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SCIENTIFIC ARTICLE

Low dose propofol vs. lidocaine for relief of resistant post-extubation laryngospasm in the obstetric patient

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Abstract

Background: Post-extubation laryngospasm is a dangerous complication that should be managed promptly. Standard measures were described for its management. We aimed to compare the efficacy of propofol ($0.5\,mg.kg^{-1}$) vs. lidocaine ($1.5\,mg.kg^{-1}$) for treatment of resistant post-extubation laryngospasm in the obstetric patients, after failure of the standard measures.

Method: This study was conducted over 2 years on all obstetric patients scheduled for cesarean delivery. Post-extubation laryngospasm was initially managed with a standard protocol (removal of offending stimulus, jaw thrust, positive pressure ventilation with 100% oxygen). When this protocol failed, the tested drug was the second line (lidocaine in the first year and propofol in the second year). Lastly, succinylcholine was used when the tested drug failed.

Results: In lidocaine group, 5% of parturients developed post-extubation laryngospasm, 31.9% of them were successfully treated via standard protocol, and 68.1% required lidocaine treatment. Among these, 65.6% of patients treated with lidocaine responded successfully and 34.4% required succinylcholine to relieve laryngospasm. In propofol group, 4.7% of parturients developed post-extubation laryngospasm, 30.1% of them were successfully treated via standard protocol, and 69.9% required propofol treatment. Among these, 82.8% of patients treated with propofol responded successfully and 17.2% required succinylcholine to relieve laryngospasm.

Conclusion: Small dose of propofol ($0.5\,mg.kg^{-1}$) is marginally more effective than lidocaine ($1.5\,mg.kg^{-1}$) for the treatment of resistant post-extubation laryngospasm in obstetric patients, after failure of standard measures and before the use of muscle relaxants.

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Dose baixa de propofol *versus* lidocaína para alívio de laringoespasmo resistente pós-extubação em paciente obstétrica

Resumo

Justificativa: O laringoespasmo pós-extubação é uma complicação perigosa que deve ser prontamente tratada. Medidas padrão para o seu manejo foram descritas. O nosso objetivo foi comparar a eficácia de propofol (0,5 mg.kg^{-1}) *versus* lidocaína (1,5 mg.kg^{-1}) no tratamento de laringoespasmo resistente pós-extubação em pacientes obstétricas após falha das medidas padrão.

Método: Este estudo foi conduzido ao longo de dois anos com todas as pacientes obstétricas programadas para cesariana. O laringoespasmo pós-extubação foi inicialmente tratado com um protocolo padrão (remoção do estímulo ofensivo, protrusão mandibular, ventilação com pressão positiva com oxigênio a 100%). Ao constatar a falha desse protocolo, o fármaco testado foi a segunda opção (lidocaína no primeiro ano e propofol no segundo ano). Por fim, succinilcolina foi utilizada quando houve falha do fármaco testado.

Resultados: No grupo lidocaína, 5% das parturientes desenvolveram laringoespasmo pós-extubação, 31,9% delas foram tratadas com sucesso via protocolo padrão e 68,1% precisaram de tratamento com lidocaína. Destas, 65,6% responderam com sucesso ao tratamento com lidocaína e 34,4% precisaram de succinilcolina para alívio do laringoespasmo. No grupo propofol, 4,7% das parturientes desenvolveram laringoespasmo pós-extubação, 30,1% delas foram tratadas com sucesso via protocolo padrão e 69,9% precisaram de tratamento com propofol. Destas, 82,8% responderam com sucesso ao tratamento com propofol e 17,2% precisaram de succinilcolina para alívio do laringoespasmo.

Conclusão: Uma pequena dose de propofol (0,5 mg.kg^{-1}) é marginalmente mais eficaz que lidocaína (1,5 mg.kg^{-1}) no tratamento de laringoespasmo resistente pós-extubação em pacientes obstétricas, após falha das medidas padrão e antes do uso de relaxantes musculares.

Introduction

Post-extubation laryngospasm accounts for 23% of all critical postoperative respiratory consequences in adults.[1] It may be caused by secretions, vomitus, foreign body in the airway, or pain at the site of surgery.[2] It is considered as a transient period of exaggerated upper airway defensive reflex; due to laryngeal hyperexcitability during the recovery time of general anesthesia.[3] It is a dangerous complication that may lead to hypoxia or Negative Pressure Pulmonary Edema (NPPE).[4,5]

Some studies listed laryngospasm as an anesthetic cause of obstetric mortality.[6,7] Fodale et al. described a case series of three parturients suffered from post-extubation laryngospasm.[8] The anatomical changes associated with pregnancy, such as pharyngeal edema or nasal congestion, could worsen the situation during laryngospasm,[9] with more risk on the patient's life. Therefore, laryngospasm must be treated immediately.

