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Effects of educational intervention on adherence to the technical recommendations for tracheobronchial aspiration in patients admitted to an intensive care unit

Efeitos de intervenção educativa na adesão às recomendações técnicas de aspiração traqueobrônquica em pacientes internados na unidade de terapia intensiva

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ABSTRACT

Objective: To evaluate the effectiveness of an educational intervention on healthcare professionals' adherence to the technical recommendations for tracheobronchial aspiration in intensive care unit patients.

Methods: A quasi-experimental study was performed to evaluate intensive care unit professionals' adherence to the tracheobronchial aspiration technical recommendations in intensive care unit patients both before and after a theoretical and practical educational intervention. Comparisons were performed using the chi-square test, and the significance level was set to $p < 0.05$.

Results: A total of 124 procedures, pre- and post-intervention, were observed. Increased adherence was observed in the following actions: the use of personal protective equipment ($p = 0.01$); precaution when opening the catheter package ($p < 0.001$); the use of a sterile glove on the dominant hand to remove the catheter ($p = 0.003$);

the contact of the sterile glove with the catheter only ($p < 0.001$); the execution of circular movements during the catheter removal ($p < 0.001$); wrapping the catheter in the sterile glove at the end of the procedure ($p = 0.003$); the use of distilled water, opened at the start of the procedure, to wash the connection latex ($p = 0.002$); the disposal of the leftover distilled water at the end of the procedure ($p < 0.001$); and the performance of the aspiration technique procedures ($p < 0.001$).

Conclusion: There was a low adherence by health professionals to the preventive measures against hospital infection, indicating the need to implement educational strategies. The educational intervention used was shown to be effective in increasing adherence to the technical recommendations for tracheobronchial aspiration.

Keywords: Intensive care units; Patient care; Suction; Education; Training; Precaution; Respiratory aspiration

This study was conducted in the Medical-Surgical Intensive Care Unit of the Hospital São Vicente de Paulo - HSVP - Passo Fundo (RS), Brazil.

Conflicts of interest: None.

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INTRODUCTION

Hospital infections that start between 48 and 72 hours after hospitalization pose a significant morbidity and mortality risk and increase hospital costs due to the additional use of antibiotics and the subsequent increase in the length of hospital stay because these infections are responsible for the development of multiresistant bacteria. Respiratory tract infection is the most common infection in the intensive care unit (ICU) and corresponds to approximately 20% of all nosocomial infections.⁽¹⁾

Patients who require endotracheal intubation, tracheostomy and mechanical ventilation are at increased risk of developing ventilator-associated pneumonia (VAP), which increases the need for permanent mechanical ventilation by 1-3%/day.⁽²⁾ The incidence of VAP is high and ranges from 6 to 52%, depending on the study population, the type of ICU and the diagnostic criteria used.⁽³⁾ Patient-inherent factors such as age, chronic diseases (cardiovascular and pulmonary), chronic renal failure, neoplasia, the use of immunosuppressive drugs, a history of smoking and/or alcohol abuse, previous hospitalization, the prolonged use of antimicrobials, immobility and abdominal and thoracic surgeries are risk factors for the development of nosocomial infection of the respiratory tract.⁽⁴⁻⁶⁾

Among invasive procedures, tracheobronchial aspiration is a simple mechanical procedure that is widely used in hospital practice to remove secretions. Nevertheless, this practice poses health risks, such as the development of nosocomial pneumonia, particularly in patients subjected to mechanical ventilation.⁽⁷⁾ There is a risk of contamination during the aspiration procedure associated with the patient and the medical team performing the procedure. The use of personal protective equipment (PPE) (goggles, mask, gown and gloves, for example) and especially routine hand hygiene pre- and post-procedures are recommended when performing the aspiration technique to avoid contamination.⁽⁸⁾ The use of PPE is essential because 10% of workplace accidents in the ICU occur during endotracheal aspiration and involve splashing of secretions onto the skin and mucous membranes.⁽⁹⁾

