Survey of Use of the Insufflator-Exsufflator in Patients With Spinal Cord Injury

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Abstract

Background/Objective: The insufflator-exsufflator has been shown to be effective in assisting cough in individuals with spinal cord injury. However, many institutions do not use this device. The study was performed to assess use of the device and attitudes among health care providers.

Methods: We developed a questionnaire with 4 categories of questions: knowledge of the device, type of facility, clinical practice with the device, and patient and provider satisfaction. The questionnaire was mailed to members of the American Paraplegia Society.

Results: Eighty-six questionnaires (16%) were returned. The device was being used in 49% of the institutions. The device was most commonly used with a tracheostomy; use did not correlate with size or type of facility. Patient and provider satisfaction with the insufflator-exsufflator was high.

Conclusions: The insufflator-exsufflator is used as a means of removal of secretions in approximately one half of institutions polled. Satisfaction with the device is high.

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INTRODUCTION

Individuals with spinal cord injury (SCI) are at increased risk for respiratory complications such as pneumonia, atelectasis, and mucus plugging (1–3). Respiratory complications are the most common cause of death in these patients (3). Although the major muscles of inspiration, including the diaphragm, are innervated by the cervical spinal cord segments, the muscles of expiration are innervated by the thoracic segments. Thus, although inspiration is impaired primarily in patients with tetraplegia, cough, which depends on both inspiration and expiration, is impaired in those with tetraplegia and many with paraplegia (4).

Cough diminishes when the patient cannot inhale at least 1.5 liters. A number of assisted-cough techniques may be used, including the costophrenic assist, the Heimlich maneuver or abdominal thrust assist, and the

counter-rotation assist (5). As an alternative to the above procedures, mechanically assisted insufflation-exsufflation may be used (6,7). This technique involves the delivery of a maximal insufflation followed by a decrease in pressure of approximately 80 mmHg. Usually pressures are set at a low level and increased as the individual becomes used to the sensation. This procedure can generate as much as 60 liters/min of expiratory flow to remove secretions from the airways. Insufflation-exsufflation can be applied through a full-face mask, a mouthpiece, or a translaryngeal or tracheostomy tube. Mechanical insufflation-exsufflation (MIE) can be simpler and easier than manually assisted coughing, which requires cooperation on the part of the patient (8). MIE has been used in the treatment and prevention of respiratory complications in a variety of neuromuscular disorders. MIE has been shown to prevent the need for intubation and tracheostomy, reduce mortality from causes such as pneumonia, and prevent the need for hospitalization (9–11). Miske et al (12) found that the device was effective in preventing atelectasis, pneumonia, and other pulmonary complications in children with

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neuromuscular disease, thereby reducing mortality and the need for hospitalization.

Reported complications of use of the insufflator-exsufflator, which are rare, include nausea, bradycardia, tachycardia, and abdominal distension (13). In theory, a rapid decrease of intrathoracic pressure during exsufflation could predispose to gastroesophageal reflux and aspiration (12). However, clinical experience indicates that this complication is uncommon (7).

There are little data on the use of insufflation-exsufflation in individuals with SCI. Hultgren et al (14) treated 12 patients with tetraplegia by insufflation and exsufflation for 6 weeks. Lung capacity, vital capacity, expiratory reserve volume, and maximum static respiratory pressures improved significantly with treatment. Improvement in ventilatory parameters lasted for a year or more. Pillastrini et al (15) found that MIE aided in clearance of bronchial secretions and increased forced vital capacity, forced expiratory volume in 1 second, and peak expiratory flow in tracheostomy subjects with high tetraplegia.

Despite the potential advantages of the insufflator-exsufflator, many institutions do not use the device. There is little information on patient and provider attitudes with the device. Garstang et al (16), in a small study, found that patients with SCI felt that the insufflator-exsufflator was more comfortable than suctioning. However, no information about provider attitudes was obtained. The following survey was conducted to assess the use of the device and attitudes toward its use among providers who care for patients with SCI.

METHODS

A questionnaire was developed by the members of the Clinical Practice Committee of the American Paraplegia Society (APS) to assess use of the insufflator/exsufflator. The survey consisted of 4 major categories: knowledge (this assessed how the member had learned about the device, whether it was used in the respondent's facility, whether a protocol was used, and whether there were established staff competencies for use of the device); facility (whether the facility was a Veterans Administration hospital, university, acute rehabilitation, or other category of facility was determined and the number of SCI beds, ventilator beds, and insufflators used in the facility and in home care was assessed); clinical practice (the third category of questions dealt with practice, including whether physicians wrote orders for settings and whether protocols were used during insufflation and exsufflation and other questions addressed whether automatic or manual settings were used, the percentage of time that the device was used with nose-mouth covering, mouthpiece, translaryngeal tube, or tracheostomy tube and use of the device in home care); and satisfaction (the final category of questions regarded staff and patient satisfaction with the device).

The questionnaire was sent to members of the APS in a single mailing. Data were analyzed by standard arithmetic, χ^2 analysis, and proportional analysis (17).

