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SCIENTIFIC ARTICLE

Anesthetic complications in a rehabilitation hospital: is the incidence related to the pre-anesthetic visit?

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KEYWORDS
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Abstract
Introduction: Approximately 234 million surgeries are done annually worldwide. There is a growing concern for the safety of the anesthetic act, and the pre-anesthetic consultation emerges as an important and widely recommended activity, used as a preventive measure for the emergence of a complication.
Objectives: To describe the complications related to anesthesia, to identify the factors that contribute to its appearance and to reflect on ways to improve clinical practice.
Methods: 700 patients, 175 cases and 525 controls, were evaluated over a period of 21 months. The data obtained through the pre-anesthetic consultation were evaluated descriptively and then tested with conditional univariate and multivariate logistic regression analysis.
Results: 175 cases of anesthesia-related complications (2.74%) out of 6365 anesthetic acts were evaluated. Hypotension was the most common complication (40 patients, 22.8%), followed by vomiting (24 patients, 13.7%) and arrhythmia (24 patients, 13.7%). Among the complications, 55% were due to patient conditions, 26% accidental, 10% predictable and 9% iatrogenic. The complications were classified as mild in 106 (61%), moderate in 63 (36%) and severe in six (3%) patients.
Conclusion: Patients with more impaired physical status (American Society of Anaesthesiology 3 and 4), with airway disease, tumor or parenchymal disease, diabetes or disorder of lipid metabolism, thyroid disease, former smokers and very prolonged anesthetic acts present a higher risk of anesthesia-related complications. Therefore, they should be actively investigated in the pre-anesthetic evaluation consultation.
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PALAVRAS-CHAVE
Avaliação pré-operatória;
Consulta anestésica pré-operatória;
Complicações anestésicas

Complicação anestésica em hospital de reabilitação. A incidência tem relação com a consulta pré-anestésica?

Resumo
Introdução: Cerca de 234 milhões de cirurgias são feitas anualmente no mundo. É cada vez maior o interesse pela segurança do ato anestésico e a consulta pré-anestésica surge como atividade importante e amplamente recomendada, usada como medida preventiva para o surgimento de uma complicação.
Objetivos: Descrever as complicações relacionadas à anestesia, identificar os fatores que contribuem para o seu surgimento e refletir sobre formas de melhoria na prática clínica.
Métodos: Foram avaliados 700 pacientes, 175 casos e 525 controles, em um período de 21 meses. Os dados obtidos por meio da consulta pré-anestésica foram avaliados descritivamente e em seguida testados com regressão logística condicional univariada e multivariada.
Resultados: Foram avaliados 175 casos de complicação relacionada à anestesia (2,74%) dentre 6.365 atos anestésicos. A hipotensão foi a complicação mais comum (40 casos, 22,8%), seguida do vômito (24%, 13,7%) e arritmia (24%, 13,7%). Das complicações, 55% foram devidas às condições do paciente, 26% acidentais, 10% previsíveis e 9% iatrogênicas. As complicações foram classificadas como leves em 106 pacientes (61%), moderadas em 63 (36%) e graves em seis (3%).
Conclusão: Pacientes com estado físico mais debilitado (ASA 3 e 4), com doença de vias aéreas, tumor ou doença parenquimatosa, com diabetes ou transtorno do metabolismo lipídico, com doença de tireoide, ex-fumantes e as anestesias muito prolongadas apresentam maior risco de complicações relacionadas à anestesia e, por isso, devem ser investigados ativamente na consulta de avaliação pré-anestésica.
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Introduction

It is common sense that the patient needs a careful clinical evaluation consisting of history, physical examination and complementary tests when appropriate, before being subjected to anesthesia. In the pre-anesthetic consultation, one can evaluate the patient, reduce risks and increase the chance of a favorable outcome. In Brazil, the pre-anesthetic evaluation for this purpose is increasing and there is even a recommendation by the Federal Council of Medicine (CFM), in its Resolution No. 1.802/06.[1] However, this type of care is still lacking.[2,3]