Recent data from mechanically ventilated patients has led to the following recommendations: endotracheal aspiration should not be performed routinely but should only be performed in the presence of bronchial secretions with catheters that occlude less than 50% of the endotracheal tube lumen in children and adults and for a procedure length of less than 15 seconds; pre-oxygenation at 100% oxygen for at least 30 seconds before and again after the procedure should be considered in patients who experience a significant decrease in peripheral oxygen saturation during endotracheal aspiration;⁽¹⁰⁾ the catheter insertion during endotracheal aspiration should reach the carina, and the catheter must then be retracted 1 to 2 cm before the start of the suction; the use of either an open or closed aspiration system is recommended, although there is some evidence that the closed aspiration system is better regarding the effects on oxygen saturation, cardiovascular instability, the removal of secretions, the incidence of VAP, environmental contamination and hospital costs;⁽¹¹⁾ and

the instillation of a saline solution during the aspiration procedure should not be performed routinely^(10,11) due to an increased risk of infection and the discomfort of the patient, although it stimulates coughing.⁽¹¹⁾

Research developed according to the recommendations of the Department of Hospital Infection Control to evaluate the tracheobronchial aspiration technique in patients admitted to a medical-surgical ICU of a general hospital concluded that the tracheobronchial aspiration technique has aspects that are amenable to improvement, mainly those related to the poor adherence of health professionals to the preventive measures against nosocomial infection, suggesting the need to implement educational strategies.⁽¹²⁾

Although there are worldwide recommendations for the prevention of nosocomial infections, they are often not properly followed by health professionals.

The Centers for Disease Control recommends educational programs aimed at practical improvement. However, such programs may result in only short-term effects on the behavior of health professionals. If the education is not regularly repeated, the improvement is not maintained for long periods.^(5,13) There are only a few studies using educational interventions that are aimed at standardizing the recommendations for the tracheobronchial aspiration technique.⁽¹³⁻¹⁵⁾

Based on the aforementioned, the present study aimed to evaluate the effectiveness of an educational intervention on the adherence of health professionals who perform the tracheobronchial aspiration technique in ICU patients.

METHODS

A quasi-experimental study that evaluated the tracheobronchial aspiration procedure before and after a theoretical and practical educational intervention was undertaken, and the adherence of health professionals to the recommendations for the use of the tracheobronchial aspiration technique in patients admitted to the adult (patients above 18 years of age) ICU was determined. The present study was conducted in the medical-surgical ICU of the *Hospital São Vicente de Paulo* (HSVP), located in the city of Passo Fundo, Rio Grande do Sul (RS), Brazil.

Tracheobronchial aspiration procedures performed by professionals working in the medical-surgical ICU of the HSVP (physiotherapists, nurses, nursing assistants and technicians) were evaluated at different shifts. The healthcare professionals were of both genders and ranged between 18 and 60 years in age. All of the professionals agreed to sign the Free and Informed Consent Form (FICF) to participate in the study. Doctors on call, interns

and medical, nursing and physical therapy students were excluded because they perform this technique only occasionally. Nurses, physical therapists, nursing assistants and technicians who were away from work during the study period and substitute professionals, due to their short stay in the service, were also excluded.

Important items included in the FICF were explained to the professionals, such as the guarantee of the right to privacy, non-mandatory participation, the study aims, the manner in which the observations and educational interventions would be performed and, most importantly, the absence of risks to the health and employment of the participants. The present study was performed in accordance with the Declaration of Helsinki and approved by the Research Ethics Committee (REC) of the HSVP and the Universidade de Passo Fundo (UPF).

Information concerning the aspiration procedure and following the biosafety guidelines and knowledge about the data collection instrument were provided to standardize the observation method and to keep the observation consistent and without comparisons. Different investigators performed the data collection to maintain the quality control of the study. On odd days, the researchers simulated the data collection, and on even days, the data were collected, thus allowing the healthcare professionals to adapt to the presence of the researchers. In an attempt to standardize the observation method of the present study, a pilot study with 20 observations of the tracheobronchial aspiration procedure was performed.

The data were collected from the observation of tracheobronchial aspiration procedures from January to August 2007. In total, 124 tracheobronchial aspiration procedures (pre-educational intervention) were observed in 3 shifts (morning, afternoon and night) with the application of an objective instrument for the data collection (evaluation form). Each item of the procedure was evaluated as to the adequacy, or not, of the execution.

The data collection instrument was developed according to the CDC and the global guidelines on the tracheobronchial aspiration technique.^(5,13) The variables evaluated were as follows: the assessment of vital signs pre- and post-aspiration procedure; washing hands pre- and post-procedure; the use of PPE; the use of aseptic precautions with the materials (whether the catheter connection latex was protected in dry and clean packaging, whether precaution was taken with opening the package and the use of sterile gloves); the explanation of the procedure to the patient and pre-oxygenation; the aspiration technique; and the details of the procedure (the length of the procedure, the execution of

circular movements, the insertion of the catheter with the vacuum pump turned off and the use of distilled water to fluidize the secretions and wash the material).

