CASE REPORT

Brainstem Anesthesia after Retrobulbar Block: A Case Report and Review of Literature

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ABSTRACT

BACKGROUND: Retro-bulbar anesthesia is one of the most common regional blocks used for intraocular surgeries. Complications associated with regional blocks may be limited to the eye or may be systemic.
CASE REPORT: After a retro-bulbar block for glaucoma surgery, a 60-year-old man developed loss of consciousness, apnea with hypotension and bradycardia-features of brainstem anesthesia. We present the clinical features, treatment and comments on how to prevent the problem as well as a review of the literature on reported cases.
CONCLUSION: Although it is rare, treating physicians should be aware of the potentially lethal consequences of retro-bulbar block, understand measures to reduce the risks and early recognition and treatment. Facilities where ophthalmic surgeries are performed under local anesthesia should be properly equipped and staffed for advanced resuscitation.
KEY WORDS: Retrobulbar block, brainstem aneasthesia, intraocular surgery, lidocaine

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INTRODUCTION

There are various types of local anesthesia (LA) used for intraocular surgery and includeintraconal block (retrobulbar anesthesia- RBA), extraconal block (peribulbar anesthesia- PBA), sub-Tenon's anesthesia (STA), subconjunctival anesthesia, and topical anesthesia, alone or in conjunction with preservative-free intracameral local anesthetic. These can also be used with an intravenous neuroleptic approach to keep the patient comfortable.

Any type of anesthesia is acceptable as long as it provides adequate comfort for the patient throughout the procedure and facilitates the success of the surgery. The choice of a particular technique depends on several factors such as patient and ocular factors as well as the surgeon's and/or the anesthesia provider's factors.

We report a case of brainstem anesthesia after RBA for intraocular surgery in Jimma University Specialized Hospital, Ophthalmology Department, in December 2012. We also review the literature on this problem.

CASE REPORT

A 60-year-old male patient with uncontrolled Pseudoexfoliative glaucoma in botheyesand was scheduled for elective trabeculectomy of the right eye, in Jimma University Specialized Hospital, Department of Ophthalmology, in December 2012. The medical history was unremarkable with no known systemic illness. He was taking Timolol eye drop (0.5%) and Acetazolamide tablets preoperatively. A retrobulbar block of the right eye with 2.5 ml of lidocaine 2% using a 21G needle (a 21- gauge, 25 mm, sharp, disposable needle) was given followed by facial block of modified Van Lint technique with 1 ml of the same medication. Possible intravascular injection was excluded by aspiration during both procedures.

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After about 8-10 minutes of the block, he developed apnea and lost consciousness, not responding to verbal queries. His blood pressure (BP) was 80/40mmHg with pulse rate of 40 bpm (feeble). Manual ventilation with a face mask and 100% oxygen was instituted, anintravenous (IV) line was secured with 0.9% Normal Saline and 10ml of 40% dextrose was given. Anoropharyngeal tube was also inserted. He was noted to have persistent bradycardia and hypotension; Atropine 1mg IV was given.

After about 30 minutes of resuscitation, he regained consciousness and obeyed commands, with spontaneous breathing. The BP and pulse averaged 120/80 mmHg and 80bpm respectively. Surgery was canceled. He remained stable throughout the day.

On the next day, he was evaluated and had maintained the preoperative vision. There was no evidence of perforation of globe or optic nerve (ON) trauma.

DISCUSSION

The practice of ophthalmic local anesthesia varies worldwide (1). In the developed nations, topical anesthesia is the most popular mode used in cataract and trabeculectomy procedures in recent years. This has found a large acceptance especially in the USA where it was used by 61% of cataract surgeons (up from 8% in 1995, 51% in 2000) (2). Although studies are lacking from developing countries including Ethiopia, ophthalmic blocks by PBA and RBA appear the most commonly practiced techniques.

There is no absolutely safe ophthalmic anesthetic method. Complications could result from the anesthetic medication itself or the technique of administration. Those particularly associated with regional block anesthesia may be limited to the eye or may be systemic. Orbital complications include chemosis, conjunctival hemorrhage, retrobulbar hemorrhage, globe penetration, optic nerve damage, ptosis and extra-ocular muscle damage (3).

