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Contents

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REVIEW

- 11214** Diabetes and skin cancers: Risk factors, molecular mechanisms and impact on prognosis
Dobrică EC, Banciu ML, Kipkorir V, Khazeei Tabari MA, Cox MJ, Simhachalam Kutikuppala LV, Găman MA
- 11226** Endocrine disruptor chemicals as obesogen and diabetogen: Clinical and mechanistic evidence
Kurşunoğlu NE, Sarer Yurekli BP
- 11240** Intestinal microbiota in the treatment of metabolically associated fatty liver disease
Wang JS, Liu JC

MINIREVIEWS

- 11252** Lactation mastitis: Promising alternative indicators for early diagnosis
Huang Q, Zheng XM, Zhang ML, Ning P, Wu MJ
- 11260** Clinical challenges of glycemic control in the intensive care unit: A narrative review
Sreedharan R, Martini A, Das G, Aftab N, Khanna S, Ruetzler K
- 11273** Concise review on short bowel syndrome: Etiology, pathophysiology, and management
Lakkasani S, Seth D, Khokhar I, Touza M, Dacosta TJ
- 11283** Role of nickel-regulated small RNA in modulation of *Helicobacter pylori* virulence factors
Freire de Melo F, Marques HS, Fellipe Bueno Lemos F, Silva Luz M, Rocha Pinheiro SL, de Carvalho LS, Souza CL, Oliveira MV
- 11292** Surgical intervention for acute pancreatitis in the COVID-19 era
Su YJ, Chen TH

ORIGINAL ARTICLE

Clinical and Translational Research

- 11299** Screening of traditional Chinese medicine monomers as ribonucleotide reductase M2 inhibitors for tumor treatment
Qin YY, Feng S, Zhang XD, Peng B

Case Control Study

- 11313** Covered transjugular intrahepatic portosystemic stent-shunt *vs* large volume paracentesis in patients with cirrhosis: A real-world propensity score-matched study
Dhaliwal A, Merhzad H, Karkhanis S, Tripathi D

Retrospective Cohort Study

- 11325** Endoscopic submucosal tunnel dissection for early esophageal squamous cell carcinoma in patients with cirrhosis: A propensity score analysis
Zhu LL, Liu LX, Wu JC, Gan T, Yang JL

Retrospective Study

- 11338** Nomogram for predicting overall survival in Chinese triple-negative breast cancer patients after surgery
Lin WX, Xie YN, Chen YK, Cai JH, Zou J, Zheng JH, Liu YY, Li ZY, Chen YX
- 11349** Early patellar tendon rupture after total knee arthroplasty: A direct repair method
Li TJ, Sun JY, Du YQ, Shen JM, Zhang BH, Zhou YG
- 11358** Coxsackievirus A6 was the most common enterovirus serotype causing hand, foot, and mouth disease in Shiyang City, central China
Li JF, Zhang CJ, Li YW, Li C, Zhang SC, Wang SS, Jiang Y, Luo XB, Liao XJ, Wu SX, Lin L
- 11371** Dynamic changes of estimated glomerular filtration rate are conversely related to triglyceride in non-overweight patients
Liu SQ, Zhang XJ, Xue Y, Huang R, Wang J, Wu C, He YS, Pan YR, Liu LG
- 11381** C-reactive protein as a non-linear predictor of prolonged length of intensive care unit stay after gastrointestinal cancer surgery
Yan YM, Gao J, Jin PL, Lu JJ, Yu ZH, Hu Y

Clinical Trials Study

- 11391** Dan Bai Xiao Formula combined with glucocorticoids and cyclophosphamide for pediatric lupus nephritis: A pilot prospective study
Cao TT, Chen L, Zhen XF, Zhao GJ, Zhang HF, Hu Y

Observational Study

- 11403** Relationship between lipids and sleep apnea: Mendelian randomization analysis
Zhang LP, Zhang XX
- 11411** Efficacy and safety profile of two-dose SARS-CoV-2 vaccines in cancer patients: An observational study in China
Cai SW, Chen JY, Wan R, Pan DJ, Yang WL, Zhou RG

