Nursing outcome “airway permeability” in postoperative patients

Resultado de enfermagem “permeabilidade das vias aéreas” em pacientes no pós-operatório

Resultado de enfermería “permeabilidad de las vías aéreas” en pacientes en el posoperatorio

ABSTRACT

Objectives: to evaluate the evolution of clinical indicators that characterize airway permeability in patients in the postoperative period of thoracoabdominal surgeries and to analyze their relationship with the occurrence of the diagnosis “ineffective airway clearance”. Methods: descriptive, quantitative, longitudinal research with 60 patients who were followed for five consecutive days. Eleven indicators of the nursing outcome “respiratory status: airway permeability” were used. Results: on the first day of evaluation, the most compromised indicators were: respiratory rate, cough, depth of breath and use of accessory muscles. During follow-up, most of the indicators presented a slight deviation from normal variation and, in the last evaluation, there was a predominance of indicators with some degree of impairment. Conclusions: with the aid of the Nursing Outcomes Classification, it was observed that patients submitted to thoracoabdominal surgeries may present compromised airway permeability even days after surgery.

Descriptors: Respiratory System; Post-Operative Period; Post-Operative Care; Nursing Evaluation; Medical-Surgical Nursing.

RESUMEN

Objetivos: evaluar la evolución de los indicadores clínicos que caracterizan a permeabilidad de las vías aéreas en pacientes no pós-operatorio de cirugías toracoabdominales e analizar su relación con la ocurrencia del diagnóstico “desobstrucción ineficaz de las vías aéreas”. Métodos: pesquisa descritiva, quantitativa, longitudinal realizada com 60 pacientes que foram acompanhados por cinco dias consecutivos. Foram utilizados 11 indicadores do resultado de enfermagem “estado respiratório: permeabilidade das vias aéreas”. Resultados: no primeiro dia de avaliação os indicadores mais comprometidos foram: frequência respiratória, tosse, profundidade da respiração e uso de músculos acessórios. Durante o acompanhamento, verificou-se que a maior parte dos indicadores apresentou desvio leve da variação normal e, na última avaliação, houve predominio de indicadores com algum grau de comprometimento. Conclusões: com auxílio da Clasificación de los resultados de enfermería, observó-se que pacientes sometidos a cirurgias toracoabdominales poden apresentar comprometimento da permeabilidad de las vías aéreas mesmo após dias da realização do procedimento cirúrgico.

Descripciones: Sistema Respiratorio; Período Pós-Operatorio; Cuidados Pós-Operatórios; Avaliação em Enfermagem; Enfermagem Médico-Cirúrgica.

RESUMEN

Objetivos: valorar la evolución de los indicadores clínicos que caracterizan a permeabilidad de las vías aéreas en pacientes en el posoperatorio de cirugías toracoabdominales y evaluar su relación con la ocurrencia del diagnóstico “desobstrucción ineficaz de las vías aéreas”. Métodos: investigación descriptiva, cuantitativa, longitudinal en la cual participaron 60 pacientes que recibieron seguimiento por cinco días. Se utilizaron 11 indicadores del resultado de enfermería “estado respiratorio: permeabilidad de las vías aéreas”. Resultados: en el primer día de evaluación, los indicadores más comprometidos fueron: frecuencia respiratoria, tos, profundidad de la respiración y utilización de músculos accesorios. Durante el seguimiento, se verificó que la mayor parte de los indicadores presentó una leve desviación de la variación normal y, en la última evaluación, hubo un predominio de indicadores con algún grado de comprometimiento. Conclusiones: con la ayuda de la Clasificación de los resultados de enfermería, se observó que los pacientes sometidos a cirugías toracoabdominales pueden presentar comprometimiento de la permeabilidad de las vías aéreas incluso después de algunos días de realizar el procedimiento quirúrgico.

Descripciones: Sistema Respiratorio; Período Pos-operatorio; Cuidados Pos-operatorios; Evaluación en Enfermería; Enfermería Médico-Cirúrgica.
INTRODUCTION

The postoperative period (PO) represents a critical phase in which the patient needs complex care, with a focus on the prevention and detection of complications from the anesthetic and surgical procedures, aimed at a safe recovery\(^\text{11}\). This criticality is due to physiological alterations resulting from the surgical process, mainly those of respiratory origin, especially when the procedure is performed in the thoracic and upper abdominal regions, since this type of surgery interferes directly with pulmonary mechanics, leading to ventilatory disorders\(^\text{2-3}\).