Patients on mechanical ventilation (MV) were subjected to an open aspiration technique, which is recommended only in the presence of bronchial secretions and not routinely, at <120 mm Hg aspiration pressure⁽¹¹⁾ with catheters that occlude <50% of the endotracheal tube lumen for a procedure length of up to 15 seconds. In addition, pre-oxygenation at 100% oxygen⁽¹⁰⁾ and the instillation of distilled water during the procedure to fluidize the secretions^(16,17) and stimulate cough were performed.⁽¹¹⁾

After the observations, the sampled professionals participated in a 2-hour theoretical and practical educational intervention. This intervention covered all items in the data collection instrument in relation to the tracheobronchial aspiration technique. In the theoretical educational intervention, expository lectures were conducted by means of audiovisual resources and interactivity, and a practical educational intervention, including the demonstration of all of the steps of the tracheobronchial aspiration technique, was provided to the participants. At the end of the educational intervention, each employee received educational material on the tracheobronchial aspiration technique.

In total, 2 theoretical and practical training sessions lasting approximately 2 hours were offered to the participants. Four weeks after the educational intervention, 124 tracheobronchial aspiration procedures were observed for 2 months, using the same data collection instrument, which evaluated adherence and the recommendations pre- and post-educational intervention. The training sessions and observations were performed by the same group of professionals (physiotherapists and physiotherapy students).

Statistical analysis was performed using the Statistical Package for Social Science (SPSS) software, version 16.0. The results were expressed as absolute and percentage values. The procedures observed pre- and post-educational intervention were compared using the chi-square test. The significance level was set at $p < 0.05$.

RESULTS

In the present study, 124 tracheobronchial aspiration procedures were observed pre- and post-educational intervention. All of the patients were aspirated with an endotracheal tube (ETT) or a tracheostomy (TCT), and the majority were aspirated via the oropharyngeal airway. After the educational intervention, the percentage of

nasopharyngeal aspirations was reduced because all of the patients used artificial airways (Table 1).

Table 1 - Distribution of procedures observed pre- and post-educational intervention, according to work shift, professional qualification and airway

| | Pre-intervention (N=124) | Post-intervention (N=124) | p value |
|----------------------------|-----------------------------|------------------------------|---------|
| Work shift | | | NS |
| Day | 89 (71.8) | 90 (72.6) | |
| Night | 35 (28.2) | 34 (27.4) | |
| Professional qualification | | | NS |
| Physiotherapist | 16 (12.9) | 10 (8.1) | |
| Nurse | 5 (4.0) | 1 (0.8) | |
| Nursing technician | 103 (83.1) | 113 (91.1) | |
| Airway aspiration | | | |
| Endotracheal tube | 68 (54.8) | 58 (46.8) | NS |
| Tracheostomy | 56 (46.8) | 66 (53.2) | NS |
| Oropharyngeal | 89 (71.8) | 78 (62.9) | NS |
| Nasopharyngeal | 41 (33.1) | 21 (16.9) | <0.01 |

NS - not significant. Results are expressed as number (%). The Chi-square test was used for the statistical analysis.

The pre- and post-intervention observations indicated greater adherence, with a significant increase in the use of PPE; however, there were no significant differences regarding the assessment of vital signs pre- and post-procedure, hand hygiene pre- and post-procedure, the explanation of the procedure to patient or the performance of pre-oxygenation (Table 2).

Table 2 - Adherence to the tracheobronchial aspiration recommendations regarding patient care and self-care during the procedure

| | Pre-intervention (N=124) | Post-intervention (N=124) | p value |
|---|-----------------------------|------------------------------|---------|
| Assessment of vital signs pre-aspiration | 46 (37.1) | 61 (49.2) | NS |
| Assessment of vital signs post-aspiration | 65 (52.4) | 34 (27.4) | NS |
| Hand hygiene pre-aspiration | 84 (67.7) | 80 (64.5) | NS |
| Hand hygiene post-aspiration | 62 (50.0) | 93 (75.0) | NS |
| Use of PPE | 78 (62.9) | 82 (66.1) | 0.01 |
| Explanation of the technique to the patient | 6 (4.8) | 92 (74.2) | NS |
| Pre-oxygenation | 6 (4.8) | 7 (5.6) | NS |

NS - not significant; PPE - personal protective equipment. Results are expressed as number (%). The Chi-square test was used for statistical analysis.