Prospective Study

- 11419** Pressure changes in tapered and cylindrical shaped cuff after extension of head and neck: A randomized controlled trial
Seol G, Jin J, Oh J, Byun SH, Jeon Y

Randomized Controlled Trial

- 11427** Effect of intradermal needle therapy at combined acupoints on patients' gastrointestinal function following surgery for gastrointestinal tumors
Guo M, Wang M, Chen LL, Wei FJ, Li JE, Lu QX, Zhang L, Yang HX

SYSTEMATIC REVIEWS

- 11442** Video-assisted bystander cardiopulmonary resuscitation improves the quality of chest compressions during simulated cardiac arrests: A systemic review and meta-analysis

Pan DF, Li ZJ, Ji XZ, Yang LT, Liang PF

META-ANALYSIS

- 11454** Efficacy of the femoral neck system in femoral neck fracture treatment in adults: A systematic review and meta-analysis

Wu ZF, Luo ZH, Hu LC, Luo YW

- 11466** Prevalence of polymyxin-induced nephrotoxicity and its predictors in critically ill adult patients: A meta-analysis

Wang JL, Xiang BX, Song XL, Que RM, Zuo XC, Xie YL

CASE REPORT

- 11486** Novel compound heterozygous variants in the LHX3 gene caused combined pituitary hormone deficiency: A case report

Lin SZ, Ma QJ, Pang QM, Chen QD, Wang WQ, Li JY, Zhang SL

- 11493** Fatal bleeding due to an aorto-esophageal fistula: A case report and literature review

Ćeranić D, Nikolić S, Lučev J, Slanić A, Bujas T, Ocepek A, Skok P

- 11500** Tolvaptan ameliorated kidney function for one elderly autosomal dominant polycystic kidney disease patient: A case report

Zhou L, Tian Y, Ma L, Li WG

- 11508** Extensive right coronary artery thrombosis in a patient with COVID-19: A case report

Dall'Orto CC, Lopes RPF, Cancela MT, de Sales Padilha C, Pinto Filho GV, da Silva MR

- 11517** Yokoyama procedure for a woman with heavy eye syndrome who underwent multiple recession-resection operations: A case report

Yao Z, Jiang WL, Yang X

- 11523** Rectal cancer combined with abdominal tuberculosis: A case report

Liu PG, Chen XF, Feng PF

- 11529** Malignant obstruction in the ileocecal region treated by self-expandable stent placement under the fluoroscopic guidance: A case report

