RESEARCH ARTICLE / *Araştırma Makalesi*

Evaluation of Intraocular Pressure in Hysteroscopic Surgery

Histeroskopik Cerrahide Göz içi Basıncının Değerlendirilmesi

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Geliş Tarihi / Received : **07.09.2020** Kabul Tarihi / Accepted : **06.10.2020**

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(Sakarya Tıp Dergisi / ***Sakarya Med J*** **2020, 10(4):549-555) DOI: 10.31832/smj.791461**

Abstract

Objective To assess the intraocular pressure (IOP) alterations before, during, and after hysteroscopy and to compare the measurements of two different hysteroscopy methods.

Materials and Methods In this retrospective study included 52 female patients who applied to the Obstetrics and Gynecology clinic of a tertiary university hospital between October 2017 and February 2020 and underwent hysteroscopy procedures. The participants were matched in reference to their age, body mass index and preoperative IOP and separated into 2 groups according to the hysteroscopy method (monopolar probe-glycin 1.5% solution (MG) and bipolar probe-isotonic solution (BI)). The IOP measurements were performed preoperatively, intraoperatively, and 12 hours after the procedure by using a portable tonometer.

Results The mean age of the participants was 50.69±7.56 years in the MG and 52.69±6.66 years in the BI groups. The mean preoperative, intraoperative and postoperative IOP measurements of the MG and BI groups were 13.69 ± 2.22, 26.62 ± 3.08, 14.69 ± 2.57 mm-Hg and 13.38 ± 1.81, 20.31 ± 2.05, 13.69 ± 1.59 mm-Hg, respectively. The mean intraoperative IOP values were significantly higher than preoperative and postoperative measurements in both groups. However, there was no significant difference between the mean intraoperative and postoperative values in any of the groups.

Conclusion The IOP peaks occurred during hysteroscopy in both methods and the utilization of monopolar probe and glycine 1.5% solution caused significantly higher fluctuations. Therefore, close monitoring of intraoperative IOP may help to prevent severe ocular complications.

Keywords Glycine; hysteroscopy; intraocular pressure; tonometry

Öz

Amaç *Histeroskopi öncesinde, esnasında ve sonrasında göz içi basıncı (GİB) değişimlerini değerlendirmek ve iki farklı histeroskopi metodunda ölçümleri karşılaştırmak*

Gereç ve Yöntemler *Bu retrospektif çalışmaya, Ekim 2017-Şubat 2020 tarihleri arasında bir üçüncü basamak üniversite hastanesinin Kadın Hastalıkları ve Doğum kliniğine başvuran ve histeroskopi işlemi uygulanan 52 kadın hasta dahil edildi. Katılımcılar yaş, vücut kitle indeksi ve cerrahi öncesi GİB değerlerine göre eşleştirildi ve histeroskopik cerrahide kullanılan yöntemlere göre gruplara ayrıldı (monopolar prob-glisin %1,5 solüsyon (MG) ve bipolar prob- izotonik solüsyon (BI)). Cerrahi öncesi, esnasında ve 12 saat sonrasında GİB ölçümleri taşınabilir tonometri cihazı kullanılarak yapıldı.*

Bulgular *Katılımcıların ortalama yaşı MG grubunda 50,69±7,56 yıl, BI grubunda ise 52,69±6,66 yıldı. Cerrahi öncesinde, esnasında ve sonrasında ortalama GİB ölçümleri MG grubunda sırasıyla 13,69 ± 2,22, 26,62 ± 3,08, 14,69 ± 2,57 mm-Hg ve BI grubunda sırasıyla 13,38 ± 1,81, 20,31 ± 2,05, 13,69 ± 1,59 mm-Hg idi. Her iki grupta da cerrahi esnasında ortalama GİB ölçümleri cerrahi öncesi ve sonrasına kıyasla anlamlı olarak yüksekti. Ancak, cerrahi öncesi ve sonrası değerler arasında her iki grupta da anlamlı fark yoktu.*

