rate. The data were analysed using a paired *t* test, and differences were considered significant ($P \leq .05$).

Results

Seventy-five patients were studied. Of these, 14 patients proved not to meet the criteria for the diagnosis of asthma established by the American Thoracic Society,[4] and 5 patients failed to return to repeat testing following part I. In the remaining 56 patients, a mean of 1.9 canister nebulizers per patient were used each month. Canister nebulizers were used for an average of five years and were prescribed by an average of four nurses or physicians.

By the criteria described above, only 23 percent (13/56) demonstrated proper canister nebulizer inhalation technique. Four were predicted by observation to have a proper technique, but pulmonary function tests revealed no airways obstruction at the time of the study. Eight were predicted to have proper technique by observation and demonstrated a bronchodilator response following self-administration of the medication. One was predicted by observation to have faulty technique, but a bronchodilator response was noted after self-administration and this patient was thus included among those with proper technique. The remaining 43 patients (77 percent of the total study group) were predicted by observation to have faulty technique and showed no bronchodilator responsiveness following self-administration of the medication. Despite their faulty technique, 53 percent of these patients (24/43) felt this form of treatment was helpful. Between the groups with proper and faulty technique, the differences in age, sex, language, length of canister use, number used each month, and number of nurses or physicians prescribing them were not statistically significant.

Of those patients with faulty technique, 79 percent (34/43) were able to learn the proper technique. Compared with those able to learn, those unable were significantly older and had used canister nebulizers significantly longer ($P < 0.05$).

Twenty-nine of the 34 patients able to learn the proper technique did so in a single training session. One week later, however, 4 of these 29 (14 percent) had not retained what they learned. These four and five other patients required a second training session to learn the proper technique.

Comment

Canister nebulizer aerosols of beta-adrenergic agonists and corticosteroids are convenient, effective, specific, and safe forms of therapy for patients with asthma provided they use a proper technique of canister nebulizer inhalation.[5-9] This

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study shows, however, that nearly 75 percent of patients with asthma selected randomly from a general medical primary care clinic used canister nebulizers with faulty technique and had done so for years. Age, sex, language, and level of education did not distinguish those with proper from those with faulty technique. Eighty percent of those with faulty technique easily learned proper technique after one or two brief training sessions. Those unable to learn were significantly older and had incorrectly used canister nebulizers significantly longer than those able to learn. The high degree of technical misuse appears to result from failure of physicians to teach their patients correct inhalation technique.

Physicians should teach their patients proper canister nebulizer inhalation technique and retest them periodically to make certain it is established.

References

1. Saunders KG: Misuse of inhaled bronchodilator agents. Br Med J 1:1037, 1965
2. Orehek L, Gayrard P, Grimaud CH, Charpin J: Patient error in use of bronchodilator metered aerosols. Br Med J 1:76, 1976
3. Paterson IC, Crompton GK: Use of pressurized aerosols by asthmatic patients. Br Med J 1:76, 1976
4. American Thoracic Society, Committee on Diagnostic Standards for Nontuberculous Respiratory Diseases: Definitions and classifications of chronic bronchitis, asthma, and pulmonary emphysema. Am Rev Respir Dis 85:762, 1962
5. Shim CS, Williams MH Jr: Bronchial response to oral versus aerosol metaproterenol in asthma. Ann Intern Med 93:428, 1980
6. Thringer G, Svedmyr N: Comparison of infused and inhaled terbutaline in patients with asthma. Scand J Resp Dis 57:17, 1976
7. Paterson JW, Shenfield GM: Bronchodilators. BTTA Rev 4:25, 1974
8. Williams MH Jr, Kane C, Shim CS: Treatment of asthma with triamcinolone acetonide delivered by aerosol. Am Rev Respir Dis 109:538, 1974
9. Brompton Hospital/MRC Trial: Double-blind trial comparing two dosage schedules of beclomethasone diproprionate aerosol in the treatment of chronic bronchial asthma. Lancet 2:303, 1974