Available online at www.medicinescience.org

ORIGINAL RESEARCH

Medicine Science International Medical Journal

Medicine Science 2017;6(4):746-9

The effect of preoperative anxiety on the incidence of perioperative bronchospasm: a prospective observational study

Ozlem Kocaturk[1], Eylem Oguz[2]

[1] *Adnan Menderes University, Department of Anesthesiology, Aydın, Turkey*
[2] *Ataturk State Hospital, Department of Anesthesiology, İzmir, Turkey*

Received 13 April 2017; Accepted 08 June 2017
Available online 21.06.2017 with doi: 10.5455/medscience.2017.06.8654

Abstract

Independently from the chronic anxiety disorder, patients could feel nervousness and anxiety due to surgical stress during preoperative period. Preoperative anxiety could lead to various complications owing to autonomous nerve system activation. We targeted to examine the effects of preoperative anxiety on bronchospasm. In the study, 20-50 years old ASA I patient to be given elective endoscopic urologic operations were included. Totally 124 patients were evaluated during preoperative period. The patients were interviewed before the operation to determine their anxiety levels (Beck Anxiety Scale). Patients were grouped according to anxiety state. 58 anxious patients (Study Group) and 66 non-anxious (Control Group) were compared according to bronchospasm, wheezing, SpO2 paucity and ETCO2 extent. Incidence of bronchospasm and wheezing were found more in the patient group having preoperative anxiety ($p<0.05$). No meaningful correlation was found between the groups with regard to the changes in SpO2 and ETCO2. Various studies were conducted using emotion-induction techniques. However, they produced artificial stress and these results were not associated with any surgical procedures. Unlike all these studies, we showed natural clinical course of non-induced anxiety effects on all perioperative period. Our study demonstrated that anxiety prior to a general anesthesia and changes in the emotional state could create a risk for total respiratory resistance. These changes could arise as bronchospasm and wheezing during the perioperative period.

Keywords: Preoperative anxiety, bronchospasm, wheezing, respiratory resistance, beck anxiety inventory

Introduction

The preoperative anxiety is a temporary emotional state caused by anxiety, nervousness, fear and high autonomic nerve system activation arising from these feelings that the patients have prior to the operation [1]. Every patient is known different levels of anxiety due to various aspects such as the previous experiences, personality characteristics, anesthetics and surgery types to be applied and the pain expectation after the surgery [2]. In addition to the negative effects of preoperative anxiety on vital findings, it was also reported that it extends the recovery period and the staying time in hospital and that it has negative effects on postoperative pain and on nausea and vomiting [3,4]. Therefore, in order for the anxiety to be taken under control, the need for the education of the premedication and preoperative anxiety has arisen [5,6]. Anxiety is already known to aggravate reactive airway diseases such as asthma and chronic obstructive pulmonary disease (COPD) and to lead to bronchospasm together with symptoms such as extended expirium and wheezing [7,9].

During a general anesthesia, broncospasm could also occur because of the medicine used, the insufficient anesthesia application, airway manipulations and some surgery types [10].

***Coresponding Author:** Ozlem Kocaturk, Adnan Menderes University, Department of Anesthesiology, Aydın, Turkey
E-mail: ozlemoget2002@yahoo.com

The anxiety occurring prior to the operation could increase the bronchospasm risk, which is among the complications related with the general anesthesia, much more than expected. In this study, we aimed at researching the effects of preoperative anxiety on the bronchospasm risk that we encountered in the general anesthesia applications. We report on perioperative bronchospasm related with preoperative anxiety. This is significant because perioperative bronchospasm would be reduce by controlling preoperative anxiety.

Material and Methods

This prospective observational study was approved by the Research Ethics Committee of Education and Research Hospital. Informed written consent was obtained from all patients, according to ethical guidelines of the 2008 Decleration of Helsinki. In the study, ASA I patients of 20-50 years old who were planned to be given elective endoscopic urologic operation were included. Patients who had neuropsychiatric illness, who had histories of cigarette, alcohol and drug usage, who had diseases such as COPD and bronchial asthma, who had atopy histories, and who had upper respiratory tract infection were excluded from the study. 124 patients who were planned to be operated under general anesthesia between 1st January and 31st March 2016 were evaluated during the preoperative period. The patients were taken to face to face interview an hour before the operation so that their anxiety levels could be measured. Anxiety levels were measured using Beck