Sonuç *Her iki yöntemde de histeroskopi esnasında GİB pikleri meydana geldi ve monopolar prob ve glisin 1,5% solüsyonu kullanımı belirgin olarak daha yüksek dalgalanmalara neden oldu. Bu nedenle, cerrahi esnasında GİB'nın yakın izlemi ciddi oküler komplikasyonların gelişimini önleyebilir.*

Anahtar Kelimeler *Glisin; histeroskopi; göz içi basıncı; tonometri*

INTRODUCTION

Hysteroscopy is widely used for the treatment and diagnosis of several gynecological conditions such as endometrial ablation, septum resection, myomectomy, and polypectomy.[1] It significantly diminishes the operational time and provides rapid recovery that reduces hospitalization.[2] Nevertheless, it is not completely safe and complication rates were reported to occur 0.24-10% in different studies.[3,4]

The hysteroscopy procedure can be performed with general, epidural and spinal anesthesia, using monopolar or bipolar probes, and with a variety of different alternatives of the non-electrolytic or isotonic solutions. All of these options have distinct advantages and disadvantages. However, similar surgical outcomes have been reported with monopolar and bipolar hysteroscopy.[5] Both diagnostic and operative hysteroscopic interventions require uterine distension, and non-electrolytic fluids (glycine, mannitol, sorbitol) are used with the monopolar probe, while the isotonic saline solution is used with the bipolar probe for the same purpose.[6] Glycine 1.5% solution is widely used in hysteroscopy for its advantages as being a non-conductive fluid which provides good optical visualization and causes minimal hemolysis.[1,7] On the other hand, the overload of non-electrolytic fluids may lead to side effects such as hyponatremia, pulmonary and/or brain edema, decreased serum osmolarity, and visual symptoms.[7,8] Besides, the neurotoxic and oculotoxic side effects due to the end-products of glycine catabolization were also mentioned in few case reports.[9,10]

The normal range of intraocular pressure (IOP) is between 10-21 mm-Hg. This balance is obtained by various factors such as intraocular aqueous humor production and filtration, choroidal serum osmolarity, scleral rigidity, orbicularis oculi tension, and episcleral venous pressure.[11] The type of anesthesia, the patient's intraoperative posture, and its duration and the fluids utilized during hysteroscopy may fluctuate the IOP.[12] Sudden peaks of IOP may decrease ocular perfusion pressure which is calculated by the difference between mean systemic arterial pressure and IOP, and that may aggravate several ocular diseases such as retinal ischemia and glaucoma.[13] Currently, non-invasive intraoperative IOP measurement is available by portable digital tonometer devices which do not require specially trained staff.[14]

Previous studies reported that the steep Trendelenburg position increased IOP by 158% during laparoscopic surgery, and the use of general anesthesia for hysteroscopy resulted in higher fluctuations of IOP compared to spinal anesthesia.[15,16] However, none of the previous studies investigated the effect of different fluids and probes used in hysteroscopy on IOP alterations. In this study, we evaluated the IOP measurements of patients in the same age group who underwent hysteroscopy with a similar anesthetic method and intraoperative posture by the same surgeon (SÇ). Therefore, we aimed to compare the IOP alterations in two different hysteroscopy methods.

MATERIALS AND METHODS

Study Group

In this retrospective, cross-sectional descriptive study included 52 female patients who applied to the Obstetrics and Gynecology clinic of a tertiary university hospital between October 2017 and February 2020 and underwent hysteroscopy procedures under spinal anesthesia for various benign endometrial and uterine pathologies. Patients who underwent hysteroscopic procedures with bipolar probe-isotonic fluid (BI) in our clinic from October 2017 to February 2019 and those who underwent with monopolar probe-glycine solution from February 2019 to February 2020 were included in the study. Ethics Committee of Recep Tayyip Erdoğan University Faculty of Medicine approved the study protocol (approval number and date 2020/114, 24.06.2020) and all researchers assured to comply with the tenets of the Declaration of Helsinki.

