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Journal of Current Ophthalmology 31 (2019) 339–341

http://www.journals.elsevier.com/journal-of-current-ophthalmology

Brief report

The use of air from the infusion line to confirm infusion tip positioning in vitreous surgery for eyes with media opacities

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Received 25 November 2018; revised 6 January 2019; accepted 9 January 2019
Available online 30 January 2019

Abstract

Purpose: To demonstrate the use of an air bubble in infusion to ascertain infusion tip (IT) positioning before commencing vitreoretinal surgery (VRS) in eyes with media opacities.

Methods: Twenty-four eyes were studied. An air bubble was introduced into the IT by manually expelling fluid from the distal end of the IT. Passage of this air bubble into the vitreous cavity immediately on opening the infusion line confirmed IT position and VRS was commenced only after this event.

Results: The air bubble was seen within the eye in 18/24 eyes immediately on opening the infusion line. In 6 eyes, the air bubble did not exit the infusion line, and VRS was commenced only after IT position was confirmed by other methods. In all 24 eyes, no untoward effect attributable to the air bubble was noticed during subsequent VRS.

Conclusions: An air bubble introduced into the IT helps to quickly confirm IT position when direct visualization of the IT is difficult. There were no untoward events in eyes where the air bubble could not enter the vitreous cavity.

Keywords: Vitreous surgery; Infusion tip position; Vitreous hemorrhage; Media opacities

Introduction

In vitreoretinal surgery (VRS), the infusion cannula tip has to go beyond the choroidal tissue and the inner non-pigmented ciliary epithelium before surgery is commenced.[1,2] Choroidal detachment is a devastating complication that could occur due to misinterpretation of infusion tip (IT) position.[2–4]

Vitreous hemorrhage, ocular trauma, emulsified silicone oil, small or eccentric pupils, pupillary membranes, and peripheral capsular opacities do not allow direct viewing of the pars plana region where IT projects.[5,6] We describe a technique to easily confirm proper positioning of IT before commencing VRS.

Methods

25-gauge VRS was performed in 24 eyes. In these eyes, IT could not be made out by direct visualization due to various reasons.

Surgical technique

The trocar-cannula system was used to fix infusion line in a routine manner. If IT is not visualized, the clamped infusion line is disconnected from the cannula and tapped so that a minimal amount of fluid at the distal end of the infusion line is expelled (Supplementary video 1). The air bubble in IT can then be seen (arrow, Fig. 1A). The infusion line is reconnected to the cannula. As soon as infusion is switched on, there is a small gush from the infusion port. Thereafter, infusion stops as there is no space for volume expansion. The surgeon can immediately see the air bubble disappear from the infusion

Conflict of interest/financial interest: None.

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Peer review under responsibility of the Iranian Society of Ophthalmology.

https://doi.org/10.1016/j.joco.2019.01.005

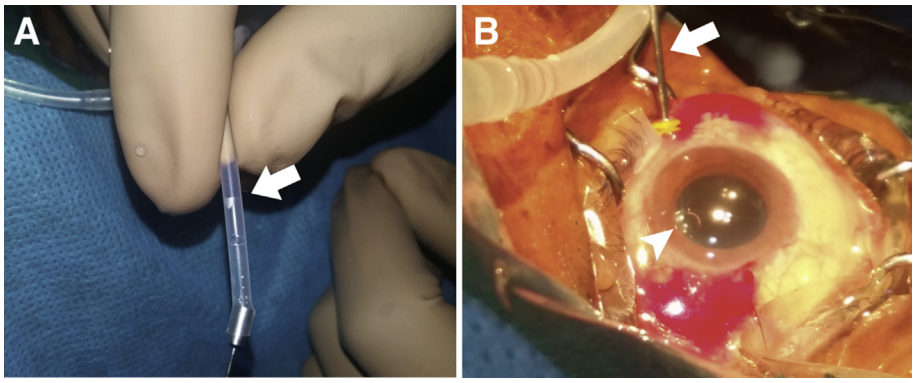

Fig. 1. Introduction of an air bubble into the distal tip of the infusion line can be confirmed by observing the air-fluid meniscus in the infusion line (arrow, Fig. 1A). The air bubble behind the lens (arrowhead, Fig. 1B) can be seen. In case of low contrast due to dense vitreous hemorrhage or exudates, placing an endoilluminator (arrow, Fig. 1B) at the mouth of the infusion port can help to highlight the air bubble.

line and appear within the eye if the IT is correctly positioned (arrowhead, Fig. 1B). If the air bubble cannot be seen within the eye, it is a pointer to improper position of the IT, and VRS is not commenced.

