

The Effect of the Anterior Ocular Structures on the Fluid Dynamics in Eyes with Gas Tamponades

In the article by Angunawela et al.¹ in the September 2011 issue, the authors used the finite-volume method and advanced computational fluid dynamic modeling to replicate a vitrectomized eye filled with gas tamponade. They computed the relationship between different fractions of gas fill and fluid shear stress on the retina in response to saccadic eye movements and rectilinear head movements and found that liquid waves and sloshing, which resulted from both saccadic eye movements and normal head movements, generated shear forces on the retina; the shear stress reached its maximum at approximately 50% gas fill. They concluded that this force could elevate a retinal tear and allow fluid to propagate beneath the retina. Therefore, patients should be advised to avoid sudden brusque head movements in the immediate postoperative period.

In their methods, they carefully defined the parameters they used, including associated Reynolds number, water viscosity, water density, air dynamic viscosity, air density, air-water interface surface tension, and temperature. However, they treated the eye as a sphere with the head modeled in an upright position.

In reality, when the head is in the upright position, the residual vitreous, the ciliary body, the zonules, and the posterior lens capsule occupy a significant part of the eye wall. At 50% gas fill, these structures would work as partial baffles and compartments. Physical barriers, such as baffles and compartments can reduce liquid sloshing.² Although I agree that the study was carefully designed, I also believe that including the residual vitreous, the ciliary body, the zonules, and the posterior lens capsule in their finite eye model would have given more realistic results.

Mabmut Dogramaci

Lister Surgicentre Hospital, Stevenage, Hertfordshire, United Kingdom.

E-mail: mahmutdogramaci@hotmail.com

References

1. Angunawela RI, Azarbadegan A, Aylward GW, Eames I. Intraocular fluid dynamics and retinal shear stress after vitrectomy and gas tamponade. *Invest Ophthalmol Vis Sci.* 2011;52:7046-7051.
2. Dongming Liu, Pengzhi Lin. Three-dimensional liquid sloshing in a tank with baffles. *Ocean Eng.* 2009;36:202-212.

Citation: *Invest Ophthalmol Vis Sci.* 2012;53:1324.
doi:10.1167/iovs.12-9560