





1.9
ANCC CONTACT HOURS

Repositioning

during robotic procedures to prevent postoperative visual loss

By Michelle Freshcoln, DNP, CRNA and M. Roseann Diehl, DNP, CRNA

The number of surgical procedures performed in steep Trendelenburg (ST) is increasing.¹ Researchers have found that a patient under general anesthesia placed in ST for a sustained period of time loses normal autoregulation of ocular pressures. The loss of normal autoregulation predisposes the patient to risk factors of postoperative visual loss (POVL).² This article will review POVL, surgery in the ST position, special considerations for robotic procedures, and interventions to decrease the risks of POVL.

POVL

Research has documented the prevalence of POVL in spinal surgeries (0.03%), cardiac procedures (0.08%), and in the supine positions, but lacks information regarding the prevalence of POVL in ST.³⁻⁵ Although exact causes of POVL are uncertain, the pathology of POVL has been attributed to compromised blood flow to the optic nerve from either increased intraocular pressure or decreased blood and oxygen supply, which leads to ischemia and visual loss. Increased pressure on the globe of the eye leads to retinal vascular neuropathy from retinal vascular occlusion. Decreased blood and oxygen supply to the optic nerve results in ischemic optic neuropathy (ION). (See *Anatomy of the eye*.)

The most predictive factor for reaching a critical intraocular pressure (IOP) threshold is an increased baseline IOP prior to anesthesia or surgical intervention and the presence of chemosis (edema of the bulbar conjunctiva producing corneal swelling) after ST positioning.⁶ Comorbid conditions, such as coronary artery disease, diabetes, and hypertension, can predispose patients to increased IOP and, therefore, the potential for POVL. Chemosis or scleral edema can be observed in patients after ST positioning and should prompt postoperative visual acuity assessment. Additional studies will likely emerge in the future, delineating the scope of POVL in the ST position.

ST and robotic procedures

ST positioning allows gravity to pull abdominal contents out of the surgical field. ST positioning may be combined with laparoscopy. Laparoscopy and ST place patients in an unnatural environment, which causes several pathophysiologic changes.¹ Abdominal insufflation, associated with laparoscopy, creates pressure within the peritoneal cavity, which can cause hemodynamic and cardiovascular changes (for example, hypertension, tachycardia, bradycardia, ventricular dysrhythmias, and asystole).¹ All

intra-abdominal organs are affected by insufflation (see *Pathophysiologic changes during laparoscopic procedures*). The ST position forces abdominal contents and diaphragm migration cephalad, causing potential difficulty with ventilation and oxygenation.¹ Additionally, the loss of cerebral and ophthalmic autoregulation during general anesthesia can cause venous congestion and edema of the face and ocular area.⁶ Eyelid and corneal/conjunctival edema (chemosis), ecchymosis, and facial edema are characteristic changes shared by both prolonged ST-positioned patients and patients experiencing POVL.²

Robotic surgery using ST position and laparoscopy is increasingly used for certain intra-abdominal procedures (for example, prostatectomy and hysterectomy) where the surgeon controls a computerized robotic system from a remote control booth located several feet away from the surgical field in the OR.¹ A major benefit of robotic procedures (from a surgeon's perspective) is that they decrease hand tremors and reduce assistant fatigue from holding instruments and cameras steady. Other benefits of robotic procedures (from a patient's