Supplementary video related to this article can be found at https://doi.org/10.1016/j.joco.2019.01.005.

Results

24 eyes where the IT was not visualized due to vitreous hemorrhage (12 eyes), emulsified silicone oil (6 eyes), small pupil (3 eyes), peripheral capsular opacity (2 eyes), and ocular trauma (1 eye) were studied. The air bubble was seen within the eye immediately after opening infusion in 18 eyes (75%). In the remaining 6 eyes (3 with vitreous hemorrhage, 1 with emulsified silicone oil, 1 with peripheral capsular opacity, and 1 with ocular trauma), alternate steps were taken to confirm IT positioning before commencing VRS. During subsequent VRS, the infusion port site was carefully checked in all the eyes, and no untoward effects such as air under the retina or choroidal detachment could be seen.

Discussion

When the IT is not directly visible in the pars plana region, the retinal surgeon has a few options to ascertain if the IT is within the vitreous cavity. Shoeibi and Ansari-Astaneh have demonstrated that the color of the vitreous cavity when the endoilluminator is inserted partially into the infusion cannula is an effective method of determining the position of the tip of the infusion port.[6] In silicone oil-filled eyes, after affixing the infusion line, gentle pressure on the globe may lead to oil being pushed into the infusion cannula, and the movement of the oil meniscus in the infusion line confirms that the tip is within the vitreous cavity. In eyes with a relatively low intraocular pressure, a momentary fluid pulse can be felt as soon as the infusion is opened if a finger is placed on the globe in the meridian opposite to the one with infusion. This pulse is indirect evidence that the IT is not behind the choroid or retina in which case, immediate volume expansion across the entire diameter of the globe will not occur. Despite their utility, these are indirect methods. We present a quicker, definitive, and more versatile technique where the passage of the air bubble from the infusion line into the vitreous is direct proof of proper IT positioning. VRS can be commenced confidently once the air bubble is seen in the vitreous. This air bubble test is the first step before vitrectomy is commenced. If the air bubble is not seen within the eye, VRS is not commenced, and any of the alternate traditional methods described earlier can be employed to check the IT position.

Physical barriers such as retinal or choroidal tissue overlying the IT can prevent the air bubble from entering the vitreous. In our series, one eye with ocular trauma had choroidal detachment with associated suprachoroidal hemorrhage, and the IT was present behind the choroid. Therefore, the air bubble did not appear in the vitreous. Of particular note, the air bubble did not enter the suprachoroidal space and instead, remained in the infusion line. In the other 5 eyes, there was no obvious physical barrier noted at the IT during subsequent vitrectomy. We therefore postulate that the absence of a pressure gradient between the infusion line and the vitreous cavity before commencement of vitrectomy appears to be the reason why the air bubble is retained in the infusion line and unable to enter the vitreous in a majority of eyes.

Unlike a balloon that is expansile, where increase in pressure results in increase in volume, the eye is a closed chamber with rigid ocular coats. Irrespective of pressure used, fluid (liquid or air) from the infusion line cannot enter the eye (into any plane) in a continuous manner until intraocular contents are being simultaneously removed. Therefore, as demonstrated by our study, choroidal or retinal detachment does not occur even if the small air bubble does not enter the vitreous cavity. If the surgeon has not seen the air bubble in the vitreous cavity, he is alerted to the possibility of improper positioning of the IT, and he should take corrective steps before starting VRS.

To conclude, surgeons can confirm proper positioning of the IT before commencing VRS or at any stage of surgery where the eye is liquid filled by use of a small air bubble in infusion line. It involves the use of no additional instruments or special procedures. A few minutes of time to perform this maneuver could prevent potentially disastrous complications.

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