There was also a statistically significant improvement with respect to the specific recommendations for the tracheobronchial aspiration technique, including

the following: precaution when opening the catheter packaging; the use of a sterile glove on the dominant hand to remove the catheter; taking care to maintain the sterile gloves in contact only with the catheter; the execution of circular movements during the removal of the catheter; wrapping the catheter with the sterile glove after the procedure; and the use of distilled water to wash the connection latex, which is opened at the beginning and discarded at the end of the procedure (Table 3).

Table 3 - Adherence to specific recommendations for the tracheobronchial aspiration technique

| | Pre-intervention (N=124) | Post-intervention (N=124) | p value |
|---|-----------------------------|------------------------------|---------|
| Latex protected | 105 (84.7) | 112 (90.3) | <0.05 |
| Catheter handling | 84 (67.7) | 120 (96.8) | <0.001 |
| Use of sterile gloves | 99 (79.8) | 115 (92.7) | <0.01 |
| Contact with the catheter | 66 (53.2) | 97 (78.2) | <0.001 |
| Catheter insertion with the vacuum off | 34 (27.4) | 51 (41.1) | <0.05 |
| Length of aspiration: 15 seconds maximum | 47 (37.9) | 65 (52.4) | <0.05 |
| Execution of circular movements | 18 (14.5) | 56 (45.2) | <0.001 |
| 10 mL of water for the aspiration | 70 (56.5) | 64 (51.6) | NS |
| 10 mL of water disposed post-aspiration | 118 (95.2) | 119 (96.0) | NS |
| Catheter wrapped in sterile glove post-aspiration | 79 (63.7) | 100 (80.6) | <0.01 |
| Previously open water for washing the latex | 77 (62.1) | 99 (79.8) | <0.01 |
| Washing the latex after each aspiration | 66 (53.2) | 77 (62.1) | NS |
| Disposal of the water used for washing the latex | 87 (70.2) | 109 (87.9) | <0.001 |

NS - not significant. Results are expressed as number (%). The Chi-square test was used for statistical analysis.

When evaluating the execution of the aspiration technique and considering a set of procedures (the explanation of the procedure to the patient, the use of sterile gloves in the dominant hand, the contact of only the aspiration catheter with the sterile gloves, the catheter insertion with the vacuum pump turned off, a maximum length of the procedure within 15 seconds and the execution of circular movements during catheter removal), the correct application of the technique increased from 0.8% in the pre- to 14.5% in the post-educational intervention group of procedures ($p < 0.001$) (Figure 1).

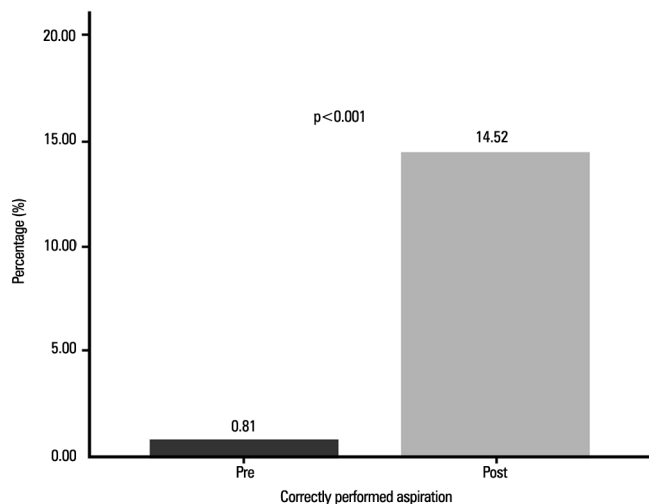


Figure 1 - Tracheobronchial aspiration technique, considering the set of procedures (explaining the procedure to the patient; the use of sterile gloves in the dominant hand; contacting the aspiration catheter with sterile gloves only; the catheter insertion with the vacuum pump turned off; maximum length of procedure of 15 seconds; and execution of circular movements during removal of the catheter).

DISCUSSION

The evaluation of 124 tracheobronchial aspiration procedures in the present study indicated that prior adherence to the CDC recommendations and global guidelines for the tracheobronchial aspiration technique^(5,18) was lower than expected, and the applied educational intervention could improve adherence to these recommendations in a number of items of the technique.