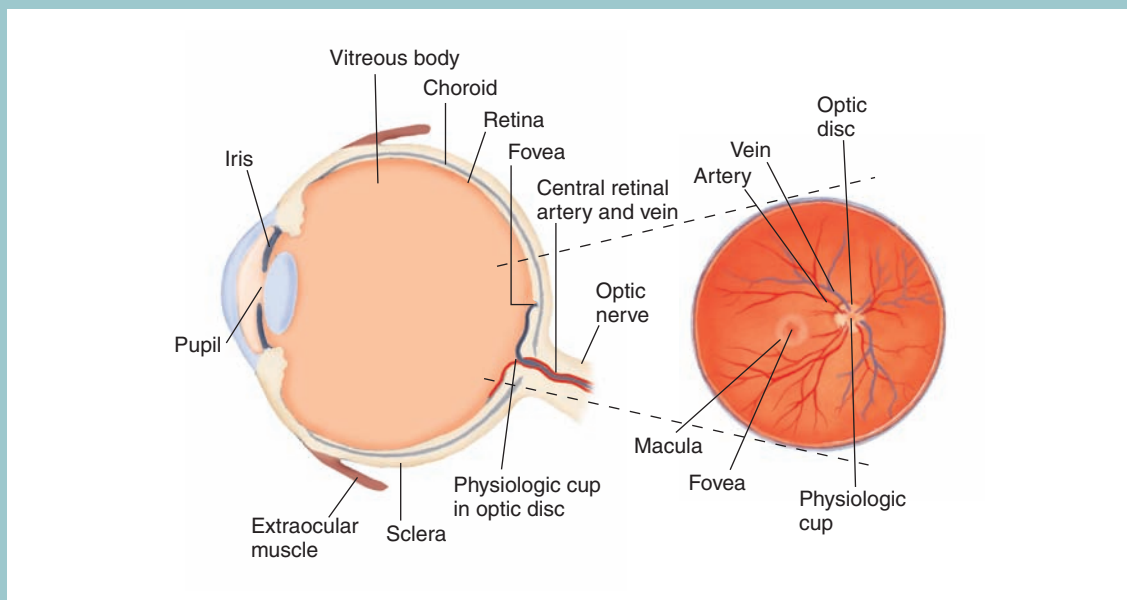
perspective) include improved range of motion of robotic arms facilitating surgical access, smaller incisions, improved three-dimensional visualization in real time, reduced postoperative pain, and quicker recovery.^{1,7} Disadvantages of robotic procedures include potential increased length of surgical time and exposure to general anesthesia (depending on surgeon skill), limited tactile feedback to surgeon, need for specific personnel training, increased procedural cost, and an inability to reposition patients while the robot is in place. Patients often remain in ST for several hours.^{1,7}

Interventions

The proposed interventions consist of five parts: discussing the risks and interventions to manage POVL with the OR team, including, but not limited to, the surgeon, perioperative nurses, and the anesthesia provider; inquiring about patient comorbidities that could predispose him or her to POVL prior to undergoing ST under general anesthesia; suggesting administration of dorzolamide hydrochloride-timolol maleate ophthalmic solution after 2 hours of persistent ST; attempting a level supine intervention

Anatomy of the eye

The illustration below shows a cross-section of the right eye and a portion of the fundus of the eye.



Source: Bickley, LS. *Bates' Guide to Physical Examination and History Taking*. 11th ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins. 2011; 217.

(LSI) for 5 minutes after 4 hours of ST; and performing a visual check immediately in the postoperative period.^{1,2,6,8-12}

A team approach is required to effectively manage the risk of POVL. The surgeons, perioperative nurses, and anesthesia providers must collaborate to design and follow through with a plan to minimize the risk of POVL for the patients.

POVL in the ST position is a risk compounded by the inability to reposition patients during the length of robot engagement during robotic procedures. Cases often last 4 to 6 hours and have been documented to last as long as 9.9 hours.^{9,10} A suggested intervention is to alleviate the physiologic complications of ST by periodically pausing the robotic procedure and disengaging the robot arms to allow an intermission from the ST position as a preventive measure to decrease the risk of POVL. An LSI should be discussed and decided on by the surgical team prior to initiation of the procedure so that all team members may prepare as they see necessary.