In 1949, the concept of pre-anesthetic evaluation was originally proposed, being a proven effective measure in reducing the preoperative anxiety.[3–5] Since 1980, at Sarah Hospital the pre-anesthetic consultation is conducted in all patients scheduled for surgery and undergoing anesthesia. In the perioperative period, the information on surgical procedures is stored in one specific form. After surgery, the evolution is recorded by the anesthesiologist in electronic reports, with a detailed account of the anesthetic procedure, also in an electronic spreadsheet. Subsequently, the data contained in the electronic spreadsheet are assessed by a quality control system, with the application of indicators.[6] With this instrument, the anesthesia/anesthesiologist relation is determined, besides daily hours of anesthesia/anesthesiologist, percentage of iatrogenic and accidental anesthetic complications (classified as mild, moderate or severe), the anaesthesiologist's qualification, quality of the filling out of the anesthesia form, qualification of equipment, state of consciousness, amnesia, analgesia, and welfare in the period of anesthesia and compliance with the anesthetic procedure, as well as pain and well-being in the post-anesthetic period.[7]

The importance of this study lies in the fact that studies aiming to describe, in a comprehensive manner, complications related to anesthesia and to pre-anesthetic evaluation are scarce.

Several studies have tried to clarify what are the complications that can be avoided or foreseen, so that the safety of anesthesia is improved.[8] But what are the factors that contribute to the emergence of anesthesia-related complications, especially in a tertiary hospital attending locomotor problems? These are some questions that we want to contextualize in this study, that seeks to understand the relationship between pre-anesthetic assessment and the emergence of anesthetic complications. The authors conducted the present study with the aim to identify those factors that contribute to the emergence of complications related to anesthesia, based on patient and procedural characteristics. Complication related to anesthesia was defined as ''an unwelcome occurrence during the perioperative period, which is related to the anesthetic act and that requires immediate intervention – which, if not taken, may incur in risk to the patient.''

Methodology

The study was approved by the Research Ethics Committee of the Sarah Network. This is a retrospective cohort study based in the analysis of medical records of patients who underwent anesthesia for surgery from April 2006

to December 2007, at Sarah Hospital, Center – Brasília, and that registered some type of complication related to anesthesia. Data were obtained from the Sarah Network's National Center for Quality Assurance (Centro Nacional de Controle de Qualidade, CNCQ). The pre-anesthetic consultation was conducted according to the recommendations in the guidelines for use in anesthesia and surgery outpatients approved by the American Society of Anaesthesiology (ASA).[9]

Patients who had some type of complication related to anesthesia, regardless of factors such as physical status, age, gender, type of surgery, duration and type of anesthesia and pre-existing diseases, among others, were included in this study. The complications related to anesthesia were classified, according to its severity and genesis, in accidental, secondary to patient conditions, iatrogenic and predictable.

Patients with complication related to anesthesia from diagnostic tests, urodynamic studies, neurophysiologic examinations and outpatient local anesthesia, were excluded from the study.

Statistical analysis

Patients who had some type of complication related to anesthesia were matched to three controls (patients with no complications), according to gender, type of surgery and physical status, and were considered as cases. Gender, type of surgery, type of anesthesia and medical specialty data were obtained by a search of electronic medical records. The other variables tested were chosen because they were part of the medical record electronic questionnaire, which is completed by the anesthesiologist during the pre-anesthetic evaluation: habits such as smoking, alcohol use, drug use, medications, previous anesthesia, family history, blood transfusion, allergies, respiratory disease, neurological disease and physical state. Initially, conditional univariate logistic regression analyses were completed (Table 1)[10,11] and those with $p < 0.25$[11] were selected to be included as covariates in the multivariate analysis. The models were elaborated by successive exclusion of each variable originated from the complete model composed by selected variables from the univariate analysis, using the likelihood ratio test.[11] After obtaining the final model, the variables that had been excluded in the univariate analysis were included in the model, one at a time, and conditional logistic regression analysis were repeated with the aim to identify variables that could have some contribution in the model, in the presence of other variables.[11]

Some variables for analysis and correlation with anesthetic complications were selected: gender and age of the patient; physical status (ASA) in the pre-anesthetic evaluation, medical specialty responsible by the surgery; type of anesthesia used – general (intravenous, inhalatory), regional (plexus blockages, peripheral and spinal), or combined (combination of more than one technique); classification of the complication by severity (mild, moderate and severe); patient's comorbidities and lifestyle habits; pre-anesthetic consultation and surgery dates.