The study included patients between 40-65 years old, BMI≤35 kg/m2 diagnosed as endometrial polyp, endome-

trial thickening, postmenopausal bleeding, uterine myoma, with no history of chronic systemic and/or ocular diseases, no previous eye surgery, and pre-operative IOP≤21 mm-Hg. In addition, the study consisted of patients who had no complications during the hysteroscopic procedure and had not previously undergone hysteroscopic surgery. All patients underwent a detailed eye examination, including visual acuity, tonometry, and biomicroscopy before and after surgery. The IOP measurements were performed by Tono-Pen Avia (Reichert, Munich, Germany) handheld tonometer before, during the hysteroscopy, and 12 hours after the procedure by the same examiner (MGA). All measurements were repeated three times and the mean of two eyes' measurements was recorded to a computer system for statistical analysis. None of the patients received any of topical anti-glaucomatous eye drops intraoperatively even if an increase was observed at the measurements in order to avoid the confounding effect of the medications.

Spinal Anesthesia and Hysteroscopy Procedure

All hysteroscopic procedures performed by the same surgeon (SÇ) between 2017 and 2020 were evaluated retrospectively. Operative hysteroscopy (Karl Storz GmbH&Co., Tuttlingen, Germany) was performed under spinal anesthesia with a 7mm hysteroscope with hegar uterine dilators cervix. Isotonic saline solution was used during the bipolar electric probe and glycine fluid solution was used during the monopolar electric probe. Quantities of in-put and out-put solution liquids were recorded. The fluid infusion was controlled by Hamou Hysteromat hysteroscopy (Karl Storz GmbH&Co., Tuttlingen, Germany). All patients had a standardized 80-millimeter mm-Hg of intrauterine pressure during surgery. Prophylactic oral doxycycline was postoperatively prescribed to all patients for 7 days.

All patients were assessed preoperatively for anesthesia and were American Society of Anesthesia classification (ASA) 2 or 3. Patients were anesthetized using similar standardized spinal anesthetic as per hospital practice. On arrival to the operating room, patients received standard monitoring including electrocardiogram, pulse oximetry, and blood pressure. The spinal anesthesia was applied to all patients from the L3–4 or L4–5 intervertebral space with a 25-gauge spinal needle using hyperbaric Bupivacaine 10.0 milligrams (mg); (5.0 mg/mL, 0.5% of 2 mL) with Fentanyl 25 µgm intrathecally under aseptic technique. After achieving sufficient block and waiting 10 min, the patient was put into the prone position. All patients were maintained on intravenous fluids 120 mL/hour and any fluid deficit was replaced.

Data Analysis

Statistical analyses were performed using SPSS version 23.0 for Windows (SPSS, Inc., Chicago, IL). Sample size calculation was conducted using WSSPAS: Web-Based Sample Size & Power Analysis Software.[17] The variables were investigated with analytical methods to determine whether they were normally distributed. Descriptive statistics were presented as mean ± SD for normally distributed variables and Repeated measures ANOVA test was used to compare normally distributed values at three-time points. Bonferroni correction was performed for multiple comparisons. Independent samples t-test was used for the comparison of differences between groups. Mixed-effects models were formed to investigate the effects of age and BMI on IOP measurements. All analyses were performed with a power of 95 % CI. The level of statistical significance was set at $p<0.05$.

RESULTS

There were 26 patients in each group and no significant difference was detected between the MG and BI groups in terms of age, BMI, and preoperative IOP measurements. The demographic data and baseline characteristics of the participants are shown in Table 1.

Table 1. The demographic data and characteristics of the patients

	Monopolar-Glycine Group		Bipolar-Isotonic Group		
	Mean	**SD**	**Mean**	**SD**	**p***
Age (years)	50.69	7.56	52.69	6.66	0.316
BMI (kg/m2)	28.93	4.56	28.50	2.97	0.688
Operational time (min)	26.73	7.47	30.96	6.00	0.29
Input volume (ml)	2592.31	1035.34	3319.23	762.11	0.006
Output volume (ml)	1657.69	923.54	2076.92	735.55	0.76
Post-op Na	138.73	2.50	139.08	2.79	0.746
Systolic BP (mm-Hg)	134.46	10.65	134.15	12.29	0.956
Diastolic BP (mm-Hg)	85.23	7.11	84.35	6.02	0.506