The changes that occur in pulmonary physiology can result in respiratory complications in the postoperative period, evidenced as one of the main problems that affect patients submitted to thoracoabdominal procedures\(^\text{8}\). The literature indicates that pulmonary complications affect approximately 10\(^\%\) to 40\(^\%\) of these patients, and the values vary according to the presence of risk factors\(^\text{5}\). Therefore, because the surgical act is an agent that causes respiratory physiological changes, it is considered important to adopt strategies that aim at the reestablishment of the pulmonary function as a way to prevent respiratory complications postoperatively.

One strategy that can be used to improve the effectiveness of care is the systematization of nursing care, which can be implemented through the application of the nursing process\(^\text{8}\). From among its stages, we highlight the identification of nursing diagnoses, which serves as a basis for directing nursing interventions and assessing the care implemented\(^\text{7}\).

NANDA International, Inc. (NANDA-I) is one of the most widespread nursing diagnosis classification systems in the world and allows qualifying care and providing visibility to nursing work\(^\text{8}\). This system is linked to two other taxonomies, the Nursing Interventions Classification (NIC), which groups interventions and nursing activities, and the Nursing Outcomes Classification (NOC), which evaluates nursing outcomes. These terminologies complement each other and are used in the stages of the nursing process, providing a standardized language and consistency in care delivery\(^\text{8}\).

NOC can be used by nursing professionals to monitor and supervise the care implemented to ensure quality patient care\(^\text{10}\). Its use facilitates the identification of changes in the actual or potential health of the person, family or community by the variation of a score throughout the period of care, which makes it possible to monitor the improvement, worsening or stagnation of the patient's state through the actions of nursing performed\(^\text{11}\).

In the implementation of the nursing process, the results are closely linked to NANDA-I nursing diagnoses. The link between NANDA-I and NOC taxonomies suggests a relationship between the problems identified as real or potential in the patient and the responses that are expected to be achieved through care actions\(^\text{12}\). Thus, the NOC taxonomy can be used in conjunction with NANDA-I diagnoses in nursing care planning so that the process of caring for the patients in the postoperative period is based on their needs.

Some conditions associated with the postoperative period of thoracic and upper abdominal surgeries may interfere with the patient's ability to maintain the airway unobstructed and these situations favor the occurrence of nursing diagnoses related to the respiratory system, among which the diagnosis "ineffective airway clearance" (IAC)\(^\text{13}\). As a way of assessing the individual's compromise and health status in the presence of IAC, NOC can be used, which presents as a suggested result "respiratory status: airway permeability"\(^\text{14-15}\).

In view of the above, we emphasize the importance of seeking strategies that help in the assessment of the individuals' health status, through the relationship between nursing diagnosis and evaluation of outcomes and indicators, so that the care process is directed to their real needs and, in the case of patients submitted to thoracoabdominal procedures, actions to restore pulmonary function.

OBJECTIVES

To evaluate the evolution of the clinical indicators that characterize airway permeability in patients in the postoperative period of thoracoabdominal surgeries and to analyze the relationship with the occurrence of the diagnosis "ineffective airway clearance".

METHODS

Ethical aspects

The present study was approved by the Ethics Committee for Research with Human Beings of the Federal University of Maranhão (UFMA).

Design, sample and inclusion and exclusion criteria

This is a descriptive, longitudinally designed research with a quantitative approach performed with 60 patients in the postoperative period, who were evaluated for a period of five consecutive days.

The sample consisted of patients of both sexes, over the age of 18 years, who were in the first 48 hours following thoracic and/or upper abdominal surgeries and who were followed up for five consecutive days. The established exclusion criteria were: having an unstable clinical condition or alteration in the level of consciousness precluding active participation in the interview, be using a nasogastric tube, nasoenteral catheter and/or tracheostomy at the time of evaluation, and not completing the five evaluations.

Study Protocol

Data were collected from March to September 2016, through an interview and physical examination performed by members of a research project aimed at assisting patients in the postoperative period of thoracic and upper abdominal surgeries. Before starting to collect data, the participants took part in a 30-hour workshop that addressed the following topics: review of propaedeutic methods inherent to respiratory assessment, respiratory system physiology, postoperative respiratory complications, handling of collection equipment (such as pulse oximeter and stethoscope), and approach to administration of the data collection instrument.