The nursing technician was the professional who performed the aspiration procedure most often. This finding was expected because mid-level professionals perform most of the actions of direct patient care.⁽¹⁹⁾

Prior to implementing the intervention, poor professional adherence with respect to the assessment of vital signs pre- and post-procedure, hand hygiene pre- and post-procedure, the explanation of the aspiration procedure to the patient, pre-oxygenation of the patient, the attention to latex protection for the catheter connection, the insertion of the catheter with the vacuum pump turned off, the length of the procedure, the use of distilled water (that was opened at the time of the procedure and discarded at the end) to fluidize secretions and the use of water to wash the probe after each aspiration procedure was observed - all of these items are recommended by the CDC and by global guidelines on the tracheobronchial aspiration technique.^(5,18)

The importance of patient care is widely known, considering the potential risks of the procedure to the

patient. It is important to check the increase in heart and respiratory rates as well as the reduction in the saturation of peripheral oxygen (SpO_2) during the procedure.⁽¹⁸⁾ In the present study, the frequency of the assessment of vital signs, before and after the tracheobronchial aspiration procedure, increased after the educational intervention, although not significantly.

Regarding explaining the procedure to the patient, a small improvement was observed. Such explanation is aimed at encouraging the patient to participate in his/her treatment, reducing stress and anxiety levels.^(13,18)

The literature recommends pre-oxygenation to prevent hypoxia before, during and after the tracheobronchial aspiration procedure.^(11,18,20,21) The results from the present study revealed that the healthcare professionals did not include pre-oxygenation in their work routine, even during the post-intervention observation. These findings are consistent with those from another study, in which the fraction of inspired oxygen (FiO_2) should be doubled or increased to 100% in the pre-oxygenation of the patient; however, the authors observed that this procedure was not performed in 88.62% of cases.⁽²²⁾

Although the hands are the primary cause of nosocomial infection,^(23,24) studies have found low adherence to hand hygiene. The main reasons for this include high costs, irritability and toxicity of the cleaning product and the time spent for such a practice, which lasts approximately 60 seconds.^(13,25-27) In addition, many healthcare professionals believe that the use of gloves creates a barrier against infection, which is a misconception.^(12,18,28,29)

The professional care recommended by the CDC that is globally accepted includes the following: the use of gloves whenever there is contact with secretions; the use of protective masks and goggles when performing procedures with the possibility of splashing body fluids (such as secretions or blood) in the oral, nasal or ocular mucosae of the professionals; and the use of medical gowns during procedures where there is the possibility of contact with biological material.^(5,18) The improper use or failure to adhere to these recommendations may result in accidents and cross contamination, leading the occurrence of work-related accidents.^(9,30-33) However, in daily hospital practice, numerous professionals seem to ignore the relevance of following the recommended precautions.⁽³⁴⁾

Studies reveal alarming data regarding the use of PPE: only 40% of healthcare professionals were using such equipment at the time of work-related accidents.^(35,36) The results of this study are consistent with these data; however, the results indicated improvement post-intervention.

The present study observed post-intervention improvements in care during aspiration, as recommended in the literature, such as the protection of the latex with dry and clean packaging, opening the package with caution, handling the catheter aseptically and the use of sterile gloves to maintain asepsis and to reduce nosocomial infection rates.^(12,18)

The literature recommends that the aspiration should be stopped during insertion of the catheter and restarted only when the catheter tip reaches the site to be aspirated to reduce the likelihood of injury to the mucosa of the respiratory tract, thereby making the insertion of the catheter easier.^(18,20) Likewise, the literature recommends that the length of the aspiration, from the time of the insertion of the catheter into the trachea to the end of the procedure, should be no longer than 15 seconds at maximum, always taking into consideration the tolerance of the patient.^(10,18,20,21,37) In the present study, there was an improvement in this item after the educational intervention, as well as good adherence to the instruction of executing a circular motion while the catheter is removed from the airway. This method facilitates the removal of secretions and prevents micro-lesions in the mucosa.⁽²⁰⁾

Several studies do not recommend the instillation of 0.9% saline solution (SS) to fluidize the secretions because most of the SS (approximately 80%) remains in the trachea and bronchi after the procedure.⁽²⁰⁾ However, the instillation of SS or distilled water is often used in many hospitals, especially when thick secretions are observed prior to respiratory physical therapy^(16,17) and also to stimulate coughing.⁽¹¹⁾ In the present study, 10 mL of distilled water was used routinely to fluidize secretions in over 50% of the cases.