BP: Blood pressure
*Independent Samples t-test
Significant values (p<0.05) are shown in bold

The mean preoperative, intraoperative and postoperative IOP measurements of the MG and BI groups were 13.69 ± 2.22, 26.62 ± 3.08, 14.69 ± 2.57 mm-Hg and 13.38 ± 1.81, 20.31 ± 2.05, 13.69 ± 1.59 mm-Hg, respectively. The mean intraoperative IOP values were significantly higher than preoperative and postoperative measurements in both groups. However, there was no significant difference between the mean intraoperative and postoperative values in any of the groups. The intraoperative IOP increase was significantly higher in the MG group compared to the BI group. Although the mean postoperative IOP was slightly higher in the MG group, this difference was not statistically significant. (Table 2)

The mean operational times of the patients were 26.73 ± 7.47 minutes in the MG group and 30.96 ± 6.00 minutes in the BI group. This difference was statistically significant. Besides, the fluid input was significantly positively correlated with operational time and was significantly lower in the MG group (p<0.001, r=0.658). However, there were no significant differences between the two groups in terms of post-operative Na, systolic, and diastolic blood pressures. Besides, we found a correlation between neither operation

Table 2. The intraocular pressure measurements of patients and the alterations in time

IOP	**Monopolar-Glycine Group**		**Bipolar-Isotonic Group**			**p***	**Age&BMI adjusted p****	
(mm-Hg)	13.69±2.22		13.38±1.81			0.587	0.727	
Pre-op	26.62±3.08		20.31 ±2.05			**<0.001**	0.020	
Intra-op	14.69±2.57		13.69±1.59			0.098	0.107	
Post-op			**Δ IOP (Postop-Preop)**			**Δ IOP (Postop –Intraop)**		
MG	**BI**	**p***	**MG**	**BI**	**p***	**MG**	**BI**	**p***
12.92±2.33	6.92±1.38	<0.001	1.0±1.78	0.30±1.35	0.121	-11.92±3.02	-6.61±2.04	<0.001

Δ: Difference, IOP: Intraocular Pressure, MG: Monopolar-Glycine, BI: Bipolar-Isotonic
*Independent Samples t-test **Mixed effect models Significant values (p<0.05) are shown in bold

time nor postoperative Na values and intraoperative IOP changes (p>0.05). The most common indication for hysteroscopy was endometrial polyp in both groups (76.92% of MG, 73.07% of BI groups), (Figure 1).

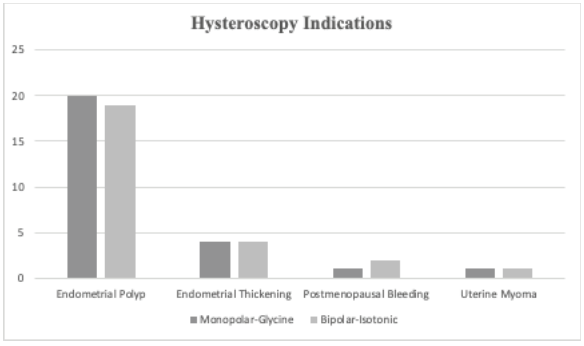

Figure 1. The diagnosis distribution of the participants for hysteroscopy

DISCUSSION

This study revealed that the intraoperative IOP significantly increased with the use of both monopolar probe-glycine 1.5% and bipolar probe-isotonic fluids in patients who underwent hysteroscopy. The IOP difference between intraoperative and preoperative measurements was significantly higher in the MG group compared to the BI group. However, there was no significant difference between IOP values at the post-operative 12-hour measurements between the two groups.