To assist in data collection, we developed an instrument that covered pertinent data about the pulmonary evaluation related to the IAC diagnosis and the nursing result “respiratory status: airway permeability”\(^\text{14-15}\). Regarding the latter, we point out that in this study, other nursing diagnoses that supported the need for follow-up were not defined.
Eleven indicators were used in the nursing outcome in question, which is composed of a five-point Likert scale and is classified as follows: 1 – Severe deviation from normal variation; 2 – Substantial deviation from normal variation; 3 – Moderate deviation from normal variation; 4 – Mild deviation from normal variation; and 5 – No deviation from normal variation. From the bibliographic review, conceptual and operational definitions were developed for each indicator in order to establish what the variations from 1 to 5 represented in clinical practice. These definitions were evaluated by members of a research group that studies nursing taxonomies and the participants made their observations on their clarity and applicability. Suggestions considered pertinent were adopted and contributed to the final version of the definitions.

For inference of the IAC nursing diagnosis, the collected information was e-mailed to an experienced nurse with more than five years of clinical practice in post-surgical care, and also in the development and publication of research on nursing taxonomies. It should be emphasized that he participated only in this stage of the study.

Analysis of results and statistics

The data were organized in Excel spreadsheets (2010) and analyzed with the Statistical Package for Social Sciences (SPSS), version 24.0 for MacOS®. For the univariate descriptive analysis, absolute frequency, percentage, central tendency and dispersion measures were considered. In order to verify if the numerical variables had a normal distribution, the Kolmogorov-Smirnov test was applied. In the analysis of non-normal numerical variables, the Mann-Whitney and Kruskal-Wallis tests were used. The Wilcoxon test was used to compare the difference in the values of the indicators between the first and fifth evaluation. The level of significance adopted was \( p < 0.05 \).

RESULTS

The obtained result showed that the majority of the sample was male (88.3%), single (51.7%), with mean age of 35.64 years (± 11.52). The prevalent surgical procedures were exploratory laparotomy (56.7%) and chest drainage (31.7%). The main reasons leading to surgeries included gunshot wound (25.9%) and knife wound (18.5%). Regarding the type of anesthesia used, 56.9% of the cases had locoregional anesthesia and 43.1% general anesthesia.

The frequency values obtained for the Likert scores of each indicator showed that, overall, there was an improvement in the degree of compromise along evaluations. By analyzing the degree of compromise on the first day, i.e., indicators scoring between 1 and 4 on the scale, we found that the sum of percentage values showed that the indicators “respiratory rate” (100%), “cough” (76.9%), “depth of breath” (48.2%) and “use of accessory muscles” (44.1%) were the most affected. Between the first and last evaluation, “effort dyspnea” showed the highest percentage of severe deviation from the normal range (score 1), corresponding to 16.7% in the first evaluation and 8.3% in the fifth (Table 1).

The analysis of each indicator’s mean showed that in the first evaluation, the majority presented some degree of impairment, with “cough” (3.65 ± 1.16) and “expel secretions” (3.46 ± 1.98) showing the lowest values. During the follow-up period, the indicators’ means were generally between 4 and 5 on the Likert scale, corresponding to a slight deviation from normal variation (Table 2).

An additional analysis performed to compare the values obtained in the first and fifth evaluations showed that there was a statistically significant increase in the indicators “pulmonary secretion accumulation” and “expel secretions” (\( p = 0.019 \) and \( p = 0.014 \), respectively), according to the Wilcoxon test.

An analysis of the relationship between nursing outcome indicators and IAC diagnosis identified that patients with said diagnosis had a greater tendency to present lower scores for the indicators Pulmonary secretion accumulation (134.81 vs. 165.80), Respiratory rate (141.79 vs. 160.59), Depth of breath (140.47 vs. 158.83), Adventitious respiratory sounds (127.06 vs. 174.63) and Cough (67.40 vs. 81.89) (Table 3).

The data in Table 4 indicate that patients who underwent thoracic surgery had a greater tendency to show alterations in the indicators “effort dyspnea” (139.00 vs. 169.50 vs. 150.26), “respiratory rate” (127, 19 vs. 168.84 vs. 157.63), “adventitious respiratory sounds” (132.49 vs. 173.30 vs. 151.29) and “expel secretions” (51.09 vs. 66.00 vs. 59.51).