The data collected were processed with SPSS 13.0, a statistical program. Initially, a study of descriptive data was conducted for getting means, standard deviations and percentages. Later, statistical inferences were also produced (odds ratio, hypothesis testing [to test the significance of variables $p \leq 0.05$] and predictive-logistic regression model). Data obtained through Sarah Brasilia's CNCQ were checked in the electronic record in approximately 50% of patients for quality control.

Results

During the study period, 175 cases of complications related to anesthesia were evaluated in Sarah Hospital/Brasilia, to which 525 controls were matched, totalling 700 patients. Regarding gender, 48.6% patients were female and 51.4% were male; whereas in the controls, 49% were female and 51% were male. In the age distribution, most groups showed a proportion of three controls for each case; from 0 to 11 months the proportion was reversed, i.e., two controls for four cases, and from 10 to 15 years the proportion was of approximately five controls by case. The distribution of patients by medical specialty was divided into five surgical clinics that performed the surgical act: cosmetic surgery, neurosurgery, orthopedics, thoracic surgery and urology (Table 2). The plastic surgery team had the lowest number of patients operated (7.5%) and of serious complications resulting from anesthesia (8%). Neurosurgery had 15.1% of total of patients: 43 cases in 106 surgeries. The orthopedics clinic had the largest number of patients who underwent surgery (379), which represented more than half the patients, 54.2% of the sample and 81 cases of anesthesia-related complications. In thoracic surgery, of 92 cases (13.1%) operated, 19 patients had complications related to anesthesia. In urology, of 71 (10.1%) cases operated, 18 patients had some type of complication. Neurosurgery and orthopedics teams had the highest proportion of cases of anesthesia-related complications.

In the ASA classification for physical status (Table 3), it can be seen that in ASA 1 patients the incidence was of 10.9%; in ASA 2 patients, 65.7%; in ASA 3 patients, 21.7%; and in ASA 4 patients, 1.7%.

We observed that the more compromised the physical state, the more likely the patient demonstrated an anesthesia-related complication.

Regarding the type of anesthesia, there was no significant difference between the anesthetic techniques. In combined anesthesia the proportion was 62 (21%) in 284 patients; in the general anesthesia, 92 (26.1%) in 352 patients; and in regional anesthesia, 21 (32.8%) in 64 patients. As for the anesthetic time, the average was 3 h and 57 min.

In the group of patients who demonstrated no anesthesia-related complication, it can be seen that the minimum, maximum and mean times are lower than those in the group with complications. While in the control group the minimum time was 5 min, in the group of cases this time was 35 min. The maximum time in the control group was 15 h and 38 min, and in the case group, 16 h and 15 min. When evaluating the time elapsed between the pre-anesthetic consultation and surgery, there was no significant relationship between this time and the occurrence of anesthetic complication.

In the group of patients with a habit of smoking (controls 78.7% and cases 69.1%) and in the group without this

Table 1 Association of independent variables with anesthetic complication – conditional univariate logistic regression.

