The Effect of Sevolurane on the Intraocular Pressure in Anesthetized Patients Undergoing Laparoscopic Cholecystectomy

Laparoskopik Kolesistektomi Operasyonu Geçiren Anestezi Altındaki Hastalarda Sevoflora'nın Göz İçi Basıncı Üzerine Etkisi

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ABSTARCT

Purpose: To assess the potential impact of sevoflurane anesthesia on intraocular pressure (IOP) in patients undergoing laparoscopic cholecystectomy.

Materials and Methods: The study included 34 elderly patients 60 and over who were to undergo a laparoscopic cholecystectomy for cholelithiazis. Mean arterial blood pressures (MBPs) and mean IOPs of both eyes were measured on five occasions: before anaesthetic induction (MBP1, IOP1), after anaesthetic induction and during mechanical ventilation (MBP2, IOP2), after pneumoperitoneum (MBP3, IOP3), after evacuation of pneumoperitoneum (MBP4, IOP4), and 1 hour after tracheal extubation (MBP5, IOP5).

Results: The mean age of patients was 63.24±6.61. MBPs were 114.51±22.05 (MBP1), 106.16±19.46 (MBP2), 101.07±16.32 (MBP3), 98.88±11.95 (MBP4), and 110.88±10.69 (MBP5). IOPs were 18.75±2.49 (IOP1), 16.47±3.2 (IOP 2), 17.09±3.52 (IOP3), 16.5±3.72 (IOP4), and 18.85±2.3 (IOP5). The effect of pneumoperitoneum on MBP and IOP was found to be statistically insignificant (p=0.135 and p=0.094, respectively).

Conclusion: IOP changes were in normal limits in elderly patients during laparoscopic cholecystectomy operation with sevofluran anesthesia.

Key Words: Intraocular pressure, sevofluran, laparoscopic cholecystectomy, pneumoperitoneum, general anesthesia.

ÖZ

Amaç: Sevofloran anestezisinin laparoskopik kolesistektomi geçiren hastalarda göz içi basıncı (GİB) üzerine potansiyel etkisini değerlendirmek.

Gereç ve Yöntem: Çalışmaya kolelithiazis nedeniyle laparoskopik kolesistektomi operasyonu geçirecek olan 60 yaş ve üzeri 34 hasta alındı. Ortalama arteriyel kan basınçları (OAKB) ve her iki gözün GİB'ları anestezi indüksiyonu öncesinde (OAKB1, GİB1) indüksiyonundan sonra ve mekanik ventilasyon sırasında (OAKB2, GİB2), pnömoperiton sonrası (OAKB3, GİB3), pnömoperitonun boşaltılmasından sonra (OAKB4, GİB4) ve ekstübasyonda 1 saat sonra (OAKB5, GİB5) olmak üzere beş kez ölçüldü.

Bulgular: Hastaların yaş ortalaması 63.24±6.61 idi. OAKB'ları 114.51±22.05 (OAKB1), 106,16±19.46 (OAKB2), 101.07±16.32 (OAKB3), 98.88±11.95 (OAKB4), ve 110.88±10.69 (OAKB5). GİB'ları 18.75±2.49 (GİB1), 16.47±3.2 (GİB2), 17.09±3.52 (GİB3), 16.5±3.72 (GİB4) ve 18.85 idi±2.3 (GİB5). OAKB ve GİB üzerine pnömoperiton etkisi istatistiksel olarak anlamlı bulunmamıştır (sırasıyla p=0.135, p=0.094).

Sonuç: GİB değişiklikleri sevofloran genel anestezisi ile laparoskopik kolesistektomi operasyonu sırasında yaşlı hastalarda normal sınırlar içinde seyretmiştir.

Anahtar Kelimeler: Göz içi basıncı, sevofloran, laparoskopik kolesistektomi, pnömoperitoneum, genel anestezi.