Table 1 – Frequency of indicators of nursing outcome “respiratory status: airway permeability” in postoperative patients of thoracic and upper abdominal surgeries, Imperatriz, Maranhão, Brazil, 2016

| Indicators                              | Score | 1st EV N % | 2nd EV N % | 3rd EV N % | 4th EV N % | 5th EV N % |
|-----------------------------------------|-------|------------|------------|------------|------------|------------|
| Pulmonary secretion accumulation        | 1     | 1-1.7      | 1-1.7      | 2-3.4      | 3-4.6      | 4-5.8      |
|                                         | 2     | 2-3.4      | 1-1.7      | 1-1.7      | 1-1.7      | 1-1.7      |
|                                         | 3     | 6-4.6      | 6-4.6      | 6-4.6      | 6-4.6      | 6-4.6      |
|                                         | 4     | 6.8-5.8    | 6.8-5.8    | 6.8-5.8    | 6.8-5.8    | 6.8-5.8    |
|                                         | 5     | 8.3-6      | 8.3-6      | 8.3-6      | 8.3-6      | 8.3-6      |
| Effort dyspnea                          | 1     | 16.6-10    | 16.6-10    | 16.6-10    | 16.6-10    | 16.6-10    |
|                                         | 2     | 4.7-2      | 4.7-2      | 4.7-2      | 4.7-2      | 4.7-2      |
|                                         | 3     | 6.7-1.7    | 6.7-1.7    | 6.7-1.7    | 6.7-1.7    | 6.7-1.7    |
|                                         | 4     | 6.7-1.7    | 6.7-1.7    | 6.7-1.7    | 6.7-1.7    | 6.7-1.7    |
|                                         | 5     | 8.3-5.8    | 8.3-5.8    | 8.3-5.8    | 8.3-5.8    | 8.3-5.8    |
| Rest dyspnea                            | 1     | 3.3-2      | 3.3-2      | 3.3-2      | 3.3-2      | 3.3-2      |
|                                         | 2     | 3.3-2      | 3.3-2      | 3.3-2      | 3.3-2      | 3.3-2      |
|                                         | 3     | 1.7-1      | 1.7-1      | 1.7-1      | 1.7-1      | 1.7-1      |
|                                         | 4     | 1.7-1      | 1.7-1      | 1.7-1      | 1.7-1      | 1.7-1      |
|                                         | 5     | 1.7-1      | 1.7-1      | 1.7-1      | 1.7-1      | 1.7-1      |
| Expel secretions                        | 1     | 38.5-10    | 38.5-10    | 38.5-10    | 38.5-10    | 38.5-10    |
|                                         | 2     | 8.3-2      | 8.3-2      | 8.3-2      | 8.3-2      | 8.3-2      |
|                                         | 3     | 5.0-1      | 5.0-1      | 5.0-1      | 5.0-1      | 5.0-1      |
|                                         | 4     | 5.0-1      | 5.0-1      | 5.0-1      | 5.0-1      | 5.0-1      |
|                                         | 5     | 19.10      | 19.10      | 19.10      | 19.10      | 19.10      |

To be continued
**DISCUSSION**

Respiratory changes that occur in the postoperative period can result in severe complications, affecting about 25-50% of patients undergoing major surgical procedures. The literature indicates that the surgical site is the most important factor for determination of postoperative pulmonary complications (POPC), which occur in 10-40% of the cases of patients whose surgical incision is in the upper abdomen or in the thorax\(^5\). A study\(^6\) that investigated the occurrence of POPC identified that thoracic (28.9%), cardiac (28%) and upper abdominal (24.3%) surgery had the highest complication rates in the postoperative period.

In addition to the surgical procedure itself, pain and anesthesia affect the thoracic dynamics and compromise ventilation and the respiratory pattern, making it shallow. These factors, together with diaphragmatic dysfunction, result in alveolar hypventilation, reduced ventilatory response and hypoxemia. The physiological and mechanical alterations add up, compromising pulmonary function and decreasing respiratory muscle strength, which may hinder the maintenance of unobstructed airways\(^7\).

In this study, the NOC taxonomy was used as a strategy to evaluate and monitor the evolution of indicators that characterize airway permeability in postoperative patients. Regarding the analysis of the indicators of the nursing outcome "respiratory state: airway permeability", the most affected in the first evaluation were respiratory rate, cough, depth of breath and use of accessory muscles.

The alteration in the "respiratory rate" indicator can be justified by abdominal rigidity and diagrammatic dysfunction occurring in the postoperative period, altering ventilatory mechanics and conferring restrictive characteristics, with a reduction in vital capacity and tidal volume. As a way to compensate for lower ventilatory efficacy, carbon dioxide retention and lower tidal volume, respiratory rate increases\(^8\).