Variables	Occurrence of anesthetic complications Control (%)	OR (CI 95%) Case (%)	*p*-Value
ASA			
1	72 (13.71)	19 (10.86)	1.00
2	402 (76.57)	115 (65.71)	1.98 (0.69–5.69)
3 and 4	51 (9.71)	41 (23.43)	23.50 (5.78–95.47)
Anesthesia			
Combined	222 (42.29)	62 (35.43)	1.00
General	260 (49.52)	92 (52.57)	1.79 (0.98–3.27)
Regional	43 (8.19)	21 (12.00)	1.69 (0.90–3.17)
SAH			
No	400 (76.19)	118 (67.43)	1.00
Yes	125 (23.81)	57 (32.57)	1.69 (1.11–2.57)
Respiratory disease			
No disease	462 (88.00)	133 (76.00)	1.00
Airways	51 (9.71)	30 (17.14)	2.31 (1.36–3.93)
Tumor/parenchymal	12 (2.29)	12 (6.86)	4.89 (1.86–12.88)
Neurological disease			
No disease	298 (56.76)	97 (53.43)	1.00
Brain	105 (20.00)	40 (22.86)	1.24 (0.72–2.15)
Marrow/PNS	122 (23.24)	38 (21.71)	0.95 (0.51–1.77)
Endocrinological disease			
No disease	479 (91.24)	141 (80.57)	1.00
Diabetes/lipid met.	26 (4.95)	21 (12.00)	2.96 (1.59–5.53)
Thyroid disease	20 (3.81)	13 (7.43)	2.60 (1.20–5.64)
Hematologic disease			
No disease	492 (93.71)	162 (92.57)	1.00
With disease	33 (6.29)	13 (7.43)	1.20 (0.61–2.36)
Haemotransfusions			
No	396 (75.43)	130 (74.29)	1.00
Yes	129 (24.57)	45 (25.71)	1.07 (0.71–1.61)
Allergy			
No	469 (89.33)	149 (85.14)	1.00
Yes	56 (10.67)	26 (14.86)	1.48 (0.89–2.47)
Alcoholism			
Never drank	438 (83.43)	146 (83.43)	1.00
Drinks or former drinker	87 (16.57)	29 (16.57)	1.00 (0.61–1.63)
Drugs			
No	518 (98.67)	174 (99.43)	1.00
Yes	7 (1.33)	1 (0.57)	0.43 (0.05–3.48)
Smoking			
No	413 (78.67)	121 (69.14)	1.00
Smoker	53 (10.10)	18 (10.29)	1.20 (0.67–2.13)
Former smoker	59 (11.24)	36 (20.57)	2.13 (1.33–3.40)
Previous anesthesia			
No	123 (23.43)	35 (20.00)	1.00
Yes	402 (76.57)	140 (80.00)	1.24 (0.80–1.92)
Family intercurrence			
No	516 (98.29)	174 (99.43)	1.00
Yes	9 (1.71)	1 (0.57)	0.33 (0.04–2.63)

Table 1 (*Continued*)

Variables	Occurrence of anesthetic complications Control (%)	OR (CI 95%) Case (%)	*p*-Value
Gastrointestinal			
No	413 (78.67)	135 (77.14)	1.00
Yes	112 (21.33)	40 (22.86)	1.10 (0.72–1.67)
Use of medications			
No	330 (62.86)	99 (56.57)	1.00
Yes	195 (37.14)	76 (43.43)	1.39 (0.94–2.06)
Duration of anesthesia			
	–	–	1.13 (1.03–1.24)
Time of evaluation			
	–	–	1.00 (0.99–1.00)
Age			
0–9	63 (12.00)	22 (12.57)	1.00
10–15	52 (9.90)	10 (5.71)	0.51 (0.22–1.20)
16–39	153 (29.14)	42 (24.00)	0.79 (0.43–1.46)
40–59	154 (29.33)	56 (32.00)	1.18 (0.63–2.21)
60–69	52 (9.90)	25 (14.29)	1.69 (0.81–3.54)
70 or more	51 (9.71)	20 (11.43)	1.51 (0.67–3.41)

Source: CNCQ Sarah – Brasília.

Table 2 Distribution of control–case patients by medical specialty.

Specialty	Complication No *n* (%)	Control–cases Yes *n* (%)	Total *n* (%)
Plastic surgery	38 (7.2)	14 (8.0)	52 (7.5)
Neurosurgery	63 (12.0)	43 (24.6)	106 (15.1)
Orthopedics	298 (56.8)	81 (46.2)	379 (54.2)
Thoracic surgery	73 (13.9)	19 (10.9)	92 (13.1)
Urology	53 (10.1)	18 (10.3)	71 (10.1)
Total	525 (100.0)	175 (100.0)	700 (100.0)

Source: CNCQ Sarah – Brasília.

habit (controls 10.1% and cases 10.3%), no great variation was observed. On the other hand, in the group of former smokers, the greatest difference was noted: controls 11.2% and cases 20.6%.