Standard measures described for management of laryngospasm started with removal of the offending stimulus, jaw thrust, and positive airway pressure ventilation with 100% oxygen by bag and mask.[10] Another technique was described by applying firm pressure at a laryngospasm point, which lies behind the ear lobe, between the mastoid process and the ramus of the mandible.[11] When these measures fail, a small dose (0.1 mg.kg^{-1}) of intravenous (iv) succinylcholine is used.[12] Some studies suggested the use of intramuscular succinylcholine in absence of venous access.[13] Other studies described the use of topical or iv lidocaine[14,15]; or the administration of iv nitroglycerine.[16]

The use of small dose of propofol (0.25–0.8 mg.kg^{-1}) have been suggested for treatment of resistant laryngospasm in pediatric patients,[17] because of its depressive effect on laryngeal reflexes.[18] Other studies tried a small dose of propofol (0.5 mg.kg^{-1}) for resistant laryngospasm in obstetric anesthesia.[8]

The aim of this work was to compare the effectiveness of a small dose of propofol (0.5 mg.kg^{-1}) versus lidocaine (1.5 mg.kg^{-1}) for treatment of resistant post-extubation laryngospasm in obstetric patients, after failure of the standard measures and before the use of muscle relaxants.

Methods

After approval of our institutional ethical committee and informed consents of participants, this prospective study was conducted over a period of two years starting from March 2014, on all parturients of ASA class I or II, who were scheduled for cesarean delivery under general anesthesia. Patients were allocated into two groups in a sequential manner as described below. Exclusion criteria included; patients with known sensitivity to lidocaine or propofol, upper respiratory tract infection, history of bronchial asthma or other

lung diseases, chronic smoking, or chronic exposure to smokers, dust or fumes.

All patients were anesthetized by the same team of expert anesthesiologists, and with the same technique including; premedication with intravenous ranitidine 50 mg with metoclopramide 10 mg, airway evaluation for possible difficult intubation, and pre-oxygenation with 100% O_2. Anesthesia was then induced with propofol 2 mg.kg^{-1} and suxamethonium 1.5 mg.kg^{-1}. Sellick's maneuver was applied until tracheal intubation was achieved. Anesthesia was maintained with isoflurane in 100% oxygen and atracurium 0.5 mg.kg^{-1} after succinylcholine effect faded. After delivery, fentanyl 2 μg.kg^{-1} and oxytocin 20 units were given. Atropine 0.02 mg.kg^{-1} and neostigmine 0.05 mg.kg^{-1} were used for reversal of neuromuscular block under train-of-four monitoring. Extubation were done when the patient was fully awake, after proper suctioning of the upper airway.

The laryngospasm cases were treated according to the Anesthesia Department protocol and is not changed from case to case. Thus, we studied the cases in a sequential manner.

All patients who developed post-extubation laryngospasm throughout the two years of our study were initially managed with a standard protocol consists of: removal of the offending stimulus (oropharyngeal suctioning of secretions), jaw thrust, gentle positive airway pressure ventilation with 100% oxygen by bag and mask.[10,11] If the spasm was not relieved by one minute (as denoted on the wall clock), or oxygen saturation decreased below 93%, or it recurred again after it was relieved, we considered it as a resistant case and added the tested drug to the management protocol. In the first year, we gave a dose of iv lidocaine (1.5 mg.kg^{-1}) and considered the cases as lidocaine group (I), while in the second year we gave a dose of iv propofol (0.5 mg.kg^{-1}) and considered the cases as propofol group (II). In both groups, again, if the spasm was not relieved and oxygen saturation dropped to 85%, we gave a dose of iv succinylcholine (0.5 mg.kg^{-1}) to relieve the spasm and restore ventilation. The studied drug and succinylcholine were routinely drawn up before extubation, and their doses were calculated based on body weight in early pregnancy.

In both groups; the total number of parturients enrolled in the study, the number of cases who developed laryngospasm, those who were successfully treated with the standard protocol, others who required the tested drug to relieve the spasm, and those who required succinylcholine to relieve the spasm, and the incidence of complications (gastric distension, aspiration, NPPE, arrhythmias, or cardiac arrest) were recorded.

Statistical analysis

The period of recruiting cases was based on the incidence of laryngeal spasm in our department data base, aiming to recruit at least 38 cases in each study group. We assumed an objective of doubling the initial success rate to treat laryngeal spasm from 35%[17] to 70% before using succinylcholine, with the α value was 0.05 and the power $(1 - \beta)$ of the study was 0.80.

Data were analyzed using the SPSS statistics program (Version 16, SPSS Inc., Chicago, IL, USA). According to the type of data they were represented as mean and standard deviation (mean $\pm$ SD) or frequencies and percentages. Comparisons of the two studied groups were performed using either Student t-test or Mann–Whitney U test. In all tests results were considered statistically significant if p-value was less than 0.05.

Results

During the study period, 1837 out of 2043 pregnant women who underwent cesarean delivery under general anesthesia accepted to participate in the study, aging 18–42 years. 942 patients were done during the first year of the study and they represented the lidocaine group (I), and 895 were done during the second year and represented the propofol group (II). A total number of 89 patients developed post-extubation laryngospasm and consequently were entered in the trial: 47 patients in the lidocaine group (I) and 42 in the propofol group (II), as shown in Table 1.