This result corroborates research\(^9\) performed with patients submitted to exploratory laparotomy who identified a significant increase in respiratory rate in the initial hours of the postoperative period. It should be noted that high values of respiratory rate contribute to an increase in respiratory work, since ventilation tends to be greater in places where airway resistance is smaller\(^10\).
In this regard, studies indicate that the action of anesthetic drugs and because of a higher degree of impairment (score of 3.65). In presented alteration in 76.9% of the patients in the first evaluation muscles(20), which corroborates the results of the present study. The body recruits accessory muscles to contribute to this increase in pressure, the mechanisms of compensation of respiratory function are triggered, including increases in pulmonary ventilation to overcome deficiency in gas diffusion, by increasing the frequency and depth of breath, and also by triggering the accessory muscles of respiration. Referring to the impairment presented by the indicator “use of accessory muscles”, factors such as anesthesia, bed rest, phrenic nerve dysfunction, surgical trauma and pain interfere with the act of coughing and compromise its effectiveness, since anesthesia depresses the cough reflex and pain reduces the amount of deep inspirations due to the surgical procedure(21). Regarding this, a postoperative study of cardiac surgeries found that, when coughing, the patients presented pain of greater intensity(22). This fact may increase the patient’s fear of coughing, which contributes to the accumulation of secretion in the respiratory tract, since coughing is a reflex action of defense designed to remove foreign substances and accumulated secretions in the bronchial tree(23).

Since cough is associated with a secretion-eliminating mechanism, when it is altered, the individual’s ability to expel secretions is therefore also impaired. Considering the above, we believed that this may explain that both the “expel secretions” and “cough” indicators presented the highest degree of impairment in the first evaluation. Postoperatively, ineffective defense mechanisms, such as coughing, and changes in the pulmonary ventilation mechanism culminate in the installation of pulmonary areas with secretion retention, and this accumulation leads to postoperative pulmonary infections(24). Therefore, nursing should evaluate the patient’s ability to expel secretion and plan care that prevents this accumulation in the lungs as a strategy to prevent aggravations.

“Effort dyspnea” was the indicator with the highest percentage of severe deviation from the normal range (score 1). Dyspnea is defined as respiratory distress that can be caused by the presence of secretion in the alveolo-capillary membrane. In this situation, the organism triggers responses such as increased pulmonary ventilation to overcome deficiency in gas diffusion, by increasing the frequency and depth of breath, and also by triggering the accessory muscles of respiration. Thus, after these mechanisms of compensation of respiratory function are triggered, the individual presents a sensation of respiratory discomfort and such signs are representative of this respiratory difficulty(25). Effort dyspnea occurs in the face of the onset or aggravation of the dyspnea sensation through normal physical exertion.

An analysis of the indicators during the follow-up period of the sample verified some degree of change until the fifth day of evaluation, when the values obtained were between four and five on the Likert scale, which corresponds to a slight deviation from normal variation. Corroborating this study, research(26,27) that accompanied patients in the postoperative period during the entire hospital stay or for a minimum period of ten postoperative days indicated that the impairment in pulmonary function was maintained throughout the evaluated period.

Postoperatively, the peak of diaphragmatic dysfunction occurs in the period between two and eight hours after surgery, returning to preoperative values in roughly seven to ten days(28). A study that

Table 3 - Test to verify the relationship between the diagnosis “ineffective airway clearance” and indicators of the nursing outcome “respiratory state: airway permeability” in postoperative patients of thoracic and upper abdominal surgeries, Imperatriz, Maranhão, Brazil, 2016

| Indicators                                | Nursing diagnosis | p value** |
|-------------------------------------------|-------------------|-----------|
|                                          | Present*          | Absent*   |           |
| Pulmonary secretion accumulation          | 134.81            | 165.80    | <0.001    |
| Effort dyspnea                            | 147.11            | 152.31    | 0.380     |
| Rest dyspnea                              | 149.19            | 149.86    | 0.870     |
| Expel secretions                          | 54.78             | 61.99     | 0.068     |
| Respiratory rate                          | 141.79            | 160.59    | 0.036     |
| Nose wings movement                       | 149.64            | 150.42    | 0.655     |
| Depth of breath                           | 140.47            | 158.83    | 0.035     |
| Respiratory rhythm                        | 144.79            | 154.96    | 0.052     |
| Adventitious respiratory sounds           | 127.06            | 174.63    | <0.001    |
| Cough                                     | 67.40             | 81.89     | 0.022     |
| Use of accessory muscles                  | 141.80            | 155.15    | 0.109     |

Note: *Mean ranks; **Kruskal-Wallis test.