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INTRODUCTION

Glaucoma, a type of multifactorial optic neuropathy, causes vision loss as a result of progressive optic nerve degeneration, and commonly occurs at an advanced age. It is the second most common reason for vision loss worldwide, with a prevalence ranging from 1% to 5% in the population over 40 years old.[1-5] The most important risk factors for the disease are elevated intraocular pressure (IOP) and old age.[6] Through recent advances and developments in laparoscopic surgery, various surgeries, including cholecystectomy, can now be achieved by using the laparoscopic technique.[7-8] The effect of this method on IOP has been assessed in several studies, with different results.[8-12] Commonly, laparoscopic surgery under general anaesthesia is known to be a safe method for young individuals without an ophthalmologic problem. However, although there have been several studies on both paediatric cases and young individuals, to our knowledge, there have been no previous studies that have investigated IOP changes in elderly individuals. Therefore, it is important to investigate possible IOP changes due to laparoscopic cholecystectomy performed on elderly individuals, who are at risk of developing glaucoma. The study aims to examine this issue.

MATERIALS AND METHODS

The study protocol was approved by the Medical Ethical Committee with consideration of the principles of the Helsinki Declaration.[13] All participants provided written informed consent. A total of 34 patients aged 60 and over, with an ASA score of I or II, who were to undergo laparoscopic cholecystectomy, were included in the study. All patients in the study underwent a detailed ophthalmic examination prior to the operation. Patients with previous ocular surgery history, corneal pathology, glaucoma, ocular hypertension, and uveitis were excluded from the study. The age, gender, height, and weight of patients were recorded during the preoperative examination. All patients were under general anaesthesia during the operation, and none of the participants received preoperative medication. Standard monitoring (heart rate, electrocardiography, arterial blood pressure, and oxygen saturation) was applied for all participants in the operation room. To induce anaesthesia, all patients received 3 mg/kg propofol, 2 µg/kg fentanyl, and 0.6 mg/kg rocuronium. Intubation was performed after anaesthesia induction. In all cases, 2% sevoflurane and a 40%/60% oxygen/air mixture were used for anaesthesia maintenance. During general anaesthesia, laparoscopic abdominal skin ports were opened, pneumoperitoneum was achieved under 14 cm H_2O pressure, and patients were extubated after the laparoscopic cholecystectomy procedure.

During the study, the IOP of both eyes was measured on five occasions using a TonoPen applanation tonometer (Tono-Pen®XL; Reichert Inc., Depew, NY, USA): before anaesthetic induction (IOP1), after anaesthetic induction during mechanic ventilation (IOP2), after pneumoperitoneum (IOP3), after evacuation of pneumoperitoneum (IOP4), and 1 hour after tracheal extubation (IOP5).

At the same time non-invasive systolic/diastolic and mean arterial blood pressures (MBPs) were measured, and MBP was recorded: before anaesthetic induction (MBP1), after anaesthetic induction and during mechanic ventilation (MBP2), after pneumoperitoneum (MBP3), after evacuation of pneumoperitoneum (MBP4), and 1 hour after tracheal extubation (MBP 5). All measurements were performed while patients were lying in supine position. All measurement values are presented as the mean±standard deviation, with the normal range indicated in parentheses.

Repeated-measures analysis of variance was used to compare all five measurement values obtained during the study. In the correlation analysis, Pearson's correlation test was used. All variables were distributed normally. Paired t-test was used to compare the groups. P values <0.05 were considered statistically significant.

RESULTS

A total of 34 patients [25 women (73.5%) and 9 men (26.5%)] were included in the study. The mean age of the patients was 64.5±5.9 years (60-76 years), (Table 1). No complications due to general anaesthesia or surgical intervention were observed in the study group. Mean pneumoperitoneum time for the study group was 28.82±8.22 minutes (18-48 minutes). MBPs recorded in the period after induction of anaesthesia (p=0.008), MBPs recorded during the post-pneumoperitoneum period (p<0.0001) and the period after evacuation of pneumoperitoneum (p<0.0001) were statistically significant when compared to the period during preanaesthesia.