Of the 175 cases of anesthesia-related complications (Table 4), the highest incidence was of hypotension, with 40 cases (22.8%), followed by vomiting and cardiac arrhythmia with 24 cases (13.7%).

The multivariate logistic regression (Table 5) revealed five significant variables for the occurrence of anesthesia-related complications – physical state (ASA) 3 and 4, respiratory disease, endocrine disease, history of smoking, and duration of anesthesia.

Table 3 Distribution of control–case patients according to physical state (ASA).

Physical state	Complication No *n* (%)	Control–cases Yes *n* (%)	Total *n* (%)
ASA 1	74 (14.1)	19 (10.9)	93 (13.3)
ASA 2	400 (76.2)	115 (65.7)	515 (73.6)
ASA 3	51 (9.7)	38 (21.7)	89 (12.7)
ASA 4	0 (0)	3 (1.7)	3 (0.4)
Total	525 (100.0)	175 (100.0)	700 (100.0)

Source: CNCQ Sarah – Brasília.

Table 4 Distribution of complications related to anesthesia.

Complication	*n*	%
Seizure	1	0.6
Erythema	1	0.6
Accidental extubation	1	0.6
Hypothermia	1	0.6
Intrathoracic migration of epidural catheter	1	0.6
Pneumothorax	1	0.6
Falling incisor	1	0.6
Thoracic rigidity	1	0.6
Nosebleed	1	0.6
Bronchoaspiration	2	1.1
Respiratory depression	2	1.1
Airway obstruction	2	1.1
Desaturation SpO_2	2	1.1
CO_2 retention	2	1.1
Hypoxemia	5	2.8
Blockage failure	7	4.0
Bronchospasm	8	4.6
Difficult intubation	8	4.6
Oliguria	8	4.6
Hypertension	10	5.7
Laryngospasm	11	6.3
Dural perforation	11	6.3
Arrhythmia	24	13.7
Vomit	24	13.7
Hypotension	40	22.8
Total	175	100.0

Source: CNCQ Sarah – Brasília.

Discussion

The authors found studies that pointed to a higher frequency of anesthesia-related complications in the first and after the sixth decade of life.[8] This feature was not observed in our study, even after grouping the ages, resulting in 12.6% of cases in the first decade of life, 25.7% after the sixth decade and 61.7% between 10 and 59 years.

As for the physical status (ASA), there was an increasing frequency of complications in patients with greater impairment of physical condition: 20.4% of patients classified as ASA 1; 22.3% as ASA 2 patients; 42, 6% as ASA 3 patients; and 100% as ASA 4 patients, i.e., 16.7 times more likely to have anesthesia-related complications compared with ASA 1 patients. We must point out the difference in the occurrence of complications from ASA 2 to 3. In the statistical analysis, it was necessary to bring together ASA 3 and 4 patients, since there were only three cases of ASA 4 patients, and no control. Certainly this union has contributed to an increased odds ratio in these two groups ($p = 0.0001$). This result is in accordance with other studies.[2,3,6,8,12–16]

In this study there were no deaths, but other studies reported a higher tendency to complications and deaths as the clinical condition of the patient becomes more compromised.[14,17] By 1970, in the study that followed elective surgeries, it was observed that in patients with ASA 1 the percentage of deaths was 0.07%; in ASA 2 it was 0.24%; in ASA 3 it was 1.4%; in ASA 4 it was 7.5%; and in ASA 5 it was 8.1%. Those numbers were even greater in cases of emergency surgery.[17]

The type of anesthesia has been classified – as in other studies[12,13] – as general, regional and combined. In the study by Vaughan,[13] general anesthesia predominated with the highest number of cases of complication, followed by regional anesthesia and, finally, combined anesthesia. In comparison with the present study, general anesthesia

Table 5 Conditional multivariate logistic regression.