Table 4 – Tests to verify the difference between type of surgery and indicators of the nursing outcome “respiratory state: airway permeability”. Imperatriz, Maranhão, Brazil, 2016

| Indicators                                | Type of surgery   | p value** |
|-------------------------------------------|-------------------|-----------|
|                                          | Thoracic          | Abdominal*| Thoracoabdominal*| |
| Pulmonary secretion accumulation          | 145.41            | 166.45    | 146.82           | 0.078 |
| Effort dyspnea                            | 139.00            | 169.50    | 150.26           | 0.009 |
| Rest dyspnea                              | 147.75            | 154.76    | 149.21           | 0.592 |
| Expel secretions                          | 51.09             | 66.00     | 59.51            | 0.034 |
| Respiratory rate                          | 127.19            | 168.84    | 157.63           | 0.003 |
| Moving the wings of the nose              | 151.50            | 147.76    | 149.78           | 0.408 |
| Depth of breath                           | 133.86            | 165.41    | 152.67           | 0.055 |
| Respiratory rhythm                        | 145.29            | 156.88    | 149.86           | 0.400 |
| Adventitious respiratory sounds           | 132.49            | 173.30    | 151.29           | 0.003 |
| Cough                                     | 68.44             | 79.75     | 74.73            | 0.495 |
| Use of accessory muscles                  | 143.66            | 149.96    | 149.71           | 0.802 |

Note: *Mean ranks; **Mann-Whitney test.
evaluated the behavior of pulmonary function and respiratory muscle strength in patients submitted to elective thoracotomies showed that forced vital capacity and forced expiratory volume in the first second only returned to preoperative values between days 15 and 30 and 10 and 15, respectively(13). Therefore, it can be inferred that the changes in respiratory function associated with the surgical procedure are maintained for a longer period than the one evaluated in this study, which was five days. This data may explain the fact that, except for “nose wings movement” and “expel secretions”, the other indicators showed some degree of impairment in the fifth evaluation.

As mentioned above, procedures performed in the thoracic and upper abdominal regions compromise respiratory function and some conditions, such as positioning, immobility in bed, pain, secretion accumulation, and others, and favor the appearance of human responses that affect the maintenance of unobstructed airways(13). This could explain the occurrence of the nursing diagnosis IAC in this sample.

Therefore, an analysis was performed to verify the relationship between the indicators studied and the IAC diagnosis. The data showed a tendency of patients with this diagnosis to score lower in the indicators “pulmonary secretion accumulation”, “respiratory rate”, “depth of breath”, “adventitious respiratory sounds” and “cough” in the NOC scale. This result is expected, since such indicators are directly associated with impairment of airway permeability. Postoperatively, vital capacity and functional residual capacity are reduced and these changes may lead to the early closure of the airways of some portions of the lungs. As a consequence, imbalance of the ventilation-perfusion relationship, hypoxemia and secretion retention(16) may occur, which could explain the alterations in said indicators.

The analysis of the relationship between indicators and type of surgery showed that the patients in this study who underwent thoracic surgery had a greater tendency to show changes in the indicators “effort dyspnea”, “respiratory rate”, “adventitious respiratory sounds”, and “expel secretions”. Patients undergoing thoracic surgeries have a significant reduction in lung volumes and capacities, as well as in respiratory muscle strength in the postoperative period, which may have caused the alterations in said indicators(13).

Surgery with incisions near the diaphragm, such as thoracic and upper abdominal ones, are associated with an increased risk of complications, but a study that evaluated the predictors of postoperative pulmonary complications pointed thoracic surgery as a factor that increases the chance of these complications(16). The reduction in pulmonary function that occurs in the postoperative period of thoracotomies may be associated with changes in the ventilatory pattern, retention of carbon dioxide, reduction of oxygen arterial pressure and impairment of pulmonary defense mechanisms, and may evolve to respiratory complications when there is deviation of the expected result for the surgical procedure(26).

**Limitations of the study**

As a limiting factor we highlight the shortage of studies with a similar methodology to ours, especially with the application of NOC in clinical practice in postoperative patients of thoracic and upper abdominal surgeries, which made it difficult to compare results. In view of this, we recommend that further research should be carried out using NOC in different practical scenarios and with postoperative patients for a subsequent comparison of results. Another limitation to be pointed out is the reduced size of the sample, since the study was performed in only one hospital unit where many patients were discharged before completing the five evaluations, which restricted the sample size and also the time set for follow-up evaluation of the patients that could influence the results.