Table 1: *Patient characteristics.*

	Value (n=34)
Age	64.5±5.9 (60-76)
Gender (F/M)	
Female	25
Male	9
Height (cm)	164.74±7.48 (155-187)
Weight (kg)	75.12±10.07 (60-99)
BMI (kg/m^2)	27.79±4.12 (20.9-38.67)

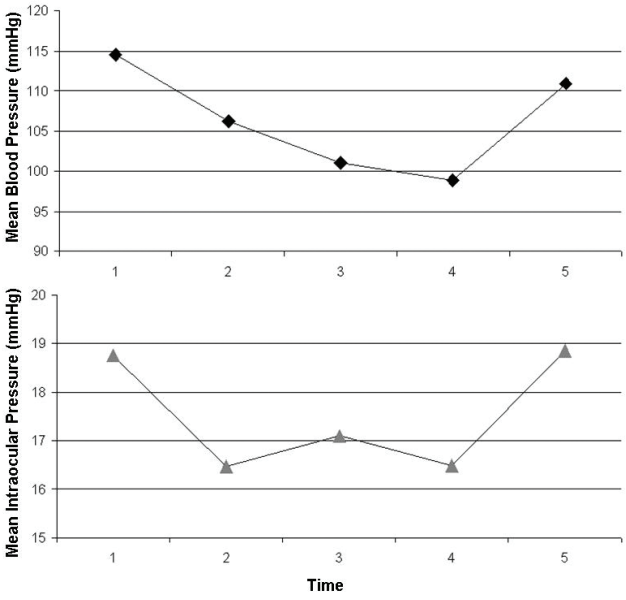
Table 2: *Mean arterial blood pressure and intraocular pressure values obtained at different time periods.*

Time	Mean blood pressure	Mean intraocular pressure
Before anaesthesia	114.51±22.05 (80.5-185)	18.75±2.49 (13-21)
After anaesthetic induction	106.16±19.46 (78-159.5)	16.47±3.2 (9-20.5)
After pneumoperitoneum	101.07±16.32 (69.5-157.5)	17.09±3.52 (11-22)
After evacuation of pneumoperitoneum	98.88±11.95 (78-136.5)	16.5±3.72 (10-21.5)
One hour after tracheal extubation	110.88±10.69 (96.5-136)	18.85±2.3 (12.5-21)

However, the difference in the MBPs during the preanaesthetic period and 1 hour after extubation (p=0.207) was not statistically significant (Table 2, Graphic). Mean IOPs recorded after induction of anaesthesia (p<0.0001), during the post-pneumoperitoneum period (p = 0.001) and the period after evacuation of pneumoperitoneum (p<0.0001) were statistically significant when compared to the period during preanaesthesia. However, comparison of the MBPs during the preanaesthetic period and 1 hour after extubation (p=0.697) was not statistically significant (Table 2, Graphic).

The effect of pneumoperitoneum on MBP and IOP was found to be statistically insignificant (p=0.135 and p=0.094, respectively).

Correlation analysis showed a relationship between MBP and IOP during the post-anaesthesia induction period (r=0.406, p=0.017) and after evacuation of pneumoperitoneum (r=0.482, p=0.004), but not during other periods (p>0.05 for all).



Graphic: *Mean arterial blood pressure (MBP) and intraocular pressure (IOP) values (mmHg) for five different time periods: (1) before anaesthesia, (2) after anaesthetic induction, (3) after pneumoperitoneum, (4) after evacuation of pneumoperitoneum, and (5) 1 hour after tracheal extubation).*

DISCUSSION

Monitoring IOP changes during general anaesthesia is an important aspect of perianaesthesic care for a patient presenting with an eye disorder.[14] It is also useful in testing hemodynamic response to anaesthesia and to changes in body position.[10,11]

In the literature, relevant studies have presented conflicting results. However, most of these studies indicate that induction of general anaesthesia causes a decline in IOP.[8-11]

In the present study, we obtained similar results-a significant decline in IOP levels after induction of anaesthesia. The anaesthesia technique used is one of the keys to preventing changes in IOP during a laparoscopic surgery.

Mowafi et al.,[8] investigated the effects of two anaesthesia techniques on IOP during gynecologic laparoscopy. They compared isoflurane inhaled anaesthesia and total IV propofol anaesthesia. They recorded IOP levels in 40 female patients with no history of eye disorder. For both techniques, they showed that IOP levels declined significantly after induction of anaesthesia.

In the propofol group, the decline was sustained during the post-pneumoperitoneum period. However, in the isoflurane group, IOP levels rose significantly compared to the preinduction period. They concluded that propofol anaesthesia is protective against increases in IOP levels during the pneumoperitoneum period.[8] We used propofol only during induction and used sevoflurane to maintain anaesthesia.