The fluids used during the hysteroscopy procedure can be systemically absorbed in 3 different pathways; intravascular, extravascular, and peritoneal.[18] Rapid intravasation occurs particularly in cases where intracavitary pressure exceeds systemic blood pressure.[19] Thus, blood osmolarity and electrolyte balance may alter depending on the properties of the fluid. Roy et al. obtained lower postoperative Na values with the monopolar probe compared to the bipolar in hysteroscopy.[20] Although we also detected lower postoperative mean Na values in the MG group, the difference was not statistically significant. However, Karcı et al. reported that the toxic effects of glycine may even occur without postoperative hyponatremia.[9] The fluid type is crucial for IOP fluctuations. Crystalloid solutions increase the flow of fluids into the extracellular compartment and that decreases the circulating blood oncotic pressure.[12] Hence, the decrease in choroidal vascular osmolarity increases the intravitreal fluid volume which leads to the increase of IOP as in the MG group of this study. A 750-1000 ml of deficit is as considered safe for hypotonic solutions and that can increase up to 2500 ml for isotonic solutions.[21] In our study, the volume deficit was 934.61±211.55 ml in the MG group and 1242.30±200.34 ml in the BI group. Although the deficit was significantly lower in the MG group, that can be suggested that the osmotic load of the solutions is a more important determinant in the IOP changes rather than the amount of the absorbed fluids.

The IOP is affected by the patient's posture during the surgical procedures. Even in healthy individuals, the prone posture increases the IOP within a few minutes and the increase may reach an average of 20 mm-Hg in 2-5 hours.[22,23] In Trendelenburg and steep Trendelenburg positions, this rate can increase by up to 158%.[22,24,25] In our study, the intraoperative the IOP increased significantly in both groups with lithotomy position compared to preoperative values. The intraoperative lithotomy position mimics the systemic side effects of the steep Trendelenburg position.[26] The aqueous humor passes to the systemic circulation by filtering through the trabecular meshwork and the episcleral veins. In the lithotomy position, the high pressure due to the congestion in episcleral veins causes the filtration gradient to decrease.[27] Besides, the forward motion of the iris-lens diaphragm in the lithotomy position may also narrow the iridocorneal angle and reduce filtration.[27] Therefore, the posture may increase the IOP via both mechanisms. In this study, all patients underwent hysteroscopy in the same lithotomy position, and the same pillow was used which provided head support without any elevation. Thus, the significant IOP increase in both groups can be explained by the intraoperative posture. It was suggested that elevating the head over the heart level may decrease the episcleral pressure, hence the IOP peaks can be prevented.[12]

The prolonged operational times eventually increase fluid input. However, Roy et al.reported no significant difference between monopolar and bipolar hysteroscopy operational times.[20] On the other side, Berg et al. reported shorter operational time in hysteroscopy with monopolar probes.6 Similarly in this study, the operational time was significantly shorter in the MG group. That might be related to the more cautious attitude of the surgeon performing the hysteroscopy procedure due to the well-known side effects of glycine 1.5% solution. Glycine, which is a non-essential amino acid, is eliminated from the body by oxidative deamination in the liver and kidney, forming toxic metabolites; glycolic acid, and ammonia.[7,28] Particularly hyperammonemia was accused of transient vision loss after hysteroscopy.[9] Nevertheless, Pinar et al. did not find any correlation between the operational time and IOP.[16] Similarly in our study, there was no correlation between IOP and the duration of hysteroscopy. That can be explained by the fact that hysteroscopy is a quick procedure. The maximum operational time was 45 minutes in both groups. Moreover, all patients in this study received spinal anesthesia which may have reduced the total operating room times, as well as the IOP.

This study had some limitations. Firstly, we could only perform one measurement intraoperatively. That would be interesting to observe IOP fluctuations with multiple measurements at different stages of the hysteroscopy. Besides, due to the small sample size of the study, that was not possible to create subgroups according to the hysteroscopy indications. The subgroup analysis with more participants may provide valuable data on IOP alterations of patients who underwent hysteroscopy.

As a result, we found an increase in IOP in both groups during hysteroscopy and monopolar hysteroscopy procedure with glycine 1.5% caused higher IOP fluctuations compared to bipolar hysteroscopy with isotonic fluid. Considering the visual impairments caused by short-term IOP peaks, it is important to detect these peaks by intraoperative measurements. Head elevation and use of topical antiglaucomatous drops may help to prevent ocular complications, especially in cases where IOP exceeds normal limits.