In MV patients, the literature recommends the use of both open and closed aspiration systems; however, the open aspiration system was used in the present study because it has been shown to be more effective in removing airway secretions⁽³⁸⁻⁴⁰⁾ and aims to reduce the incidence of VAP in the same way as the closed aspiration system,^(41,42) although it may have a greater impact on changes in cardiorespiratory parameters, such as a reduced arterial oxygen pressure and elevated arterial carbon dioxide pressure up to 15 minutes after the procedure.⁽⁴⁰⁾

The educational intervention improved professional adherence regarding the proper handling of the catheter after the aspiration procedure.

The present educational intervention, in addition to being simple and quickly developed, had significant results that included the improved adherence to standard precautions by professionals in relation to hand hygiene, the use of PPE and the recommendations for tracheobronchial aspiration.

Educational programs bring improvements to the technique and have a positive influence, at least for a short period of time. The CDC recommends the adoption of basic measures to reduce nosocomial infections, such as the implementation of strategies for the continuing education of healthcare professionals based on standardized educational methods.^(5,43-45) Although educational programs are important to maintain a standard of quality, these programs have not yet been thoroughly studied and implemented. Therefore, educational programs must be disseminated effectively and regularly implemented.⁽⁴⁶⁾

The main limitations of the present study include the following: the inadequate characterization of patients; the lack of evaluation of clinical outcomes because increased adherence in itself does not provide any benefit to the patient, although it may potentially reduce the incidence of VAP; a relatively small number of observations of the aspiration procedure; conducting the study in only one ICU; carrying out only one educational intervention and only one post-intervention observation in a short period of time.

The results of the present study suggest the need for broader studies with repeated interventions and assessments that utilize different strategies of practical and theoretical educational interventions and have a longer follow-up after intervention.

CONCLUSION

The results indicate that the tracheobronchial aspiration technique in an intensive care unit improved in several aspects after the educational intervention. However, the technique still has room for improvements. The low adherence of healthcare professionals to measures that prevent nosocomial infections suggests the need for the application of educational strategies. Even a simple educational intervention had a positive effect, at least in a short follow-up period, and improved adherence to proper aspiration techniques. However, new studies with educational interventions are required to standardize and disseminate the recommendations for the tracheobronchial aspiration technique to improve the application of the measures regarding the prevention of complications and to provide well-being and comfort to the patient during the procedure.

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RESUMO

Objetivo: Avaliar a efetividade de uma intervenção educacional na adesão dos profissionais da saúde às recomendações técnicas de aspiração traqueobrônquica em pacientes internados na unidade de terapia intensiva.

Métodos: Estudo quasi-experimental, com avaliação da adesão dos profissionais da unidade de terapia intensiva às recomendações da técnica de aspiração traqueobrônquica, em pacientes internados na unidade de terapia intensiva, antes e após uma intervenção educacional teórico-prática. As comparações foram feitas com teste do qui-quadrado e foi utilizado o nível de significância de $p < 0,05$.

Resultados: Foram observados 124 procedimentos, pré e pós-intervenção. Verificou-se aumento da adesão em: utilização de equipamento para proteção individual ($p = 0,01$), cuidado com a abertura da embalagem do cateter ($p < 0,001$), uso de luva estéril

na mão dominante para retirada do cateter ($p = 0,003$), contato da luva estéril apenas com o cateter ($p < 0,001$), realização de movimentos circulares durante a retirada do cateter ($p < 0,001$), cateter envolto na luva estéril no final do procedimento ($p = 0,003$), utilização de água destilada, aberta no início do procedimento, para lavagem do látex de conexão ($p = 0,002$), descarte do restante do conteúdo de água destilada ao final do procedimento ($p < 0,001$) e realização do conjunto dos procedimentos da técnica de aspiração ($p < 0,001$).

Conclusão: Houve baixa adesão dos profissionais de saúde às medidas preventivas de infecção hospitalar, indicando a necessidade de implantação de estratégias educativas. A intervenção educativa utilizada mostrou-se efetiva para melhorar a adesão às recomendações da técnica de aspiração traqueobrônquica.

Descritores: Unidades de terapia intensiva; Assistência ao paciente; Sucção; Educação; Capacitação; Precaução; Aspiração respiratória

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