In contrast to the study of Mowafi et al.,[8] we did not find an increase in IOP levels during the pneumoperitoneum period. Although it is known that propofol causes a decline in IOP levels,[15,16] It is not clear how propofol prevents the increase in IOP during laparoscopic surgery. It is hypothesized that the mechanism involves a negative propofol effect on release of arginine vasopressin.[8,17] Our study failed to establish a relationship between laparoscopic surgery and changes in IOP levels.

In this respect, the results of our study are consistent with those of Lentschener et al.,[9] who found no correlation between an increase in intraperitoneal pressure caused by a pneumoperitoneum of 15 mmHg and changes in IOP levels.

In conclusion, our study showed that IOP changes were in normal limits in an elderly population during laparoscopic cholecystectomy operation with general anesthesia.

REFERENCES/KAYNAKLAR

1. Olsen J, Berdeaux G, Skov J. Glaucoma costs in Denmark in treatment naive patients. Acta Ophthalmol 2011;11. doi: 10.1111/j.1755-3768.2011.02212.x.
2. Anraku A, Jin YP, Butty Z, et al. The Toronto epidemiology glaucoma survey: a pilot study. Can J Ophthalmol 2011;46:352-7.
3. Song W, Shan L, Cheng F, et al. Prevalence of glaucoma in a rural northern china adult population: a population-based survey in kailu county, inner mongolia. Ophthalmology 2011;118:1982-8.
4. Chen J, Runyan SA, Robinson MR. Novel ocular antihypertensive compounds in clinical trials. Clin Ophthalmol 2011;5:667-77.
5. Gupta SK, Niranjan DG, Agrawal SS, et al. Recent advances in pharmacotherapy of glaucoma. Indian J Pharmacol 2008;40:197-208.
6. Garudadri C, Senthil S, Khanna RC, et al. Prevalence and risk factors for primary glaucomas in adult urban and rural populations in the Andhra Pradesh Eye Disease Study. Ophthalmology 2010;117:1352-9.
7. Lau KN, Sindram D, Agee N, et al. Bile duct injury after single incision laparoscopic cholecystectomy. JSLS 2010;14:587-91.
8. Mowafi HA, Al-Ghamdi A, Rushood A. Intraocular pressure changes during laparoscopy in patients anesthetized with propofol total intravenous anesthesia versus isoflurane inhaled anesthesia. Anesth Analg 2003;97:471-4.
9. Lentschener C, Benhamou D, Niessen F, et al. Intra-ocular pressure changes during gynaecological laparoscopy. Anaesthesia 1996;51:1106-8.
10. Alon E, Robert YC, Dekker PW. Continuous monitoring of intraocular pressure is helpful in testing hemodynamic response to anesthesia and to changes in body position. J Clin Monit Comput 1998;14:77.
11. Robert YC, Dekker PW, Battig U, et al. Measurement of intraocular pressure during laparoscopy and its relationship to central venous pressure. J Am Assoc Gynecol Laparosc 1998;5:125-8.
12. Astuto M, Minardi C, Uva MG, et al. Intraocular pressure during laparoscopic surgery in paediatric patients. Br J Ophthalmol 2011;95:294-5.
13. World Medical Association (WMA). Declaration of Helsinki. 1964. As amended by the WMA 52nd General assembly, Edinburgh, Scotland, October 2000.
14. Chawda PM, Pareek MK, Mehta KD. Effect of nalbuphine on haemodynamic response to orotracheal intubation. J Anaesthesiol Clin Pharmacol 2010;26:458-60.
15. Lauretti GR, Lauretti CR, Lauretti-Filho A. Propofol decreases ocular pressure in outpatients undergoing trabeculectomy. J Clin Anesth 1997;9:289-92.
16. Schäfer R, Klett J, Auffarth G, et al. Intraocular pressure more reduced during anesthesia with propofol than with sevoflurane: both combined with remifentanil. Acta Anaesthesiol Scand 2002;46:703-6.
17. Inoue Y, Shibuya I, Kabashima N, et al. The mechanism of inhibitory actions of propofol on rat supraoptic neurons. Anesthesiology 1999;91:167-78.