RESULTS

A total of 525 questionnaires were mailed to members of the APS. Eighty-six questionnaires (16%) were returned, representing 76 facilities. Six facilities submitted more than 1 questionnaire. The most common ways that the physician learned about the device was from a colleague (41%), SCI meetings (17%), journals (15%), in training (9%), vendors (8%), a patient (5%), and other sources (9%). In some instances, the responder noted more than 1 source of information.

Forty-four responders (51%) reported using the insufflator-exsufflator (95% error bound $\pm 10\%$). This means that, assuming random distribution, we are 95% certain that the calculated proportion, 0.51, is within 2 SE of the true proportion (ie, the true proportion is 0.41–0.61) (17). When the data were corrected for responses by more than 1 member of an institution, 37 institutions (49%) reported using the device. Of the 51 providers who answered the question whether physicians wrote settings for the device, 27 (41%) said they wrote settings. The average insufflation pressure used was 37 mmHg (range, 35–50 mmHg). The average exsufflation pressure was 37 mmHg (range, 35–50 mmHg). The mean percentage of time that the device was used with the 4 interfaces was as follows: nose-mouth, 18% (range, 0–90%); mouthpiece, 20% (range, 0–100%); translaryngeal, 1% (range, 0–25%); tracheostomy, 61% (range, 0–100%). Tracheostomy was the most common way of using the device in the 3 major categories of institutions responding to the questionnaire (100% of universities, 75% of acute rehabilitation hospitals, and 72% of Veterans Administration medical centers).

To determine whether the type of institution, number of SCI beds, or number of ventilator beds predicted the use of the insufflator-exsufflator, a χ^2 analysis was performed. The type of institution (Veterans Administration, acute rehabilitation, university, or other [private, chronic care]) failed to predict use of the device ($P > 0.05$; Table 1). Table 1 shows the percentage of those who stated that they used/did not use the device in each category of institution. Likewise, neither the number of SCI beds (range, 0–100) nor number of ventilator beds (range, 0 to >20) correlated with the use of the device ($P > 0.05$).

Of institutions using the device, 56% had a specific protocol, and 63% had staff competencies. Of those who used the device, 36 (72%) prescribed the device for home care and 14 (28%) did not. Of the 42 responders to the question, "Who provides home care with the device?," 48% stated that this was a family member, 40% that it was a caregiver, and 12% that it was a home care nurse. One respondent answered that the device was used by the patient, and 1 respondent answered that it was used

Table 1. Responses from Each Category of Facility Regarding Their Use of the Insufflator-Exsufflator

Institution	Veterans Administration	University Hospital	Acute Rehabilitation	Private	Other
Device used	38% n = 12	57% n = 9	64% n = 20	40% n = 2	20% n = 1
Device not used	62% n = 19	43% n = 6	36% n = 10	60% n = 3	80% n = 4

n, actual number of providers responding to the question.

by a physical therapist. In 12 questionnaires, more than 1 individual was given as the provider of insufflation-exsufflation.

The average level of patient satisfaction with the device was 4 on a scale of 0 (unsatisfied) to 5 (highly satisfied). The average level of provider satisfaction with the insufflator-exsufflator was 3.7. Of 49 responders to the question, "Would you recommend the device?" 48 (98%) recommended the insufflator-exsufflator. (One responder did not recommend the device.)

In 62% (54/86) of the surveys returned, the provider commented on the best and worst features of the insufflator-exsufflator. The most common positive comment was that the device was effective in removing secretions. Other positive comments were that the device was easy to use, was less invasive, was more comfortable than other devices, and that when it was used in the automatic mode, the hands were free.

The most commonly mentioned negative feature of the device most was that respiratory technicians and pulmonologists did not accept the device or were unfamiliar with it. Other negative features were that it was difficult to use in children, made noise, and that insurance companies would not pay for it.

DISCUSSION

In this survey, 44 responders (51%) reported that the insufflator-exsufflator was in use in their institutions. More than one half of institutions using the device had protocols and staff competencies. Use of the device seems unrelated to the categories of institution (acute rehabilitation, Veterans Administration, university, or other), nor was there a correlation between the number of SCI beds or ventilator beds and use of the device. This would suggest that the use of the device is not related to any particular type of care.

Provider and patient satisfaction with the device was high because of the perception that the device was effective in removing secretions. Our study did not specifically test efficacy. The lack of use of the device in many institutions seems to be caused by lack of knowledge of its existence or lack of acceptance by respiratory therapists and pulmonologists. Likewise, the failure of some insurers to pay for the device may be because of their lack of awareness of its efficacy.

These results are similar to the report of Garstang et al (16), who found that patients with SCI preferred MIE to endotracheal suctioning as a means of removing secretions. However, we are not aware of a previous report of provider use of and satisfaction with the device.

This study was limited by the relatively small numbers of responders to the questionnaire. The likelihood of return of the questionnaire was not related to the geographic location, age, or institutional affiliation of the member. The relatively small number of responses might in part be caused by the length of the questionnaire (22 questions). Moreover, caregivers who were not members of APS were not surveyed. It is possible that nonmembers have different experiences with and attitudes toward the device.

CONCLUSION

In view of the efficiency of the device in removing secretions in patients with SCI and the potentially fatal consequences of defective pulmonary toilet, efforts to improve awareness of the insufflator-exsufflator are indicated.

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