Variable	OR	CI 95%	Wald test	*p*-Value
ASA				
1	1.00	–	–	–
2	1.657	0.581–4.724	0.892	0.3449
3 and 4	16.733	4.013–69.780	14.955	0.0001
Respiratory disease				
No disease	1.00	–	–	–
Airways	2.297	1.308–4.032	8.379	0.0038
Tumor/parenchymal	3.625	1.330–9.882	6.334	0.0118
Endocrinological disease				
No disease	1.00	–	–	–
Diabetes/lipid met.	1.975	0.977–3.990	3.595	0.0579
Thyroid disease	2.413	1.049–5.552	4.292	0.0383
Smoking				
No	1.00	–	–	–
Smoker	1.447	0.778–2.692	1.363	0.2431
Former smoker	1.889	1.119–3.187	5.672	0.0172
Duration of anesthesia	1.111	1.006–1.228	4.286	0.0384

Source: CNCQ Sarah – Brasília.

remains the most comprehensive, combined anesthesia comes in second place and, in the last place, regional anesthesia.

It is noteworthy that in this study, the types of anesthesia used had a uniform distribution, both in cases and in controls. This variable was not a selection criterion for the choice for controls; it emerged as an element that added confidence to the result obtained, as it characterizes a similarity of the two groups.

The analysis of the duration of the anesthetic act showed that, for each additional hour of anesthesia, the chance of the emergence of complications increases 11.1%, $p = 0.038$. Thus, longer surgeries (therefore demanding more anesthesia time) are more likely to have some complication. This relationship may be due to the higher dose of the anesthetic and hence a longer time to wake up, since longer surgeries require greater amounts of anesthetic drugs.

Chronic hypertension is seen as the most frequently observed comorbidity before anesthesia and the main cause of postponed or canceled surgeries.[18] In this study, hypertension as a disease prior to anesthesia was present in 32.6% of patients who had some type of anesthesia-related complication, but hypertension as an anesthetic complication occurred in 10 patients (12.0%). This frequency coincided with findings of another survey conducted in 2006, that evaluated adverse effects of anesthesia in 1000 patients.[19]

Previous disease or respiratory change proved to be a decisive factor for the occurrence of complications related to anesthesia. For better evaluation, these patients were grouped into two categories. In one group, patients with upper airway disease were allocated, including patients with sinusitis, colds, those tracheotomised and with tonsillitis. In the other group patients with tumors and lung nodules, emphysema, bronchitis and asthma were allocated. Both groups were considered statistically significant for greater chance of complication related to anesthesia. In the group of upper airway diseases, there is a chance 2.3 times greater ($p = 0.00038$) of complication, and in the group with parenchymal/tumor disease, the chance increases 3.6 times ($p = 0.011$). No studies addressing the issue of the incidence of anesthetic complications related to the respiratory change or disease prior to anesthesia were found.

Among the diseases evaluated in the pre-anesthetic consultation, the neurological diseases were the group of clinical conditions showing greater diversity. In this classification, patients with Parkinson's disease, sequelae of head trauma and stroke (ischemic and hemorrhagic), myelomeningocele, paraplegia, quadriplegia, depression, cerebral palsy, Arnold–Chiari syndrome, epilepsy, brain or spinal cord tumor, tethered spinal cord, neurofibromatosis, seizures, peripheral polyneuropathy, motor neuron disease, cerebral aneurysm, psychotic episode, hydrocephalus, neurocysticercosis, ataxia, disorientation, cerebral anoxia, dementia, neurological regression, spinal cord compression, and schizophrenia were included. Possibly because of such diversity of conditions, ''neurological diseases'' did not appear as a risk factor for the occurrence of anesthetic complications. The endocrinological diseases were also divided into two groups, because of their clinical importance. The first group was composed of patients who had diabetes or changes in lipid metabolism, and the second group of patients was composed by those suffering thyroid disease. In the group with diabetes or changes in lipid metabolism, we observed an increase of almost twice ($p = 0.057$) the chance for anesthesia-related complication. Despite the p-value, this finding was considered, since it was situated on the margin of the upper limit for $p < 0.05$. In patients with thyroid disease (hypothyroidism, hyperthyroidism, and total or partial resection of the thyroid), we found a 2.4 times higher chance of complication, $p = 0.038$. Therefore, endocrinological diseases proved important in the emergence of anesthesia-related complications. Studies point out to the care that the anesthesiologist should have in relation to patients with diabetes, because this is a systemic disease that may interfere with the functioning of the heart and kidneys. Glycaemic and metabolic changes should be carefully monitored.[20] Another author discusses the importance of the pre-anesthetic evaluation in patients with diabetes, as this condition causes a higher incidence of hypertension and of cerebrovascular and myocardial disease, difficult intubation because of thickening of soft tissues and joints, diabetic acidosis or hypoglycaemia in the perioperative period.[21]