Ethics Committee Approval

Ethics Committee Approval of the study was obtained from the Ethics Committee of Recep Tayyip Erdoğan University Faculty of Medicine (Date: 24.06.2020, Approval number: 2020/114).

References

1. *Sethi N, Chaturvedi R, Kumar K. Operative hysteroscopy intravascular absorption syndrome: A bolt from the blue. Indian J Anaesth. 2012;56:179-182. doi:10.4103/0019-5049.96342.*
2. *Stamatellos I, Koutsougeras G, Karamanidis D, Stamatopoulos P, Timpanidis I. Bontis, J. Results after hysteroscopic management of premenopausal patients with dysfunctional uterine bleeding or intrauterine lesions. Clin Exp Obstet Gynecol. 2007;34:35-38.*
3. *Aydeniz B, Gruber IV, Schauf B, Kurek R, Meyer A, Wallwiener D. A multicenter survey of complications associated with 21 676 operative hysteroscopies. Eur J Obstet Gynecol Reprod Biol. 2002;104:160-164. doi:10.1016/S0301-2115(02)00106-9.*
4. *Propst AM, Liberman RF, Harlow BL, Ginsburg ES. Complications of hysteroscopic surgery: Predicting patients at risk. Obstet Gynecol. 2000;96:517-520. doi:10.1016/S0029-7844(00)00958-3.*
5. *Tammam AE, Ahmed HH, Abdella AH, Taha SAM. Comparative study between monopolar electrodes and bipolar electrodes in hysteroscopic surgery. J Clin Diagnostic Res. 2015;9:QC11-QC13. doi:10.7860/JCDR/2015/16476.6792.*
6. *Berg A, Sandvik L, Langebrekke A, Istre O. A randomized trial comparing monopolar electrodes using glycine 1.5% with two different types of bipolar electrodes (TCRis, Versapoint) using saline, in hysteroscopic surgery. Fertil Steril. 2009;91:1273-1278. doi:10.1016/j.fertnstert.2008.01.083.*
7. *Witz CA, Silverberg KM, Burns WN, Schenken RS, Olive DL. Complications associated with the absorption of hysteroscopic fluid media. Fertil Steril. 1993;60:745-756. doi:10.1016/S0015-0282(16)56268-2.*
8. *Hahn RG. Is glycine a safe irrigating fluid? [1]. Acta Anaesthesiol Scand. 1997;41:545. doi:10.1111/j.1399-6576.1997.tb04740.x.*
9. *Karci A, Erkin Y. Transient blindness following hysteroscopy. J Int Med Res. 2003;31:152-155. doi:10.1177/147323000303100213.*
10. *Pramod A, Rajagopal S, Padmanabha Iyer V, Murthy HS. Glycine induced acute transient postoperative visual loss. Indian J Anaesth. 2015;59:318-319. doi:10.4103/0019-5049.156890.*
11. *Cunningham AJ, Barry P. Intraocular pressure -physiology and implications for anaesthetic management. Can Anaesth Soc J. 1986;33:195-208. doi:10.1007/BF03010831.*
12. *Nuzzi R, Tridico F. Ocular Complications in Laparoscopic Surgery: Review of Existing Literature and Possible Prevention and Treatment. Semin Ophthalmol. 2016;31:584-592. doi:10.3109/08820538.2015.1009557.*
13. *Van Keer K, Breda JB, Pinto LA, Stalmans I, Vandewalle E. Estimating Mean Ocular Perfusion Pressure Using Mean Arterial Pressure and Intraocular Pressure. Invest Ophthalmol Vis Sci. 2016;57:2260. doi:10.1167/iovs.16-19375.*
14. *Panek WC, Boothe WA, Lee DA, Zemplenyi E, Pettit TH. Intraocular pressure measurement with the Tono-Pen through soft contact lenses. Am J Ophthalmol. 1990;109:62-65. doi:10.1016/S0002-9394(14)75580-1.*