In 2010, Molloy reported results from studying IOP in patients who sustained continuous ST and compared IOP in patients who had an intermission in ST using 5 minutes of LSI.¹¹ IOP in patients without an LSI at 120 minutes ranged 25 to 54 mm Hg. The IOP of the group who received the LSI ranged from 10 to 33 mm Hg (IOP measured by the nurse anesthetists). When the patients were returned to level supine following the conclusion of the procedure, 11% of the non-LSI returned to baseline IOP. A return to baseline IOP was seen in 75% of the patients who received the LSI.¹¹ The patients undergoing an LSI showed a decreased IOP following the LSI and a quicker return to baseline as compared with those who did not receive the LSI.

A review of evidence supports the intervention to perform an LSI of about 5 to 7 minutes during lengthy ST procedures.^{11,12} Returning the patient to supine, or a position in which the ocular level is above the heart, will reduce IOP to below critical levels and facilitate an earlier return to baseline upon repositioning to level at the end of the case.¹¹ Elevated IOP is a risk factor for ION and POVL; however, there is no one specific cause for POVL. The intervention of an LSI has the potential to decrease a contributing cause of POVL.

Using an ophthalmic solution to reduce critical IOP is an even more appealing intraoperative

Pathophysiologic changes during laparoscopic procedures^{1,7}

Cardiovascular:

- Increased systemic vascular resistance
- Increased mean arterial pressure
- Decreased cardiac output

Pulmonary:

- Increased end-tidal carbon dioxide
- Increased inflation pressures
- Decreased functional residual capacity
- Decreased lung compliance

Renal:

- Decreased renal blood flow
- Decreased urine output

Hepatic:

- Decreased portal flow

option. Unlike an LSI, eye drops can be administered without surgical interruption. Dorzolamide hydrochloride-timolol maleate ophthalmic solution is a topical carbonic anhydrase inhibitor and beta-adrenergic blocking agent, typically used in the treatment of glaucoma, and has been shown to be effective in reducing the increased IOP that results from ST while under general anesthesia.¹¹ Dorzolamide hydrochloride-timolol maleate ophthalmic solution should be administered by the anesthesia provider per the manufacturer's recommendations and at the physician's and anesthesia provider's discretion.

Using the dorzolamide hydrochloride-timolol maleate ophthalmic solution after 2 hours of ST, followed by an LSI of 5 minutes after 4 hours of ST, are effective ways to decrease the risk of POVL during general anesthesia in the ST position.⁶ Further research is needed to identify the most optimal time and frequency to administer the ophthalmic solution and perform an LSI. Both interventions of LSI and utilization of eye drops decrease IOP below the critical threshold.⁸

The team approach

Patients under general anesthesia in the ST position for a sustained period of time experience increased IOP and are at an increased risk of developing POVL. During the time out in the OR, perioperative nurses can provide the following suggestions for interventions for the patient undergoing a procedure that requires the ST

position: discussing the risks and interventions to manage POVl with the OR team including, but not limited to, the surgeon, scrub person, and the anesthesia provider; inquiring about patient comorbidities that could predispose him or her to POVl prior to undergoing ST under general anesthesia; suggesting administration of dorzolamide hydrochloride-timolol maleate ophthalmic solution after 2 hours of persistent ST⁸; suggesting an LSI for 5 minutes after 4 hours of ST; and performing a visual check immediately in the postoperative period. **OR**