Wu Y, Li X, Xiong F, Bao WD, Dai YZ, Yue LJ, Liu Y

- 11536** Granulocytic sarcoma with long spinal cord compression: A case report

Shao YD, Wang XH, Sun L, Cui XG

- 11542** Aortic dissection with epileptic seizure: A case report

Zheng B, Huang XQ, Chen Z, Wang J, Gu GF, Luo XJ

- 11549** Multiple bilateral and symmetric C1-2 ganglioneuromas: A case report
Wang S, Ma JX, Zheng L, Sun ST, Xiang LB, Chen Y
- 11555** Acute myocardial infarction due to Kounis syndrome: A case report
Xu GZ, Wang G
- 11561** Surgical excision of a large retroperitoneal lymphangioma: A case report
Park JH, Lee D, Maeng YH, Chang WB
- 11567** Mass-like extragonadal endometriosis associated malignant transformation in the pelvis: A rare case report
Chen P, Deng Y, Wang QQ, Xu HW
- 11574** Gastric ulcer treated using an elastic traction ring combined with clip: A case report
Pang F, Song YJ, Sikong YH, Zhang AJ, Zuo XL, Li RY
- 11579** Novel liver vein deprivation technique that promotes increased residual liver volume (with video): A case report
Wu G, Jiang JP, Cheng DH, Yang C, Liao DX, Liao YB, Lau WY, Zhang Y
- 11585** Linear porokeratosis of the foot with dermoscopic manifestations: A case report
Yang J, Du YQ, Fang XY, Li B, Xi ZQ, Feng WL
- 11590** Primary hepatic angiosarcoma: A case report
Wang J, Sun LT
- 11597** Hemorrhagic shock due to ruptured lower limb vascular malformation in a neurofibromatosis type 1 patient: A case report
Shen LP, Jin G, Zhu RT, Jiang HT
- 11607** Gastric linitis plastica with autoimmune pancreatitis diagnosed by an endoscopic ultrasonography-guided fine-needle biopsy: A case report
Sato R, Matsumoto K, Kanzaki H, Matsumi A, Miyamoto K, Morimoto K, Terasawa H, Fujii Y, Yamazaki T, Uchida D, Tsutsumi K, Horiguchi S, Kato H
- 11617** Favorable response of primary pulmonary lymphoepithelioma-like carcinoma to sintilimab combined with chemotherapy: A case report
Zeng SY, Yuan J, Lv M
- 11625** Benign paroxysmal positional vertigo with congenital nystagmus: A case report
Li GF, Wang YT, Lu XG, Liu M, Liu CB, Wang CH
- 11630** Secondary craniofacial necrotizing fasciitis from a distant septic emboli: A case report
Lee DW, Kwak SH, Choi HJ
- 11638** Pancreatic paraganglioma with multiple lymph node metastases found by spectral computed tomography: A case report and review of the literature
Li T, Yi RQ, Xie G, Wang DN, Ren YT, Li K

- 11646** Apnea caused by retrobulbar anesthesia: A case report
Wang YL, Lan GR, Zou X, Wang EQ, Dai RP, Chen YX
- 11652** Unexplained septic shock after colonoscopy with polyethylene glycol preparation in a young adult: A case report
Song JJ, Wu CJ, Dong YY, Ma C, Gu Q
- 11658** Metachronous isolated penile metastasis from sigmoid colon adenocarcinoma: A case report
Yin GL, Zhu JB, Fu CL, Ding RL, Zhang JM, Lin Q

ABOUT COVER

Editorial Board Member of *World Journal of Clinical Cases*, Muhammad Hamdan Gul, MD, Assistant Professor, Department of Internal Medicine, University of Kentucky, Chicago, IL 60657, United States.
hamdan3802@hotmail.com

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Apnea caused by retrobulbar anesthesia: A case report

Yue-Lin Wang, Guo-Ru Lan, Xuan Zou, Er-Qian Wang, Rong-Ping Dai, You-Xin Chen

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Yue-Lin Wang, Guo-Ru Lan, Xuan Zou, Er-Qian Wang, Rong-Ping Dai, You-Xin Chen, Department of Ophthalmology, Peking Union Medical College Hospital, Beijing 100730, China

Corresponding author: You-Xin Chen, MD, PhD, Professor, Department of Ophthalmology, Peking Union Medical College Hospital, No. 1 Shuaifu Garden, Dongcheng District, Beijing 100730, China. chenyx@pumch.cn

Abstract

BACKGROUND

Apnea caused by retrobulbar anesthesia is a very rare but severe complication during ophthalmic surgery.

CASE SUMMARY

We report a rare case of apnea caused by retrobulbar anesthesia, and emergency resuscitation was used. A 74-year-old female patient was diagnosed with rhegmatogenous retinal detachment in the right eye and planned to undergo vitrectomy under retrobulbar anesthesia. After the retrobulbar anesthesia in her right eye, she became unconscious and apneic. It was suggested that she had developed brainstem anesthesia. Assisted ventilation was initiated. Atropine 0.5 mg, epinephrine 1 mg, ephedrine 30 mg, and lipid emulsion were given. Five minutes later, her consciousness and breathing gradually returned, but with uncertain light perception in her right eye. Alprostadil 20 µg was given, and after 2 h her visual acuity resumed to the preoperative level.

CONCLUSION

Brainstem anesthesia is a serious complication secondary to retrobulbar anesthesia. Medical staff should pay attention to the identification of brainstem anesthesia and be familiar with the emergency treatment for this complication.

