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CLINICAL REPORT

Effect of pressure-reducing devices on the quality of anterior orbit anesthesia

Waleed Riad

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Abstract Needle length is an important consideration in the safe conduct of ophthalmic blocks. A shorter needle could be used to insert the local anesthetic before the globe equator in the anterior orbit and to direct the injectable posteriorly using Honan's balloon to produce the desired effect. However, the use of pressure-reducing devices is not advisable in procedures with impaired retinal blood flow. The aim of this work was to demonstrate the effect of ocular compression with a Honan's balloon on the quality of peribulbar anesthesia when a short needle was used. The blockades were performed in 120 patients using a 27 G, half-inch-long needle. The needle was inserted into the inferotemporal quadrant adherent to the inferior orbital notch. The 7 to 10 ml of local anesthetic solution, consisting of bupivacaine 0.5%, lidocaine 2% in a ratio of 3:2 with hyaluronidase 5 U/ml, was injected followed by application of Honan's balloon or no compression. Ocular akinesia was assessed 10 min later; if inadequate, supplementary anesthesia was provided. No difference was detected in terms of volume injected, supplementation, and akinesia score. Under the conditions of this study, Honan's balloon did not contribute to the quality of the anterior orbit anesthesia, and the technique can be successfully used when ocular compression is contraindicated.

Keywords Ophthalmic anesthesia · Peribulbar blockade · Honan's balloon

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W. Riad (✉)
Department of Anesthesia, King Khaled Eye Specialist Hospital, P.O. Box 7191, Riyadh 11462, Kingdom of Saudi Arabia
e-mail: waleed_riad@yahoo.com

Introduction

Peribulbar blockade is still used for many ophthalmic procedures [1]. To improve the safety of the procedure, a shorter needle together with ocular compression is used for peribulbar blockade. Nevertheless, although beneficial, ocular compression has potential risks [2].

Ophthalmic anesthesiologists divide the orbit anatomically into three compartments (anterior, mid, and posterior). The anterior orbit is the space between the lids and the attachment of the extraocular muscles to the periorbital tissue 2–5 mm anterior to the globe equator, The mid-orbit follows and ends posteriorly about 10–12 mm behind the hind surface of the globe. The posterior orbit is primarily the site of muscle origin and a collection of arteries, nerves and veins, and it ends at the optic canal [3]. It has been demonstrated that a 16-mm needle reaches only to the junction between the anterior and mid orbit and cannot pass beyond it; consequently, when a shorter needle is used for block administration, the tip will rest only in the anterior orbit [4]. The anterior orbit anesthesia technique originally described by this author involves the injection of the local anesthetic solution before the globe equator using a 27 G, half-inch-long needle and the direction of the injectable substance posteriorly using Honan's balloon to produce the desired anesthetic effect [5]. However, the use of pressure-reducing devices is not advisable in patients with a reduced retinal blood supply [6]. The retina is a highly metabolic structure and is extremely sensitive to ischemia. Patients undergoing glaucoma or posterior segment surgery have an ischemic retina; any further application of pressure can cause a detrimental effect on the visual outcome. To date, there has been no published report of a clinical trial demonstrating the efficacy of the technique in absence of ocular compression. The aim of this prospective randomized control trial was to study the effect of using ocular compression with Honan's balloon on the effectiveness of anterior orbit anesthesia using post-block ocular akinesia as the primary endpoint.

Clinical report

Following approval of the Hospital Research and Human Ethics committees and informed written consent from all participating patients, 120 patients, American Society of Anesthesiologists (ASA) I–IV, undergoing different ophthalmic procedures under regional anesthesia were enrolled in this prospective randomized blind study. All anesthesia procedures were performed by the author. Patients allergic to local anesthetic or with local infection, coagulation impairment, and orbital abnormalities were excluded from the study. Patients were randomly divided into two groups ($n = 60$ each group) using a sealed envelope technique.

Patients were instructed to fast for 6 h prior to the procedure and were premedicated orally with hydroxyzine 0.5–1.5 mg/kg and two tablets of the combination of acetaminophen 500 mg and codeine 10 mg (Revacod; Arab Pharmaceutical Manufacturing Co, Salt, Jordan). Upon arrival of the patient in the preoperative holding areas, baseline globe movements in the major directions of gaze (superior, inferior, medial, and lateral) were assessed. Standard monitoring of pulse oximetry, electrocardiography, and non-invasive blood pressure were commenced, and an intravenous cannula was put in place. Anterior orbit peribulbar blockade was performed with a disposable sharp 27 G, half-inch-long needle (BD Microlance 3; Becton Dickinson, Benelux, Belgium). After disinfection of the lower eyelid in the infero-temporal quadrant with 70% isopropyl alcohol, the needle was inserted perpendicular to the skin adherent to the inferior orbital notch until its hub rested on the orbital bony rim. Digital pressure was applied by the thumb and index fingers around the needle hub during injection. This prevents needle displacement and promotes a postero-superior spread of the injectable solution instead of accumulation into the lower eyelid. After negative aspiration, 7–10 ml of local anesthetic solution (bupivacaine 0.5%, lidocaine 2% in a ratio of 3:2; Astra, Astra Sodertalje, Sweden) with hyaluronidase 5 U/ml (CP Pharmaceutical, Wrexham, UK) was injected until total drop of the upper eyelid was achieved. This was followed immediately by the application of Honan's balloon at 30 mm Hg for 10 min (Group 1) or no ocular compression (Group 2). Ocular akinesia was assessed 10 min later using the Simple Akinesia Score [7] by an anesthesiologist who was unaware of the study. The Simple Akinesia Score measures eye movement in main four directions of gaze (medial, lateral, superior, and inferior), with a score of two for normal movement, one for reduced movement, and zero for flickering and no movement. Combining the four directions of ocular movement gives a maximum score of eight and a minimum score of zero (total akinesia). A score of one or total akinesia was considered to be suitable for surgery purposes. If the block was inadequate for surgery, supplementary anesthesia was provided using the same needle. Any complications or additional anesthesia supplementation were documented.