Anxiety Inventory (BAI). The BAI is comprised of 21 symptoms that measure anxiety levels. Each item can be scored from 0 (not at all) to 3 (severely). The total score is determined by summing the individual scores and ranges from 0 to 63. The BAI has a high internal consistency and test-retest reliability. According to the total scores, values until 8 were recorded as "no anxiety", and the value 8 and higher ones were recorded as "anxious". While 58 patients who were identified as "anxious" were making the study group (SG), 66 patients who were identified as "non-anxious" made the control group (CG). All the patients were injected with 0.05 mg/kg IM midazolam 30 minutes prior to the operation. The patients were made vascular access after they were taken into the operation room and the anesthesia induction with 1 µg/kg remifentanyl, 2 mg/kg propofol, 0.8 mg/kg rocuronium was performed. In the process, the standard general anesthesia application was done using 0.1 µg/kg/min remifentanyl infusion and sevoflurane 2% in 50% O2 and 50% air. Patients were observed and auscultated with regard to bronchospasm findings once in 5 minutes all through the perioperative period. During the operation, intraoperative heart rate, noninvasive blood pressure (NIBP), SpO2, temperature and ETCO2 values were monitored. During controlled ventilation with a tidal volume of 10 ml/kg, respiration parameters and capnographic findings were recorded. The patients who had prolonged expiration, whose peak airway pressure increased, whose tidal volume decreased and who had characteristic shark-fin findings in capnography were recorded as "having bronchospasm".10,11 Wheezing was defined as high-pitched expiratory rhonchi [11]. Wheezing was assessed and recorded by an independent blinded observer. The patients whose SpO2 values were lower than 90% were recorded as "Decreased in SpO2" and the patients whose ETCO2 values were over 40 were recorded as "Increased in ETCO2". All these patients with bronchospasm and/or wheezing were ventilated with 100% oxygen. The endotracheal tube was checked and the patient was aspirated. If the findings of the bronchospasm did not improve, the anesthesia was deepened and reauscultated. If the findings of bronchospasm still remained unchanged, the patient was given hydrocortisone 1 mg/kg IV and aminophylline bolus (3 mg/kg infusion in 20 min) was given. Mechanical obstructions were taken into account seriously and the false positives that could occur depending on them were eliminated. During the postoperative period, the heart rate, NIBP, SpO2, Visual Analog Scale (VAS) and Aldrete scores of the patients who were taken to recovery room were evaluated. The patients whose Aldrete scores were 9 were sent to service.

Statistical Analysis: For statistical data analysis, we used SPSS 17.0 (SPSS Inc., Chicago, IL, USA). All data were expressed as numbers (%) or means ± SD. The student t-test was used to analyze continuous variables and the chi-square test or Fisher's exact test was used to analyze categorical variables. A level of $p<0.05$ was considered significant.

Results

58 of the total 124 patients who were given general anesthesia were the SG patients who had preoperative anxiety, and 66 of them were the CG patients who had no preoperative anxiety. The SG and CG patients were statistically similar with regard to their ages, their civil statuses, and the education levels they had been given. The number of the female patients in the SG was significantly higher than in the CG (53 and 29 in SG and CG, respectively, $p<0.01$); however, no correlation was found between the female sex and the risk for the occurrence of bronchospasm. (Table 1)

Table 1. Demographic variables of CG (n=66) and SG (n=58)

	SG (Anxiety) group (n=58)	CG (No-anxiety) group (n=66)	P*
Age	32.04 ± 10.53	35,90 ± 8,28	P=0.072
Gender, male / female	29 (%35.4) / 29 (%69.0)	53 (%64.6) / 13 (%31.0)	X2=12,65 P=0.001*
Weight	75.08 ± 14.57	77.57 ± 14.09	P=0.478
Civil status, single / married	17 (%36.2) / 40 (%53.2)	30 (%63.8) / 35 (%46.7)	X2=4,29 p>0.05

Numbers represent mean (±SD) or n (%).

The bronchospasm presence that could be the case all through the perioperative period between the SG with preoperative anxiety and CG was evaluated. The bronchospasm frequency in the SG was seen to be more (p=0.005). While bronchospasm symptoms were encountered in the 20% of the patients in the SG, only 8 bronchospasm findings were determined in 66 patients in the CG. Similarly, the wheezing frequency in the SG with preoperative anxiety was determined significantly high (p=0.016). Wheezing was identified in 13 patients in the SG and in 6 patients in the CG. The majority of patients did not require intensive intervention of bronchospasm. All these patients with bronchospasm and/or wheezing were ventilated with 100% oxygen. Hydrocortisone 1 mg/kg IV and aminophylline bolus (3 mg/kg infusion in 20 min) should be given to only 3 patients from the study group.

