

Macular Hole Surgery With Air Tamponade and OCT-based Duration of Prone Positioning

A modified OCT can determine hole closure and reduce inconvenience for some patients.

BY CLAUS ECKARDT, MD

Surgical procedures for the repair of idiopathic macular holes in the hands of most retinal surgeons today consist of vitrectomy, peeling of the internal limiting membrane (ILM), and gas tamponade. However, the choice of the type of gas to be used for tamponade and whether and for how long to prescribe postoperative face-down positioning vary widely among surgeons.¹⁻⁸

Our patients will be happier, and so will we, if we can spare them the discomfort and inconvenience of postoperative prone positioning. No matter what devices or resources we employ, this requirement remains a torture for our patients.

Several studies have reported successful macular hole surgery with no postoperative prone positioning.^{7,8} Generally, this requires the injection of long-lasting gases such as C_3F_8 or SF_6 . While this relieves patients of the burden of days of face-down immobility, the benefit is counterbalanced by a significant drawback; for several weeks, the patient experiences considerable irritation due to the presence of the gas bubble in the eye.

To the best of my knowledge, only two studies have reported the use of air as a tamponade after macular



Figure 1. A patient in prone position looks down into the modified OCT for examination.

hole surgery. In 1999, Park and colleagues⁴ reported hole closure in 91% of their patients after 4 days of prone positioning with air tamponade. In 2003, Sato and Isomae⁵ achieved hole closure after only 1 day prone positioning, also in 91% of cases. Their report, however, included only small macular holes.

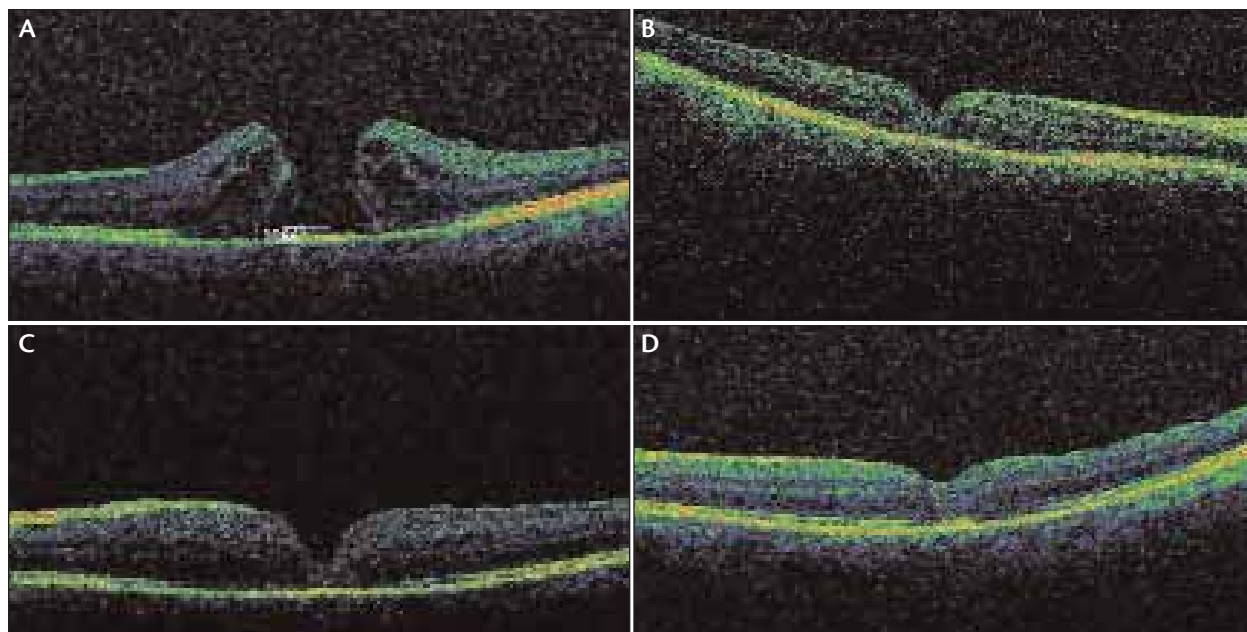


Figure 2. OCT of a patient before surgery for macular hole (A). The same patient at 1 day (B), 4 days (C) and 4 weeks (D) postoperative.

PILOT STUDY AND DISCUSSION

We performed a pilot study of air tamponade with 3 days postoperative prone positioning in 35 eyes with idiopathic macular holes. In 31 patients (88%), the macular hole was successfully closed after 3 days. All eyes in which the hole did not close underwent a second surgery, raising the final success rate to 97%.

In this pilot study, we chose 3 days as the duration for prone positioning because with air tamponade the macula can be examined only after 3 days. On the first postoperative day, with the vitreous cavity 60% full of air, and on day 2, with the cavity still 50% full, the macula cannot easily be seen through the ophthalmoscope. The inferior retina can be examined by directing the optical beam of the ophthalmoscope under the air bubble, and even the superior retina can be visualized because the light beam strikes the air bubble at the correct angle. If one tries to examine the macula, however, the ophthalmoscope beam strikes the face of the air bubble tangentially and is deflected.

