MR Imaging Characteristics of Intraocular Perfluoro-n-Octane

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ABSTRACT

SUMMARY: We describe the unique MR imaging characteristics of intraocular perfluoro-n-octane, a liquid used for intraoperative and postoperative tamponade in the context of complex retinal detachment repair, and contrast it with other intraocular pathologies. Because trace amounts of perfluoro-n-octane may be left in the globe postoperatively, it may be confused for other abnormalities, such as foreign bodies or tumors.

ABBREVIATION: PFO = perfluoro-n-octane

Perfluoro-n-octane (PFO) is a low-viscosity perfluorocarbon liquid used for intraoperative retinal tamponade in complex retinal detachments.[1] Its high specific gravity makes it useful for stabilizing and flattening the retina intraoperatively.[1] PFO is thought to exert a long-term toxic effect on the retina, depending on the amount left in the eye, and typically at the end of the surgical procedure, it is exchanged with a perfluorocarbon gas or silicone oil for postoperative tamponade.[1] The fluid–air exchange process is not perfect, and trace amounts of PFO may be left in the eye without consequence, except in rare cases when trace amounts of the liquid may be trapped in the subretinal space.[2] There have been reports, however, of trace amounts of PFO mimicking intraocular foreign bodies on CT, thus prompting further unnecessary work-up when its history of use was unrecognized.[3,4] Although its CT characteristics have been reported, its MR imaging characteristics have not been described to our knowledge.

In some cases, PFO may be intentionally left in the globe short term postoperatively for tamponade in eyes at high risk of redetachment because of proliferative vitreoretinopathy or in patients with giant retinal tears or multiple inferior breaks who cannot tolerate face-down positioning.[5] We describe here the MR imaging characteristics of PFO in a patient with a history of recurrent retinal detachments of the left eye requiring postoperative PFO tamponade who subsequently underwent MR imaging for unrelated vision loss of the right eye.

A 64-year-old male patient with a history of repair 2 weeks earlier of a recurrent rhegmatogenous retinal detachment of the left eye, complicated by proliferative vitreoretinopathy requiring PFO for postoperative tamponade, underwent MR imaging of the orbits (Figure) after presenting with vision loss of unclear cause of the right eye.

FINDINGS

PFO liquid demonstrates signal void on conventional fast spin-echo MR imaging, appearing hypointense on T1-weighted sequences, fat-suppressed T2-weighted sequences, and STIR sequences. In large quantities, the signal void of PFO on MR imaging resembles air. However, the high specific gravity of PFO accounts for its dependent layering when placed in the posterior segment, which is opposite of the nondependent layering of air and gaseous compounds.

DISCUSSION

The appearance of PFO on MR imaging results from its high specific gravity and lack of proton spins within the substance, leading to dependent layering and signal void on all sequences. The lack of proton spins owes to its chemical composition, C_8F_{18}, consisting entirely of carbon and fluorine atoms without any hydrogen atoms. In clinical contexts, PFO is most likely to be encountered in trace quantities. In these trace amounts, PFO could be mistaken for subhyaloid or retinal hemorrhage, air bubbles, dystrophic calcification, intraocular masses, or foreign bodies. Of the 5 substances injected into the globe for retinal tamponade, including filtered air, sulfur hexafluoride gas, perfluoropropane gas, silicone oil, and PFO, PFO is the only substance

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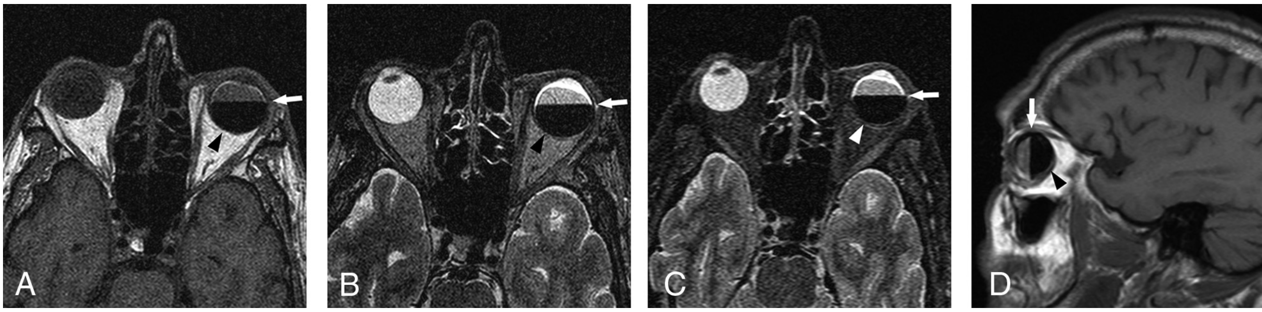

FIGURE. Axial T1-weighted (*A*), axial fat-suppressed T2-weighted (*B*), axial STIR (*C*), and sagittal T1-weighted (*D*) MR imaging of the orbits demonstrate hypointense PFO layering dependently within the posterior segment of the left globe (*arrowheads*) with fluid–fluid level (*arrows*). Note that the attenuation of PFO is greater than that of water, causing it to layer dependently within the left globe in this supine patient.

with a specific gravity higher than water and would be the only substance of the 5 expected to settle in a dependent manner. Silicone oil has been described as appearing similar to hemorrhage, demonstrating hyperintensity to vitreous on T1-weighted imaging and hypointensity on T2-weighted imaging.[6]

Intraocular masses, including uveal melanoma, intraocular metastases, retinoblastoma, and retinal capillary hemangioma, all demonstrate hypointensity to vitreous on T2-weighted images but are distinguishable from PFO by hyperintensity to vitreous on T1-weighted sequences or isointensity to vitreous on T1-weighted images in the case of metastases.[7] Calcifications, which may be seen in phthisis bulbi, retinoblastoma, and optic disc drusen, would not feature fluid–fluid levels and typically take on a more disorganized or scattered appearance in the case of phthisis bulbi and retinoblastoma.[8]

Depending on their physical properties, intraocular foreign bodies can demonstrate a wide range of signal characteristics on MR imaging. Nonmetallic foreign bodies typically demonstrate low T1-weighted and T2-weighted signal intensity and may appear similar to PFO, especially if they are small.[9] However, nonmetallic intraocular foreign bodies of larger size typically demonstrate geometric shapes without the fluid–fluid level appearance of PFO.[9] Most nonmetallic intraocular foreign bodies also typically demonstrate a thin high-intensity rim most notable on T1-weighted images, with some foreign bodies, particularly certain types of glass and wood, also demonstrating variable blooming artifacts not seen with PFO.[9]

CONCLUSIONS

PFO may be differentiated from other intraocular entities by its signal void on all sequences, fluid–fluid levels when present in sufficient quantity, and dependent layering in the globe, owing to its high specific gravity. Multiple cases have been reported of trace amounts being confused for intraocular foreign bodies on CT, and if unrecognized, it may prompt further unnecessary work-up.[3,4] In cases of repair of ocular trauma, both silicone oil droplets and PFO droplets have been reported to migrate intracranially, potentially leading to further diagnostic confusion.[10,11] Knowledge of its MR imaging characteristics compared with other intraocular entities is important to avoid incorrect diagnosis.

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