The SpO2 values of the four patients in the study group were low, while the control group was seen in one patient. There were two patients with increased ETCO2 in both groups. No meaningful correlation was found between the groups with regard to the changes in SpO2 and ETCO2. (Table 2)

Table 2. Incidence of bronchospasm, wheezing and decreased in SpO2 among CG (n=66) and SG (n=58)

	SG (Anxiety) group (n=58)	CG (No-anxiety) group (n=66)	P*
Bronchospasm -/+	38 (%30.6) / 20 (%16.1)	58 (%46.8) / 8 (%6.5)	X2=8.83 p=0.005*
Wheezing -/+	45 (%36.2) / 13 (%10.4)	60 (%66.7) / 6 (%6.7)	X2=6,17 p=0.016*
Decreased in SpO2 -/+	54 (%43.5) / 4 (%3.2)	65 (%52.4) / 1 (%0.8)	X2=2.31 p>0.05
Increased in ETCO2 -/+	56 (%45.1) / 2 (%1.6)	64 (%51.6) / 2 (%1.6)	X2=2.42 p>0.05

Numbers represent n (%).

Tachycardia (> 100 beat/min) was observed in two patients with bronchospasm and wheezing in the Study group and one patient with bronchospasm and wheezing in the control group. But these patients did not need treatment. The NIBP was within normal limits in all patients.

Discussion

Bronchospasm is a significant morbidity and mortality factor among the airway complications during the perioperative period [12]. Medications used during the general anesthesia, insufficient anesthesia application, surgical stimulations, airway attempts and airway soiling cause bronchospasm and laringospasm. Furthermore, reactive airway diseases such as asthma and COPD, respiratory tract infections, smoking and atopy story also prepare an environment for bronchospasm.10 In our study, all these predisposing factors were excluded from the study content, and the effect of the anxiety prior to the operation on bronchospasm was evaluated under a single type surgical procedure. Some volatile anesthetic and IV agents that could influence the results were avoided and a standard anesthesia protocol was determined. This study demonstrated that preoperative anxiety, too, had a trigger effect on the bronchospasm risk in healthy individuals regardless of all predisposing factors. In our study, while bronchospasm findings were determined in 16.1% of the patients with preoperative anxiety, this rate was found as 6.5% in non-anxious control group patients. This meaningful difference between the incidences indicated the state when the preoperative anxiety could not be prevented, it could lead to a tendency for bronchospasm.

The emotional state alternatives and the anxiety in asthma patients are known to trigger bronchospasm and wheezing, its symptom.7,9 The difference that we found between the broncospasm incidences during the general anesthesia could be explained similarly to the bronchi smooth muscle response created by the anxiety, like in the asthma patients. The autonomic regulation on the airway is mainly vagal [13]. The vagal system was traditionally thought to be the main pathway for emotional influences [8]. We could encounter bronchospasm symptoms as a result of the contraction of the vagal outflow on airway smooth muscles.

A great number of studies, in which emotion-induction techniques have been used experimentally, have been conducted until present day in order to evaluate the airway response towards emotional stimulants [14,19]. The emotional effect on the airway particularly displays itself in the central airways [9]. There happens differences in the severity of the resistance in the airways depending on its localization as well [13]. The phasic airway response, occurring against the triggers like anxiety in healthy individuals, is generally thought to occur by the effects of upper airways (muscles of larynx, glottic aperature) more generally during expirium [17,20,21]. Ritz et al. experimentally observed a total airway resistance against affective stimulants in healthy individuals only in the inspiratory section.8 However, in the experimental studies conducted afterwards, the inspiratory or the expiratory resistances in the airway that are created by affective stimulants could not have been proved to be superior to the other [19]. Respiratory resistance changes induced by stress in healthy individuals are very small and they are usually under the threshold value [22]. Therefore, they may not appear as bronchospasm clinically. However, in such cases as asthma disease that have airway hyperactivity, stress and anxiety makes the respiratory resistance prominent clinically as well. [9,18]. Our study indicated that anxiety and emotional state changes make up a risk for the total respiratory resistance also in the general anesthesia procedures, as in asthma. These respiratory resistance changes could appear as bronchospasm and wheezing in perioperative period. This study is valuable in the view that it indicates the bronchospasm caused clinically by stress without using experimental induction methods. Olsson et al. found the incidence of bronchospasm and wheezing as 0.17% during a general anesthesia, and they determined laringospasm incidence during general anesthesia as 0.89% in another study they conducted [23]. These retro-specific studies were done on non-asthmatic patients. As can be foreseen, in the studies done on asthma patients, the incidences were found higher. Shnider and Papper determined the bronchospasm incidence seen in asthma patients after tracheal intubation as 6.7% [24]. Gold and Helrich indicated the bronchospasm seen in patients under general anesthesia as 8.1%.25 According to a study conducted by Pizov et al., [25]. 42% wheezing was determined in asthma patients in the auscultation after intubation under general anesthesia, and 6.25% wheezing in non-asthmatic ones [26]. Although our patient profile was composed of non-asthmatic healthy individuals, in our study, too, bronchospasm and wheezing incidences were found higher, like in the study of Pizov et al. [26]. This result is most likely related to the method of data collection and to the more sensitive criteria used for establishing the diagnosis of bronchospasm. In addition, our study was prospective unlike the previous studies. In retrospective studies, such episodes of wheezing may not have been noted in an anesthetic record and subsequently analyzed in chart review. Otherwise, most status of wheezing seen in our study was mild and self-limited.