**Contributions to the health area**

By using the indicators contained in the nursing outcomes, the nurse can detect and establish the degree of impairment of clinical signs related to airway permeability presented by the patient, which, together with other parameters, will enable early diagnosis of acute respiratory failure, which constitutes an important condition for patient recovery in the postoperative period. Thus, we highlight the importance of the continuity of the nursing care implemented and the use of standardized taxonomies, such as NOC, which allow uniformity of evaluation and resolution of the health problems manifested by the patient.

**CONCLUSIONS**

From the results, it was verified that there are clinical indicators associated with the evaluation of airway permeability that present a greater degree of impairment in the first 48 postoperative hours of surgeries performed in the thoracic and/or abdominal regions to the detriment of others, namely: respiratory rate, cough, depth of breath and use of accessory muscles. However, it is important to note that even five days after the surgical procedure, it was still possible to observe impairment in some indicators, but to a lesser degree. This data reinforces the importance of performing a careful evaluation of the patient, not only in the immediate postoperative period, but also throughout the hospitalization time, to identify possible complications early.

Another point to be highlighted is that the IAC diagnosis was associated with a greater impairment in the indicators “pulmonary secretion accumulation”, “respiratory rate”, “depth of breath”, “adventitious respiratory sounds” and “cough”. In addition, the site of surgical incision also influenced in the impairment of some indicators, since patients undergoing thoracic surgery alone had a greater tendency to manifest changes in “effort dyspnea”, “respiratory rate”, “adventitious respiratory sounds”, and “expel secretions”.

In view of the above, it can be noted that NOC is an important tool for evaluating the individual’s health status, since in this study it was possible to determine compromised airway permeability in postoperative patients of thoracic and upper abdominal surgeries, following the clinical evolution of these patients in the hospitalization period.

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REFERENCES

1. Carvalho IM, Silva RAR, Ferreira DKS, Nelson ARC, Duarte FHS, Prado NCC. Systematization of nursing care in mediate post-operative of cardiac surgery. Rev Pesqui: Cuid Fundam. 2016;8(4):5062-7. doi: 10.9789/2175-5361.2016.v8i4.5062-5067

2. Peixoto-Souza FS, Gallo-Silva B, Echevarria LB, Silva MAA, Pessotti E, Pazzianotto-Forí EM. Fisioterapia respiratória associada à pressão positiva nas vias aéreas na evolução pós-operatório da cirurgia bariátrica. Fisioter Pesq. 2012;19(3):204-9. doi: 10.1590/S1809-29502012000300003

3. Martínez BP, Silva JR, Silva VS, Gomes Neto M, Fargiariini Júnior LA. Influence of different body positions in vital capacity in patients on postoperative upper abdominal. Rev Bras Anestesiol. 2015;65(3):217-21. doi: 10.1016/j.bjane.2014.06.002

4. Oliveira KTS, Freitas DA, Campos TF, Borja RO, Mendonça KMP. Pressões respiratórias máximas na predição de risco pós-operatório em cirurgia cardíaca. Conscientiae Saud. 2012;11(1):119-24. doi: 10.5585/conssaude.v11n1.3250

5. Scherencz CF, Gonçalves JJ. Comparative evaluation of ventilatory function through pre and postoperative peak expiratory flow in patients submitted to elective upper abdominal surgery. Rev Col Bras Cir. 2016;43(3):165-70. doi: 10.1590/0100-699120160030007

6. Vasconcelos AC, Castro CGA, Silva DF, Sousa VJ. Frequency of nursing diagnoses in a surgical clinic. Rev RENE. 2015;16(6):826-32. doi: 10.15253/2175-6783.2015000600008

7. Herdman TH, Kamitsuru S, editors. Diagnósticos de enfermagem da NANDA: definições e classificação 2015-2017. Porto Alegre: Artmed; 2015.

8. Chaves DBR, Beltrão BA, Pascoal LM, Oliveira ARS, Silva VM, Andrade LZC, et al. Defining characteristics of the nursing diagnosis “ineffective airway clearance”. Rev Bras Enferm. 2016;69(1):92-8. doi: 10.1590/0034-7167.2016690114i

9. Silva NCM, Oliveira ARS, Carvalho EC. Knowledge produced from the outcomes of the “Nursing Outcomes Classification – NOC”: integrative review. Gaúcha Enferm. 2015;36(4):104-11. doi: 10.1590/1983-1447.2015.04.53339

10. Bitencourt GR, Santana RF, Menezes AK, Cimador F, Delvalle R. Philosophical fundamentals and concept of outcomes classification: contributions in nursing assessment. Rev Enferm UPE. 2016;10(5):4326-42. doi: 10.5205/reou.9284-81146-S1.1005sup201622

11. Moorhead S, Johnson M, Maas M, Swanson E. Classificação dos resultados de enfermagem: mensuração dos resultados em saúde. 5ª ed. Rio de Janeiro: Elsevier; 2016.