In lidocaine group (I), 15/47 patients (31.9%) were successfully treated via standard protocol, and the remaining 32 patients required lidocaine treatment. 21/32 patients (65.6%) responded to lidocaine successfully and 11/32 patients (34.4%) required succinylcholine to relieve laryngospasm.

In propofol group (II), 13/42 patients (30.1%) were successfully treated via standard protocol, and the remaining 29 patients required propofol treatment. 24/29 patients (82.8%) responded to propofol successfully and 5/29 patients (17.2%) required succinylcholine to relieve laryngospasm.

The number of patients who developed post-extubation laryngospasm was comparable in the two studied groups. Also the number of those was treated successfully via the standard protocol showed no statistically significant difference between the two groups. Yet, the percentage of patients successfully treated by propofol without the need for succinylcholine was statistically significant higher than the number of those treated by lidocaine. No complications were recorded in both groups, as shown in Table 2.

Discussion

The results of this study showed that the incidence of laryngospasm after extubation in parturients underwent cesarean section under general anesthesia was less than 5%. These results are in agreement with the results of the study done by Afshan et al., who found that the incidence of laryngospasm was 3% out of 725 pediatric patients operated for inguinal hernia, orchidopexy and hydrocele under general anesthesia using Laryngeal Mask Airway (LMA),[17] and the incidence in the study done by Pak et al., which showed that 8.6% of pediatric patients submitted for strabismus and inguinal hernia repair surgery under general anesthesia with endotracheal intubation developed post-emergence laryngospasm.[19] In contrast, the incidence of laryngospasm in the present study was much lower than that in the study done by Leicht et al. (22%),[20] and in the control group of the study done by Batra et al. (20%).[21] This higher incidence of post-extubation laryngospasm in these two studies could be explained by the site and the type of the operation (tonsillectomy in the oropharynx) and the young age of the studied patients.

Table 1 Patient characteristics and number of patients developed laryngospasm.

	Group (I) lidocaine (n = 942)	Group (II) propofol (n = 895)	p-Value
Age (years)	28 ± 8	30 ± 6	0.242
ASA status I:II	533:409	498:397	0.253
Number of patients developed laryngospasm	47 (5%)	42 (4.7%)	0.371

Data represented as mean ± SD, ratio, number of patients and percentage (%).
No statistically significant differences between the two groups.

Table 2 Number of patients treated successfully via standard protocol, examined drug and succinylcholine.

	Group (I) lidocaine (n = 942)	Group (II) propofol (n = 895)	p-Value
Number of patients successfully treated via standard protocol	15/47 (31.9%)	13/42 (30.1%)	0.433
Number of patients successfully treated by examined drug	21/32 (65.6%)	24/29 (82.8%)[a]	0.041
Number of patients required succinylcholine	11/32 (34.4%)	5/29 (17.2%)[a]	0.033

Data represented as number & ratio and percentage (%).
[a] Statistically significant compared to group (I), p < 0.05.

The results of the present study also showed that the number of patients successfully treated via the standard protocol (oropharyngeal suctioning of secretions, jaw thrust, gentle positive airway pressure ventilation with 100% oxygen by bag and mask, and applying of firm pressure at a laryngospasm point) was comparable between the two studied groups, (31.9% and 31% in lidocaine and propofol groups respectively). These results were in agreement with the results of the study done by Afshan et al., which showed that 35% of cases were successfully treated with positive pressure ventilation via face mask,[17] and also in agreement with the standard-practice group of the study done Al-Metwalli et al. (38.4%).[22]

Regarding the patients necessitated the use of the studied drugs, the number of patients successfully treated with propofol was statistically significant higher than those successfully treated with lidocaine (82.7% and 65.6% respectively). These results are in accordance with the results of the study done by Afshan et al., which showed that propofol (0.8 mg.kg^{-1}) successfully relieved laryngospasm in 76.9% of cases.[17] Again, the results of the present study were supported by the results of the study done by Pak et al., who showed that no case of post-extubation laryngospasm reported with the use of small dose of propofol (0.25 mg.kg^{-1}) on emergence from anesthesia compared to the control group.[19]

In the present study, although lidocaine success rate to relieve laryngospasm was significantly lower than propofol; yet, it was still effective in 65.6% of cases. This is in contrast to the study done by Pernille et al., which showed no significant role of 1% lidocaine (0.15 mL.kg^{-1}) in the prevention of post-extubation laryngospasm in children.[20]

A main limitation of our study was the lack of randomization. Because laryngospasm is an emergency situation, we had to follow a fixed protocol over a period of time. Another limitation was the lack of a control group, because we had compared the efficacy of two drugs, one in each group. However, because the results of our study was promising, we recommend to do further randomized and double-blinded studies, to ensure the efficacy of the tested drugs.

In conclusion, small dose of propofol (0.5 mg.kg^{-1}) is marginally more effective than lidocaine (1.5 mg.kg^{-1}) for the treatment of resistant post-extubation laryngospasm in obstetric patients, after failure of the standard measures and before the use of muscle relaxants.

Conflicts of interest

The authors declare no conflicts of interest.

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