The respiratory resistant response changes according to the given signal's being positive, negative or neutral [17]. Not only studies supporting the airway resistance created by negative stimulants exist [19], but there are various studies backing up respiratory resistance happening under the effects of both positive and negative stimulants as well.8 Preoperative stress could be accepted as a negative stimulant leading to anxiety.

The applications during the general anesthesia, the medication used and various factors belonging to the patient have influences on the respiratory resistance. Certain volatile anesthetic agents, if introduced quickly, can trigger bronchospasm [26]. It was particularly indicated that desflurane increased the airway resistance [10]. Some IV anesthetics increase the wheezing incidences and effect the respiratory mechanics, as well [26]. In the study Pizov et al. conducted, they interpreted the wheezing frequency during the general anesthesia induction in non-asthmatic patients. They observed wheezing incidences at high rates and different according the medication used [26]. In addition, IV agents, such as beta-blockers, NSAIDs and cholinesterase inhibitors can cause bronchospasm. Histamine release (thiopentone, atracurium, mivacurium, morphine, d-tubocurarine) can also precipitate bronchospasm; care should be taken with these drugs in higher risk patients. Manipulation of the airway or surgical stimulation under inadequate depth of anesthesia increases the risk of bronchospasm. Bordet et al. determined that the airway applications in children increased the risk of bronchospasm according to the invasiveness degree [12]. A kinked, blocked, misplaced tube or occlusion in the breathing circuit can mimic severe bronchospasm.

Certain surgical procedures have highly stimulating stages that can trigger bronchospasm (and laryngospasm). Examples of these include anal or cervical dilatation, stripping of the long saphenous

vein during varicose vein surgery and traction on the peritoneum [10]. In our study, the cause of high bronchospasm incidence in both groups may be due to endoscopic urological surgery. The incidence of bronchospasm may have increased the surgical procedure associated with urethral sphincter. Some previous studies have included all elective surgical procedures that have not evaluated bronchospasm in a specific surgical procedure [23,26]. Moreover; the risks possessed by the patient are also the case. The bronchospasm risk escalates in the patients who are known to have hyperreactivity risk. Particularly, the patients suffering from reactive airway diseases, such as poorly controlled asthma and COPD, are under serious risk. Bronchial hyperreactivity is also associated with preoperative exposure to tobacco smoke, upper respiratory tract infection and a history of atopy [10]. Unexplained bronchospasm, especially in patients without increased risk of airway hyperreactivity, should prompt consideration of airway soiling due to secretions, regurgitation or aspiration [10].

Conclusion

In our study, the anxiety was demonstrated to have created a tendency to bronchospasm in addition to all these bronchospasm factors that could appear during general anesthesia. There are numerous studies using emotion-induction techniques. They produced artificial stress and these results have not been associated with any surgical procedure. Unlike all these studies, our study has unique features; first of all, we showed naturel clinical course of non-induced anxiety and its effect on all perioperative period. However, this issue requires more clinical studies at larger scales. The measurements of preoperative anxiety should be made routine procedures. The anxiety levels that will be determined in these routine procedures could facilitate the determination of the premedication doses to be given. The anesthetic medication selection for the patients who have preoperative anxiety, airway and the surgical approach should be determined by taking the increased bronchospasm risk into account in these patients.

Conflict of interest

The authors have declared that no conflicts of interest exist.