Systemic complications may arise from anaphylactic reaction to the drug(s) used or either of the following mechanisms: inadvertent injection or diffusion into orbital vasculature or injection into the subarachnoid space (SAS). These can lead to a range of symptoms depending on the route and the type, volume and concentration of the LA. Anaphylactic reactions to the drugs manifest with immediate onset of rash, bronchospasm as well as persistent cardiovascular collapse.

The inferior ophthalmic artery may be prone to injury because in 15% of cases, it has an anomalous position inferior to the optic nerve (4). Such inadvertent intra-arterial injection of LA produces retrograde flow through the ophthalmic artery into the internal carotid artery. Then it is delivered to the thalamus and other midbrain structures. This event induces immediate CNS symptoms such as respiratory arrest and hemodynamic changes. The classic clinical picture resulting from intra-arterial injection is, however, the immediate onset of grand mal seizure activity as the predominant sign (4). Diffusion of the anesthetic drug through the fine regional vasculature to the central circulation can also lead to similar symptoms.

As the eye is developmentally a part of the brain, the optic nerve has extensions of the meningeal sheath covering it, and the cerebrospinal fluid communicates freely with the SAS around the nerve. Inadvertent puncture of the dura during orbital blocks may lead to drug injection beneath the sheath, leading to spread via the SAS and toxicity at control centers in the brainstem. The onset of signs and symptoms of CNS spread and brainstem anesthesia (BSA) is usually within 10 minutes of the LA injection (5). Initially, parasympathetic blockade may be more in evidence, and signs and symptoms include mental confusion to coma, multiple cranial nerve palsies, shivering to convulsion, nystagmus, dysphagia, sympathetic hyperactivity with sudden swings in the cardiovascular vital signs; and latersympathetic blockade along with hypotension and apnea may follow (6).

In our case, the clinical presentation of loss of consciousness along with hypotension, bradycardia and respiratory arrest was compatible with BSA due to puncture of dural sheath and spreading of the LA to the subarachnoid space. The recovery of symptoms after 30 minutes of resuscitation with oxygen and atropine also supports our explanation. The onset of symptoms after 5–10 minutes following RBA also rules out the possibility of either anaphylactic reaction to the drug or direct intravascular injection, where a more prompt onset is expected (7, 8).

Brainstem Anesthesia

The incidence of CNS complications from RBA is variable in the literature. Among 6000 patients undergoing RBA, Nicoll et al. reported that 1 in 375(0.27%) patients developed CNS complications, and 1 in 700 of these were described as life threatening (5). Hamilton described three cases of BSA from 1500 consecutive cases (6). A 0.044% incidence among 4500 subsequent cases has also been reported (9).

Manifestations of BSA among the reported cases in the literature vary significantly. Similar cases to ours of BSA causing loss of consciousness, apnea and bradycardia have been well documented (6, 8, 10-12).There are reported cases presenting with dysarthria (13), ocular motor nerve paresis (14-17), bilateral hearing loss (18) and localized convulsions of the ipsilateral face followed by hemiparesis (19).

Sustained hypertension and tachycardia have also been reported (6). Possible vagal blockages at the brainstem or affection of the glossopharyngeal rootlet resulting in abolition of carotid sinus reflex are possible explanations given.

Strictly, PBA is generally considered safer than RBA due to lesser chances of injury and a lesser potential for intra-dural injection. Practically, however, both PBA and RBA are blind techniques, since multiple communications exist between intraconal and extraconal compartments. It has been suggested that one cannot be completely certain that the blockade is really intra- or extraconal (20).There are reports of brainstem anesthesia following PBA (21-23), including patients who required tracheal intubation and mechanical ventilation (25). A Cochrane systematic review of RBA versus PBA for cataract surgery also concluded that there is little to choose between the two in terms of anesthesia and akinesia during surgery, measuring acceptability to patients, need for additional injections and development of severe complications (25). Furthermore, since all the above dangers are inherent when using the right needle length and shape with the correct technique, there are advocates for STA over PBA and RBA (26-27).

STA is considered to have an acceptable safety profile. Because a sharp needle is not used,intradural puncture is less likely. In a study in the UK, the reported incidence of sight-threatening complications among 161,000 patients having cataract surgery with STA was less than 0.6 per 10,000 cases (28). In a rare case of BSA after STA described from Moorfields Eye Hospital, a possible explanation given was that the tip of the Westcott scissors may have perforated the dural sheath upon dissection of the sub-Tenon's space, which let the drug cross the sheath.