15. *Walick KS, Kragh JE, Ward JA, Crawford JJ. Changes in intraocular pressure due to surgical positioning: Studying potential risk for postoperative vision loss. Spine (Phila Pa 1976). 2007;32:2591-2595. doi:10.1097/BRS.0b013e318158cc23.*
16. *Pınar HU, Kaşdoğan ZEA, Başaran B, Çöven İ, Karaca Ö, Doğan R. The effect of spinal versus general anesthesia on intraocular pressure in lumbar disc surgery in the prone position: A randomized, controlled clinical trial. J Clin Anesth. 2018;46:54-58. doi:10.1016/j.jclinane.2018.01.026.*
17. *Arslan AK, Yaşar Ş, Çolak C, Yologlu S. WSSPAS: An Interactive Web Application for Sample Size and Power Analysis with R Using Shiny. Turkiye Klin J Biostat. 2018;10:224-246. doi:10.5336/biostatic.2018-62787.*
18. *Motashaw ND, Dave S. Vision disturbances after operative hysteroscopy. J Am Assoc Gynecol Laparosc. 1999;6:213-215. doi:10.1016/S1074-3804(99)80106-6.*
19. *Hahn RG. Fluid absorption in endoscopic surgery. Br J Anaesth. 2006;96:8-20. doi:10.1093/bja/aei279.*
20. *Roy KK, Kansal Y, Subbaiah M, Kumar S, Sharma JB, Singh N. Hysteroscopic septal resection using unipolar resectoscope versus bipolar resectoscope: Prospective, randomized study. J Obstet Gynaecol Res. 2015;41:952-956. doi:10.1111/jog.12646.*
21. *Umranikar S, Clark TJ, Saridogan E, Miligkos D, Arambage K, Torbe E et al. BSGE/ESGE guideline on management of fluid distension media in operative hysteroscopy. Gynecol Surg. 2016;13:289-303. doi:10.1007/s10397-016-0983-z.*
22. *Ozcan MS, Praetel C, Tariq Bhatti M, Gravenstein N, Mahla ME, Seubert CN. The effect of body inclination during prone positioning on intraocular pressure in awake volunteers: A comparison of two operating tables. Anesth Analg. 2004;99:1152-1158. doi:10.1213/01.ANE.0000130851.37039.50.*
23. *Hunt K, Bajekal R, Calder I, Meacher R, Eliahoo J, Acheson JF. Changes in intraocular pressure in anesthetized prone patiente. J Neurosurg Anesthesiol. 2004;16:287-290. doi:10.1097/00008506-200410000-00005.*
24. *Cheng MA, Todorov A, Tempelhoff R, McHugh T, Crowder CM, Lauryssen C. The effect of prone positioning on intraocular pressure in anesthetized patients. Anesthesiology. 2001;95:1351-1355. doi:10.1097/00000542-200112000-00012.*
25. *Awad H, Santilli S, Ohr M, Roth A, Yan W, Fernandez S et al. The effects of steep trendelenburg positioning on intraocular pressure during robotic radical prostatectomy. Anesth Analg. 2009;109:473-478. doi:10.1213/ane.0b013e3181a9098f.*
26. *Sutton S, Link T, Makic MBF. A Quality Improvement Project for Safe and Effective Patient Positioning During Robot-Assisted Surgery. AORN J. 2013;97:448-456. doi:10.1016/j.aorn.2013.01.014.*
27. *Lam AKC, Douthwaite WA. Does the change of anterior chamber depth or/and episcleral venous pressure cause intraocular pressure change in postural variation? Optom Vis Sci. 1997;74:664-667. doi:10.1097/00006324-199708000-00028.*
28. *Roesch RP, Stoelting RK, Lingeman JE, Kahnoski RJ, Backes DJ, Gephardt SA. Ammonia toxicity resulting from glycine absorption during a transurethral resection of the prostate. Anesthesiology. 1983;58:577-579. doi:10.1097/00000542-198306000-00021.*