The results were analyzed using the Statistical Package for Social Science for Windows ver. 14 (SPSS, Chicago, IL). The sample size calculation indicated that 120 patients were required to detect a 0.5 difference in the mean of the Simple Akinesia Score, ($\alpha = 0.05$, and $\beta = 0.20$). Numerical data were analyzed using the independent sample, two tailed t test, while categorical data were compared using the chi-square test. A p value of 0.05 was set as the level of significance.

Demographic and descriptive data are shown in Table 1. There was no difference between the groups in terms of age, sex, body mass, operated eye, ASA classification, staphyloma prevalence, and axial length. There was no statistical significant difference between the groups for the volume of primary injection, total volume of local anesthetic, number of patients requiring supplementary injection, total number of the supplements, akinesia score 10 min after the first injection (primary endpoint of the

Table 1 Demographic and descriptive data

	Group 1 (Honan's balloon) ($n = 60$)	Group 2 (No Honan's balloon) ($n = 60$)	p value
Age (years)	63.5 ± 11.2	61.5 ± 13.4	0.48
Body mass index	28.7 ± 5.9	28.5 ± 4.9	0.78
Sex			
Male	36 (60)	33 (55)	0.58
Female	24 (40)	27 (45)	
Side			
Right eye	32 (53.3)	33 (55)	0.85
Left eye	28 (46.7)	27 (45)	
ASA classification			
I	7 (11.7)	5 (8.3)	0.79
II	24 (40)	23 (38.3)	
III	27 (45)	28 (46.7)	
IV	2 (3.3)	4 (6.7)	
Frequency of staphyloma	1 (1.7)	2 (3.3)	0.55
Axial length (mm)	23.2 ± 1.1	23.8 ± 1.2	0.16

Data are expressed as a mean ± standard deviation (SD), or as a number of patients with the percentage in parentheses

Axial length represents the antero-posterior diameter of the eye; the normal value for an adult is approximately 23–25 mm

Table 2 Volume of local anesthesia injected, supplementation rate and akinesia

Anesthesia variables	Group 1 (Honan's balloon) ($n = 60$)	Group 2 (No Honan's balloon) ($n = 60$)	p value
Initial volume injected (ml)	9.2 ± 1.5	9.5 ± 0.95	0.28
Total volume injected (ml)	12.3 ± 5.4	12.3 ± 5.9	0.94
Number of patients required supplementary injection	17 (28.3)	16 (26.7)	0.51
Total number of supplements	20	21	0.87
Akinesia score after 10 min	0.6 ± 1.1	0.9 ± 1.3	0.20
Akinesia score after supplementation	0.3 ± 4.8	0.3 ± 4.7	1.00

Data expressed as the mean ± SD, or as the number of patients with the percentage in parentheses

study), and akinesia score after supplementation (Table 2). There were no cases of globe perforation, retrobulbar hemorrhage, optic or retinal damage, orbital hematoma, and lid hemorrhage in both groups. No major life-threatening complications were recorded.

Discussion

The results of this study show that the use of Honan's balloon had no effect on the quality of anterior orbit anesthesia. Patients in both groups received a comparable volume of local anesthetics. Similar results in terms of the akinesia score and secondary injection were found with or without the use of Honan's balloon.

The effect of Honan's balloon on intraocular pressure (IOP) and the need for its usage have been thoroughly discussed in the literature. It is well documented that there is a sharp and momentary rise in IOP after peribulbar blockade [6, 8]. Bowman and colleagues [8] reported that ocular compression is effective in lowering the IOP in normal eyes as well as after peribulbar injection. In this study, based on the onset of action, 8 min was required to achieve maximum anesthesia with the local anesthetic mixture used. Morgan and Chandra reported that IOP decreased to the pre-injection pressure within 4 min in the absence of Honan's balloon and that the IOP measured 10 min after the blockade did not differ from that of patients in whom ocular compression was used [9]. However, they investigated only the effect of the pressure-reducing device on block quality if the local anesthetic fluid injection was anterior to the orbital equator. Ling and colleagues studied the effect of the Honan balloon on IOP following peribulbar block performed with a 25-mm needle and documented no significant changes between baseline values and those 10 min after block without compression [10]. In accordance with the results of the present study, they reported no differences between groups with or without ocular compression in terms of the surgeon's assessment of akinesia, analgesia effectiveness, and patients' pain scale [10]. On the other hand, Change and associates reported that the use of a 10-min compression with Honan's balloon reduces IOP and improved pulsatile ocular blood flow following peribulbar anesthesia due to improved perfusion pressure [2]. In the same study, they also reported that the post-injection IOP was similar to the pre-injection pressure in the non-compression group. In another report, Watkins and colleagues reported that the reduction in pulsatile ocular blood flow is only a short-term effect and that it is mainly mediated by pharmacological alteration of vascular caliber rather than by ocular compression [11].

In conclusion; among the patients studied here, Honan's balloon compression did not contribute to any enhancement of the quality of the anterior orbit anesthesia. The technique is, however, effective under conditions in which ocular compression is contraindicated.

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