Key Words: Apnea; Retrobulbar anesthesia; Brainstem anesthesia; Ophthalmic surgery; Case report

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Core Tip: Apnea caused by retrobulbar anesthesia is a very rare but severe complication. Failure to recognize brainstem anesthesia or delaying the treatment may be life threatening. We report a rare case of apnea caused by retrobulbar anesthesia, and emergency resuscitation was used. Assisted ventilation and vasodilator treatment were used, and the consciousness and breathing of the patient was gradually recovered. The mechanism of retrobulbar anesthesia is varied, but a skillful operation of retrobulbar anesthesia is important. Doctors and nurses should be aware of the potential risk of retrobulbar anesthesia, and be familiar with the resuscitation procedures.

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INTRODUCTION

Retrobulbar anesthesia is commonly used in ophthalmic surgeries, especially for posterior segment surgeries, including vitrectomy, external-route surgery, *etc.* By injecting anesthetic drug into the posterior musculus cone of the eye to block the III, IV, and VI cranial nerves and the ciliary nerves, rapid analgesia can be achieved. Compared with topical anesthesia (often used for short-time or superficial anterior segment surgeries), peribulbar anesthesia (frequently used for long-time anterior segment surgery) or subtenon capsule injection (which requires conjunctival sac incision and subtenon region blunt dissection), retrobulbar anesthesia is a more effective and convenient anesthesia method for posterior segment surgeries.

However, retrobulbar anesthesia is associated with risk of complications[1], including: (1) Local complications, such as retrobulbar hemorrhage, eyeball perforation, optic nerve injury and retinal vascular occlusion; and (2) systemic complications, such as the ocular-heart reflex and brainstem anesthesia. Among them, brainstem anesthesia is very rare (with an incidence rate of only 0.06%-0.2%) but severe, as anesthetic agents gain access to the central nervous system, causing apnea and cardiac arrest[2]. Failure to recognize brainstem anesthesia and delaying treatment may be life threatening[3].

We report a case of apnea and unconsciousness caused by retrobulbar anesthesia, with saturation of pulse oxygen (SpO₂) that dropped to 80%; emergency resuscitation was performed.

CASE PRESENTATION

Chief complaints

A 74-year-old female patient presented to the hospital with decreased vision in the right eye that had persisted for 1 mo.

History of present illness

The patient reported that her symptoms had started in her right eye 1 mo prior.

History of past illness

The patient had a 5-year history of hypertension but denied cerebrovascular diseases or drug allergies. She reported that she had not previously experienced any procedure that necessitated anesthesia.

Personal and family history

The patient denied any family history of cardiovascular or cerebrovascular diseases.

Physical examination

Physical examination showed blood pressure (BP) of 111/57 mmHg, respiratory rate (RR) of 17 breaths/min (bpm), SpO₂ of 98%, and heart rate (HR) of 75 bpm.

The patient's right eye visual acuity was HM/30 cm. Retinal detachment with a horseshoe-shaped hole was found in the superior temporal fundus.

Imaging examinations

The patient's chest radiography and electrocardiograph examinations gave normal results.

FINAL DIAGNOSIS

Rhegmatogenous retinal detachment in the right eye.

TREATMENT

The patient planned to undergo a vitrectomy with retrobulbar anesthesia of her right eye.

The operation started by performing a retrobulbar anesthesia. No narcotics or muscle relaxants were used prior to retrobulbar anesthesia. The patient was instructed to lay in the supine position. A 28 G needle was used to penetrate the position of the junction of the middle 1/3 and the outer 1/3 of the infraorbital margin. After puncturing the skin and inserting the needle approximately 1.5 cm, the needle was turned towards the foramen magnum and was then slowly advanced approximately 2 cm, with no return of blood. Then, 2 mL (40 mg) lidocaine and 2 mL (20 mg) ropivacaine were injected with slight resistance. Six minutes later, the patient was unconscious and unresponsive. Her right eye was dilated because of drugs, and the pupillary light reflex of the contralateral eye was sluggish. Immediately, an electrocardiogram (ECG) was applied for monitoring; her BP was 150/70 mmHg, her HR was 98 bpm, her RR was undetectable, and her SpO₂ dropped to 80%.