The macula can be visualized if the eye is rotated, with the patient in a prone position and the examiner beneath. In this orientation, the ophthalmoscope beam strikes the air bubble at a right angle and is not deflected. Unfortunately, even in this position, the magnification provided by the ophthalmoscope is not sufficient. Also, this examination technique is very strenuous.

MODIFIED OCT

We searched for a way to examine the retina with the

air bubble in place, to answer the question of whether 3 days prone positioning is really necessary. This is one of the main reasons there are such differences among clinicians regarding the length of postoperative prone positioning; no one knows when macular hole closure occurs after surgery because we cannot examine the retina. Does the hole close right away, on the first day postop, or does it take several days? Would 1 day prone positioning be sufficient?

Optical coherence tomography (OCT) can show us when the hole is closed, but in the normal upright position it can be used only after sufficient gas has been resorbed so that it fills no more than 40 to 50% of the vitreous cavity.⁹⁻¹¹

To address this problem, we had a 3D OCT-1000 (Topcon Europe Medical BV, Capelle a/d Ussel, Netherlands) Fourier-domain OCT remodeled so that the optical beam strikes the eye vertically rather than horizontally. The device was attached to a motorized, height-adjustable arm at a 90° angle to its usual orientation. The patient in prone position looks down into the aperture for the examination (Figure 1). In this position, the laser beam strikes the air bubble at a right angle and is not deflected as it would be in a conventional OCT exam.

PROSPECTIVE STUDY

We performed a prospective study to assess the efficacy of air tamponade and OCT-based duration of prone positioning.¹² In 48 eyes with idiopathic macular holes,

we performed vitrectomy and ILM peeling with air tamponade. Patients were examined with the modified OCT on postoperative days 1, 2, and 3. When OCT confirmed closure of a patient's macular hole, prone positioning for that patient was discontinued.

Patients were divided into four groups on day 1 based on OCT findings. Group 1 included patients whose macular holes were definitely closed. At 24 hours postop these patients did not need to continue prone positioning. Group 2 included patients whose holes were questionably closed; these patients had to stay in prone position for a further 24 hours. Group 3 included patients whose macular holes were definitely still open after 24 hours; these patients too were required to continue in prone position. For patients in group 4, OCT images could not be obtained due to clouding of the optical media; these patients also remained in prone position.

On postoperative day 1, macular hole closure was confirmed in 28 eyes (58.3%). The holes were questionably closed in four eyes (8.3%) and definitely open in five eyes (10.4%). OCT was not possible in 11 eyes (22.9%).

With regard to the vertical OCT, my colleagues and I can no longer imagine performing macular surgery without it.

After 48 hours, hole closure was confirmed in 36 eyes (75%), and after 3 days in 44 eyes (91.6%).

In the five eyes in which holes were definitely still open after the first day, despite continued prone positioning, only one closed during the following 3 days. The four eyes with holes that did not close were operated on a second time, 3 to 5 days later, again using air, and after 3 days in prone position three of the four holes had closed.

Figure 2 shows the OCT scans of a patient before surgery for macular hole, at 1 and 4 days, and 4 weeks postoperative.

DISCUSSION AND CONCLUSIONS

Air, the simplest of tamponades, led to successful closure of idiopathic macular holes in more than 90% of patients in this study. This success rate suggests that use of longer-lasting gases is unnecessary. Air also has the advantage that OCT images of the macula can be obtained on the third postoperative day, and even sooner if a vertical OCT is used. Air, therefore, allows earlier reoperation should the holes fail to close after the first day. This is a great advantage compared to C_3F_8 gas.

It should be noted that in 25 eyes (52%) of the 48 in this study, macular holes were stage 3 or 4. Even large holes, 900 μ m in size, closed without delay, within 1 day. We have not encountered any reopening of a macular hole with follow-up of more than 7 months.

As noted, in the five eyes in which holes were still open on day 1 postop, only one closed during the following 3 days despite continued prone positioning. We conclude from this that if the hole has not closed within 24 hours, there is only a slight chance that it will close during continued face-down positioning. These results suggest that air tamponade of the macula for longer than 2 days is of no use.

With regard to the vertical OCT, my colleagues and I can no longer imagine performing macular surgery without it. We can tell our patients that more than half of patients in the study were able to discontinue prone positioning after the first postoperative day. The availability of this vertical OCT technique motivates patients to remain in the face-down position from one day to the next, and it helps us to avoid prescribing unnecessarily long prone positioning. ■

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Prof. Eckardt states that he possesses patents for vitreo-retinal instruments produced by Dutch Ophthalmic Research Center. He may be reached at +49 69 3106 2355; or via e-mail at C.Eckardt@em.uni-frankfurt.de.

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