Treatment

The most important point remains early recognition of the complication and institution of the appropriate treatment with no delay. It is advisable to observe the patient for the initial 15 minutes after the injection. Treatment involves basic and advanced life support. This includes airway control and respiratory support with administration of 100% oxygen. If necessary, intubation and cardiopulmonary resuscitation can be added; including administration of intravenous fluids, pharmacologic circulatory support and maintenance of vital signs and oxygen saturation. It is also recommended that monitoring with pulse oximetry, ECG and BP measurement should be employed for all patients undergoing major eye surgery under ophthalmic blocks, and be continued throughout the procedures (29). If immediate medical support is instituted, the outcome is generally favorable.

Prevention

Adequate preoperative counseling of patients about the procedure can enhance their cooperation and maintenance of gaze in the suggested position. Knowledge of the orbital anatomy and structures as well as use of the suitable size of needles with proper positioning of the needle and the patient's gaze during the retrobulbar block is critical. The patient should be instructed to look straight ahead. When the globe is adducted and elevated, the optic nerve is placed in close proximity to the advancing needle. Although the lengths of the orbits vary between individuals, 11% of optic nerves can easily be perforated with needles measuring 38 mm in length. It has been suggested that the needle length should not exceed 31mm to avoid injury to the nerve (30). Currently, for PBA and RBA, use of a 25-G, 31-mm long needle is generally recommended (31). Needles without cutting edges and a blunt rounded tip are thought to push vessels out of the way instead of cutting into them (32).During the injection, "wiggle test"

is useful in determining if the needle tip has pierced an orbital structure fixed to the eye. In this test, after the retrobulbar needle is in the orbit, but before any anesthetic is injected, the needle is moved from side to side; any rotation of the eye suggests that the sclera, optic nerve, or an extraocularmuscle may have been penetrated. If this test is positive, then the operator should withdraw the needle before injection (33). Table 1 summarizes important measures to reduce the risk of complications during RBA.

Table 1: Measures to Reduce the Risk of Complications after Retrobulbar Block

Know the orbital anatomy and structures
Preoperative counseling of patients about the procedure & maintenance of gaze
Maintain the eye in a neutral position (patient should look straight ahead)
Use the appropriate needle (25G, 31mm long, and possibly without cutting edge)
Proper positioning of needle and check for intravascular entry
Do not insert the needle more than 31 mm.
Do the "wiggle test"
Early recognition:Observe the patient for at least 15 minutes after the injection
Monitor with pulse oximetry, ECG*, and BP† measurement

*ECG- Electrocardiography † BP- Blood pressure

For our case, we used the 21G needle because the recommended size is not available in our setting. Trabeculectomy involves specific surgical steps which produce increased sensitivity to pain such as cauterization, scleral incision, iridectomy and conjunctival manipulation and suturing. We were not able to use topical modes due to lack of the necessary setting to give sedatives, and preservative free lidocaine for supplemental subconjunctival or intra-cameral administration. Subtenon block has become the surgeons' preferred mode for most of the glaucoma procedures in the current practice. Even though the specific cannula is unavailable, modification of the available ones has proved practical and very useful. We bend the available 23G blunt tip cannula to take on the curvature of the globe. After application of topical anesthetic drops, 5% povidone iodine solution and placement of a lid speculum, the conjunctiva and Tenon capsule are gripped with non-toothed forceps, 5 to 10 mm away from the limbus in the inferonasal quadrant. A small incision is made through these layers with scissors to expose the sub-Tenon space, and the cannula is inserted following the globe.

Brainstem anesthesia is well recognized complication of retrobulbar block. Although this is rare, treating physicians should be aware of its potentially lethal consequences. Facilities where ophthalmic surgeries are performed under LA should be appropriately equipped and staffed for advanced resuscitation. The physician in charge should also have the appropriate skills to safely manage them. Every ophthalmic theatre unit should also have one anesthetist with overall responsibility for critical care to ensure the safety of patients. An audit of the complications of anesthetic techniques used in ophthalmic theatre units in eye hospitals is highly recommended. Such particular cases should also open our eyes to evaluate our routine clinical practice and consider alternatives to peribulbar or retrobulbar anesthesia as needed.

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