The ophthalmologist called the anesthesia team to assist in resuscitation. Mask-assisted ventilation was given, and an intravenous catheter was placed. It was considered that she developed brainstem anesthesia, so the anesthesiologist gave the patient 0.5 mg atropine, 1 mg epinephrine, and 30 mg ephedrine intravenously. Considering local anesthetic poisoning, an intravenous infusion of 250 mL of 20% lipid emulsion (1.5 mL/kg 20% lipid emulsion bolus over 1 min, followed by 0.25 mL/kg/min of infusion) was given. After 5 min, the patient regained consciousness. The patient's spontaneous breathing was restored with 16 beats/min. The operation was cancelled, and the patient returned to the ward under SpO₂, BP, and ECG monitoring. One hour after leaving the operation room, visual acuity in her right eye was uncertain light perception, which was checked at bedside. Alprostadil 20 µg was given, and her vision gradually recovered to the preoperative state.

OUTCOME AND FOLLOW-UP

Two hours after the operation, head computed tomography scan identified a bubble at the posterior of patient's right eye (Figure 1). The ECG and myocardial enzyme test results were roughly the same as at admission. She had no recall of the incident.

DISCUSSION

This patient had a clear diagnosis of rhegmatogenous retinal detachment in the right eye, and vitrectomy was indicated[4]. Her vital signs were good preoperatively, and retrobulbar anesthesia was planned.

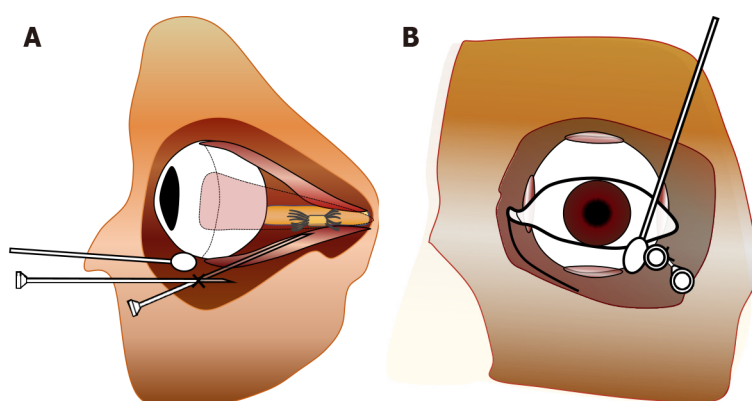
The patient was unconscious and apneic shortly after retrobulbar anesthesia, so systematic complications such as brainstem anesthesia, anesthetic allergy, and ocular-heart reflex were primarily considered. Brain stem anesthesia was regarded as the most likely complication, because she did not have any allergic history, and her HR was not decreased. The mechanism of brainstem anesthesia may be as follows[5]: (1) The anesthetic could have been injected into the nerve sheath and then could have entered the cerebrospinal fluid, causing a loss of consciousness, apnea, *etc*; (2) The anesthetic could have entered the blood, causing central anesthesia; and (3) There could be an anaphylactic reaction to the drug. For this patient, loss of consciousness and apnea occurred after retrobulbar anesthesia were found after her recovery from anesthesia. For the differentiation of mechanisms of intraarterial and intrasheath injection, if inadvertent intraarterial injection was achieved, the onset of symptoms such as loss of consciousness, apnea, and seizures would be expected within seconds, while brainstem anesthesia from a nerve sheath injection occurs over a matter of minutes, mostly 5–50 min[2]. For this case, the mechanism may have involved accidental intrasheath injection, because the difficulty in breathing started about 6 min after the injection. The patient did not have any seizure or retrobulbar hemorrhage, and there was no return of blood during the puncture process; therefore, respiratory arrest was unlikely to be caused by intravascular injection. We also considered that the anesthetics and/or bubbles in the needle were injected into the neurovascular tissues around the eye, causing an increase in local pressure, which led to a transient compression of the optic nerve or pressed the anesthetic into the sheath of optic nerve, causing brainstem anesthesia.