The smoking habit was divided into patients as non-smokers, former smokers and smokers. In the group of smokers, there is a 1.44 greater chance for complication, but with $p = 0.24$, so this group was excluded from the model. The most significant factor for the onset of complications was observed in the group of patients who claim to be former smokers, with OR = 1.88 and $p = 0.017$.

The literature coincides with the findings of our study, stating that there is an increased risk (two to six times) for emergence of lung complications in smokers. In this study, it was noted that former smokers have a chance 1.89 times greater for emergence of a complication. Taking into account that our study did not obtain data about the time when the patient discontinued this habit, one can assume that the patients stopped smoking shortly before their surgery. In face of this scenario, there is need for more studies to determine more accurately the factors related to smoking, with the aim to determine the genesis of complications related to anesthesia in this group of patients.

Pre-anesthetic consultation was also evaluated in relation to the interval between its occurrence and the surgery. There was no significance in that lapse of time, $p = 0.45$. In patients with pre-anesthetic consultation taken a few days before surgery, and in those patients whose appointment had been done almost 12 months before, the results were not statistically significant for emergence of anesthesia-related complications. Some authors indicate that the pre-anesthetic consultation should not be held too close to the surgery, because if the patient has a concomitant disease, it may require some compensation of his/her medical condition and the surgery may be postponed or suspended.[18] These authors also advise against the consultation many months in advance, because the patient's clinical status may be modified, some pre-existing disease may decompensate, and the anesthesiologist–patient relationship may be lost after such a long time. It is recommended that the pre-anesthetic consultation be made between two weeks and two months before the surgery.[18]

In the limitations of this study, the characteristics of our hospital and motor-functional rehabilitation were

considered. Therefore, ours is classified as a tertiary institution, which excludes cases widely found in the literature, such as emergency surgeries. However, the characteristic of the population served included chronic, severe and difficult to treat diseases, including patients with tetraplegia, autoimmune degenerative diseases, muscle diseases, and tumors of the central nervous system, among others.

The incidence of complications was low. From 6365 anesthetic acts, 175 patients presented some complication to anesthesia, i.e., 2.74%. Another important factor is the higher incidence of minor complications: 61% of cases. Studies show rates of complications related to anesthesia with values up to 18%.[19] Jung found a rate of 3.6%.[8]

Another important finding of this study refers to the non-occurrence of death or severe sequelae resulting from these complications. Surveys show death rates between 0.13% and 1.5% and the current probability of death during anesthesia, and as a result of the anesthetic act, is estimated to be something between 1:250,000 and 1:300,000.[8,12,15,19,22,23]

Conclusion

ASA 3 and 4 patients are 16.73 times more likely to have complications in anesthesia, compared with ASA 1 patients; patients with respiratory disease in the airways are 2.30 times more likely to have complications in anesthesia than patients without respiratory disease; patients with lung tumor or parenchymal disease are 3.60 times more likely to have complications in anesthesia than patients without respiratory disease; those with thyroid disease are 2.41 times more likely to have complications in anesthesia than patients without endocrine disease; former smokers are 1.89 times more likely to have complications in anesthesia than non-smokers. Each increase of 1 h in duration of anesthesia increases the chance of complications in 11.1%.

Conflicts of interest

The authors declare no conflicts of interest.

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