REFERENCES

1. Irvine M, Patil V. Anesthesia for robot-assisted laparoscopic surgery. Continuing education in anaesthesia. *Crit Care Pain*. 2009;9(4):125-129.
2. Molloy BL. Implications for Postoperative Visual Loss: Steep trendelenburg position and effects on intraocular pressure. *AANA J*. 2011;79(2):115-121.
3. Shen Y, Drum M, Roth S. The prevalence of perioperative visual loss in the United States: A 10-year study from 1996 to 2005 of spinal, orthopedic, cardiac and general surgery. *J Anesth Analg*. Publish ahead of print August 27,2009.
4. Roth S. Perioperative visual loss: what do we know, what can we do? *Br. J. Anaesth*. 2009;103(1):31-40.
5. Lee LA, Roth S, Posner KL, Cheney FW, Caplan RA, Newman NJ. The American society of anesthesiologist postoperative visual loss registry: Analysis of 93 spine surgery cases with postoperative visual loss. *Anesthesiology*. 2006;105:652-9.
6. Molloy B. A Preventive Intervention for Rising Intraocular Pressure: Development of the Molloy/Bridgeport Anesthesia Associates Observation Scale. *AANA Journal*. 2012;80(3):213-222.
7. MedlinePlus. Robotic Surgery. www.nlm.nih.gov/medlineplus/ency/article/007339.htm. Accessed March 4, 2013.
8. Molloy B. A comparative assessment of intraocular pressure in prolonged steep trendelenburg position vs. dorzolamide/timolol ophthalmic solution (CosoptTM) IDT intervention. *J Clin Exp Ophthalmol*. 2013;4(3):40.
9. Lee LA, Roth S, Todd MM, et al. The postoperative visual loss study group. *J Anes*. 2012;117(2):434-436.
10. Weber ED, Colyer MH, Lesser RL, Subramanian PS. Posterior ischemic optic neuropathy after minimally invasive prostatectomy. *J Neuroophthalmol*. 2007;27(4):285-287.
11. Molloy BL. A comparative assessment of intraocular pressure in prolonged steep trendelenburg position vs. supine position intervention. Poster presented at the PostGraduate Assembly in Anesthesiology; December 2010. New York, NY.
12. Awad H, Santilli S, Ohr M, et al. The effects of steep Trendelenburg positioning on intraocular pressure during robotic radical prostatectomy. *Anesth Analg*. 2009;109(2):473-478.

Michelle Freshcoln is a certified registered nurse anesthetist at Touro Infirmary, New Orleans, La. M. Roseann Diehl is an associate professor of professional practice at Texas Christian University, Harris College of Nursing and Health Sciences, School of Nurse Anesthesia, Fort Worth, Tex.

The authors and planners have disclosed that they have no financial relationships related to this article.

DOI-10.1097/01.ORN.0000451045.05365.94

For more than 96 additional continuing education articles related to surgical topics, go to Nursingcenter.com/CE.



Earn CE credit online:
Go to <http://www.nursingcenter.com/CE/ORNurse>
and receive a certificate *within minutes*.

INSTRUCTIONS

Repositioning during robotic procedures to prevent postoperative visual loss

TEST INSTRUCTIONS

- To take the test online, go to our secure website at <http://www.nursingcenter.com/ORNurse>.
- On the print form, record your answers in the test answer section of the CE enrollment form on page 41. Each question has only one correct answer. You may make copies of these forms.
- Complete the registration information and course evaluation. Mail the completed form and registration fee of \$17.95 to: Lippincott Williams & Wilkins, CE Group, 74 Brick Blvd., Bldg. 4 Suite 206, Brick, NJ 08723. We will mail your certificate in 4 to 6 weeks. For faster service, include a fax number and we will fax your certificate within 2 business days of receiving your enrollment form.
- You will receive your CE certificate of earned contact hours and an answer key to review your results. There is no minimum passing grade.
- Registration deadline is August 31, 2016.

DISCOUNTS and CUSTOMER SERVICE

- Send two or more tests in any nursing journal published by Lippincott Williams & Wilkins together and deduct \$0.95 from the price of each test.
- We also offer CE accounts for hospitals and other health care facilities on nursingcenter.com. Call 1-800-787-8985 for details.

PROVIDER ACCREDITATION

Lippincott Williams & Wilkins, publisher of *ORNurse2014* journal, will award 1.9 contact hours for this continuing nursing education activity. Lippincott Williams & Wilkins is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

Lippincott Williams & Wilkins is also an approved provider of continuing nursing education by the District of Columbia and Florida #50-1223. This activity is also provider approved by the California Board of Registered Nursing, Provider Number CEP 11749 for 1.9 contact hours.

Your certificate is valid in all states.