Brainstem anesthesia is a rare but severe complication caused by retrobulbar surgery. Patients often develop symptoms within 2 min after injection of the aesthetic drug, and severe symptoms occur within 10–20 min and gradually improve after 2–3 h. Clinical manifestations include amaurosis, hearing loss,



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Figure 1 Postoperative head computed tomography. Two hours after retrobulbar anesthesia, head computed tomography showed bubbles at the posterior of the patient's right eye, partially compressing the optic nerve.



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Figure 2 Schematic diagram of retrobulbar anesthesia. A: Side view, the trick of using a cotton bud was applied to assist the operation, as it lifts the eyeball but with the eyes staring at the front, helping to prevent penetration of the eyeball and decreasing risk of injury to the optic nerve; B: Front view.

dysphagia, dysarthria, contralateral oculomotor nerve, and trochlear nerve palsy. Severe symptoms include disturbances of consciousness, respiratory failure, and cardiac arrest. Therefore, early detection of brainstem anesthesia is important, especially during the first 20 min after retrobulbar injection. During this period, careful monitoring of the patient's vital signs is important.

Apnea caused by retrobulbar anesthesia is rarely reported. Tong *et al*[6] reported a patient who was unresponsive 1 min after retrobulbar anesthesia. After oxygen therapy and an intravenous injection of nicosemide and nicardipine, the patient did not improve and subsequently developed respiratory arrest and ventricular fibrillation. Emergency chest compressions, tracheal intubation, and defibrillation were given, and he was transferred to an emergency center. However, the patient died 4 d later due to cerebral hypoxia and edema. Tolesa *et al*[7] reported a patient who regained consciousness and spontaneous breathing after being given oxygen *via* a mask, intravenous fluids, and an intravenous injection of atropine 1 mg.

To prevent brainstem anesthesia, skillful operation of retrobulbar anesthesia is important. First, a low volume of anesthetic drug is recommended to reduce systematic side effect. According to our clinical observations, the dose of 2 mL (generally 2-5 mL) anesthetic is enough for a proper anesthetic effect, if the anesthetic infiltrates the ciliary ganglion. Second, longer needles have deeper puncture, which may increase the risk of penetrating the blood vessels or optic nerve sheaths, so the maximum needle length recommended for retrobulbar block is 31 mm according to Kostadinov *et al*[8]. A blunt needle is less likely to penetrate the optic nerve sheath, but its insertion may be painful and traumatic. Third, it is recommended that the patient look straight forward rather than upwards to avoid stabbing the blood vessels or the optic nerve. Figure 2 illustrates a trick of using cotton-bud to assist retrobulbar anesthesia.

For the treatment of brainstem anesthesia[9,10], first, the operator should immediately stop the injection of the anesthetic drugs. Second, doctors should identify the early clinical manifestations of brainstem anesthesia in a timely manner, and emergency measures such as ECG monitoring, oxygen inhalation, and the placement of an intravenous catheter should be performed immediately. Timely symptomatic treatment can reduce the adverse prognosis caused by brain hypoxia. Then, the patient

should be treated with central stimulants and BP stabilizers, including atropine, epinephrine, *etc.* Meanwhile, anesthetic drug antagonists such as lipid emulsions can be given to reduce the central inhibitory effect of the anesthetic drugs by wrapping lipophilic anesthetics[11]. If there is a further decrease in BP, blood oxygen saturation, or respiratory and cardiac arrest, resuscitation measures such as the usage of pressor agents, tracheal intubation, mechanical ventilation and even chest compressions can be considered; the patient should also receive intensive care after surgery.

CONCLUSION

Brainstem anesthesia is a serious complication caused by retrobulbar anesthesia. Doctors and nurses should be aware of the potential risk, be familiar with the resuscitation procedures, and treat the relevant symptoms in a timely manner.

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FOOTNOTES

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ORCID number: Yue-Lin Wang 0000-0001-9843-6280; Rong-Ping Dai 0000-0002-7901-5998; You-Xin Chen 0000-0002-7231-5058.

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