12. Canto DF, Almeida M. Nursing outcomes for ineffective breathing patterns and impaired spontaneous ventilation in intensive care. Rev Gaúcha Enferm. 2013;34(4):137-45. doi: 10.1590/S1983-14472013000400018

13. Sousa VE, Lopes MVO, Araujo TL, Rolim LL, Nascimento RV, Oliveira TF. Clinical indicators of ineffective airway clearance for patients in the cardiac postoperative period. Eur J Cardiovasc Nurs. 2013;12(2):193-200. doi: 0.1177/1474515112443931

14. Jarvis C. Exame físico e avaliação de saúde para enfermagem. 6ª ed. Rio de Janeiro: Elsevier; 2012. 880 p.

15. Potter PA, Perry AG. Fundamentos de enfermagem. 8ª ed. Rio de Janeiro: Elsevier; 2013.

16. Silva DR, Gazzana MB, Knorst MM. Valor dos achados clínicos e da avaliação funcional pulmonar pré-operatórios como preditores das complicações pulmonares pós-operatórias. Rev Assoc Med Bras. 2010;56(5):551-7. doi: 10.1590/S0104-42302010000500016

17. Medeiros AICD, Oliveira ADS, Costa SKA, Barbosa ML, Oliveira GWDS. Avaliação da função pulmonar, força muscular respiratória e qualidade de vida no pré-operatório de cirurgia cardíaca. Rev Fisioter Saúde Funcional [Internet]. 2016 [cited 2018 May 10];5(2):14-22. Available from: http://periodicos.ufc.br/fisioterapiaeaudencialfuncional/article/view/20614

18. Matos CJO, Miranda CB, Barreto Neto J, Melo VA. A influência da frequência respiratória sobre os gases sanguíneos arteriais no pós-operatório imediato de laparotomia exploradora por trauma abdominal. ASSOBRAFIR Ciênc [Internet]. 2013 [cited 2018 May 10];4(2):53-63. Available from: http://www.uel.br/revistas/uel/index.php/rebrafis/article/view/13805

19. Franco AM, Torres FCC, Simon ISL, Morales D, Rodrigues AJ. Assessment of noninvasive ventilation with two levels of positive airway pressure in patients after cardiac surgery. Rev Bras Cir Cardiovasc. 2011;26(4):582-90. doi: 10.9789/1678-9741.20110048

20. Borges-Santos E, Genz ICH, Longo AF, Hayahsi D, Gonçalves CG, Bellinetti LM, et al. Pulmonary function, respiratory muscle strength and quality of life in patients submitted to elective thoracotomies. Rev Col Bras Cir. 2012;39(1):4-9. doi: 10.1590/S0100-69912012000100003

21. Santos FDRP, Nascimento JN, Nunes SFL, Pascoal LM, Almeida AGA, Lima Neto PM. Medo da tosse em pacientes no pós-operatório de cirurgias torácica e abdominal. Rev Cien Ext [Internet]. 2017 [cited 2018 May 13];13(2):83-8. Available from: http://ojs.unesp.br/index.php/revista_proex/article/view/1249

22. Faria Filho GS, Gaixeta LR, Stival MM, Lima LR. [Acute pain: nurses’ clinical judgement in postoperative cardiac surgery]. Rev Min Enferm. 2016;12(3):400-9. doi: S1474-5151201600000012

23. Guyton AC, Hall JE. Tratado de fisiologia médica. 13ª ed. Rio de Janeiro: Elsevier; 2017.

24. Cabral GDB, Silva RDF, Borges ZDO. Complicações pulmonares no pós-operatório: preditores. Rev Med Minas Gerais. 2014;24(Suppl 8):73-80. doi: 10.5935/2238-3182.20140130
26. von Baranow K, Silva NM, Moussalle LD, Kessler A. Inspirômetro de incentivo no pós-operatório de cirurgia torácica: uma revisão sistemática. Ciênc Saúde [Internet]. 2016 [cited 2018 May 11];9(3):210-7. Available from: http://revistaseletronicas.pucrs.br/ojs/index.php/faenfi/article/view/23081