References

1. Markland D, Hardy L. Anxiety, relaxation and anesthesia for day-case surgery. Br JClin Psychol. 1993;32(4):493-504.
2. Kindler CH, Harms C, Amsler F, Ihde-Scholl T, Scheidegger D. The visuel analog skale allows effective measurement of preoperative anxitey and dedection of patient anesthetic concerns. Anesth Analg.. 2000;90(3):706-12.
3. Sadati L, Pazouki A, Mehdizadeh A, Shoar S, Tamannaie Z, Chaichian S. Effect of preoperative nursing visit on preoperative anxiety and postoperative complications in candidates for laparoscopic cholecystectomy: a randomized clinical trial. Scand J Caring Sci. 2013;27(4):994-8.
4. Caumo W, Schmidt P, Schneider N, Bergmann J, Iwamoto CW, Bandeira D, Ferreira BC. Risk Factors for Preoperative Anxiety in Adults. Acta Anaesthesiol Scand. 2001;45(3):298-307.
5. Walker KJ1, Smith AF. Premedication for anxiety in adult day surgery. Cochrane Database Syst Rev. 2009;7:(4):CD002192.
6. Asilioglu K, Celik SS. The effect of preoperative education on anxiety of open cardiac surgery patients. Patient Educ Coun. 2004;53(1):65-70.
7. Isenberg SA, Lehrer PM, Hochron S. The effects of suggestion and emotional arousal on pulmonary function in asthma: a review and a hypothesis regarding vagal mediation. Psychosom Med. 1992;54(2):192-216.
8. Ritz T, George C, Dahme B. Respiratory resistance during emotional stimulation: evidence for a nonspecific effect of experienced arousal? Biol Psychol. 2000;52(2):143-60.
9. Lehrer, PM, Isenberg S, Hochron SM. Asthma and emotion: a review. J Asthma. 1993;30(1):5-21.
10. Looseley A. Management of bronchospasm during general anaesthesia. Update in Anesthesia. www.anaesthesiologists.org access date 01.04.2017.
11. Murray JF: History and physical examination. In: Murray JF, Nadel JA, eds, Textbook of Respiratory Medicine, 5th edition. Philadelphia, WB Saunders, 1988,443.
12. Bordet F, Allaouchiche B, Lansiaux S, Combet S, Pouyau A, Taylor P, Bonnard C, Chassard D. Risk factors for airway complications during general anaesthesia in paediatric patients. Paediatr Anaesth.. 2002;12(9):762–9.
13. Barnes, PJ. Neural control of human airways in health and disease. Am Rev Respir Dis. 1986;134(6):1289–314.
14. Ritz T, Kullowatz A, Goldman MD, Kanniess F, Magnussenc H, Dahme B. Emotional reactivity of the airways in asthma: Consistency across emotion-induction techniques and emotional qualities. Biol Psychol. 2010;84(1):74-81.
15. Ritz T, Kullowatz A. Effects of stress and emotion on lung function in health and asthma. Current Respiratory Medicine Reviews. 2005;1(2),209-18.
16. Ritz T, Steptoe A. Emotion and pulmonary function in asthma: reactivity in the field and relationship with laboratory induction of emotion. Psychosom Med. 2000;62(6):808–15.
17. Ritz T, Thöns M. Airway response of healthy individuals to affective picture series. Int Journal Psychophysiol. 2002;46(1)67–75.
18. Ritz T, Steptoe A, De Wilde S, Costa M. Emotions and stress increase respiratory resistance in asthma. Psychosom Med. 2000;62(3):401-12.
19. Ritz T, Alatupa S, Thöns M, Dahme B. Effects of affective picture viewing and imagery on respiratory resistance in nonasthmatic individuals. Psychophysiology. 2002;39(1)86–94.
20. Cauberghs M, Van deWoestijne KP. Changes of respiratory input impedance during breathing in humans. J Appl Physiol. 1992;73(6)2355-62.
21. Ferris BG, Mead J, Opie LH. Partitioning of respiratory flow resistance in man. J. Appl. Physiol. 1964;19,653–8.
22. Dahme B, Richter R, Maß R. Interoception of respiratory resistance in asthmatic patients. Biol. Psychol. 1996;42(1-2),215–29.
23. Olsson GL. Bronchospasm during anaesthesia. A computer-aided incidence study of 136,929 patients. Acta Anaesthesiol Scand. 1987;31(3):244-52.
24. Shnider SM, Papper EM. Anesthesia for the asthmatic patient. Anesthesiology. 1961;22:886-92.
25. Gold MI, Helrich M. A study of complications related to anesthesia in asthmatic patients. Anesth Analg. 1963;42:238-93.
26. Pizov R, Brown ARH, Weiss YS, Baranov D, Hennes H, Baker S, Hirshman CA. Wheezing during induction of general anesthesia in patients with and without asthma. Anesthesiology. 1995;82(5):1111-6.