

# Chandelier Retroillumination–Assisted Cataract Extraction in Eyes With Vitreous Hemorrhage

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**W**e describe the surgical technique of using an illuminated infusion chandelier for cataract extraction in patients with absent red reflex due to vitreous hemorrhage. A 23-gauge illuminated infusion chandelier was used for cataract extraction in 6 consecutive patients (6 eyes) who underwent combined surgery: phacoemulsification and 23-gauge sutureless vitrectomy. During surgery, the light from the illuminated infusion chandelier was used to enhance the red reflex and to better visualize the lens structure and capsule. Continuous curvilinear capsulorhexis and phacoemulsification were successfully performed. Capsular polishing was also performed safely and easily. The posterior capsule remained intact and the intraocular lens was inserted into the bag in all cases. Thus, the use of the 23-gauge illuminated infusion chandelier can improve visualization of the lens structure and capsule, thereby facilitating successful cataract extraction in select patients with vitreous hemorrhage.

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Phacoemulsification has been routinely performed for cataract removal since 1967, when Kelman<sup>1</sup> first introduced the ultrasonic phacoemulsification technique. Performing phacoemulsification requires good visualization of the anterior capsule, cortex, and posterior capsule. Visualization of the red reflex using the operating microscope is important for assessing the lens structure and capsule during surgery. When other organic problems such as corneal opacity or vitreous hemorrhage and opacity are present, visualization of the red reflex may be compromised and phacoemulsification will be more difficult. Several techniques have therefore been introduced to overcome such a difficulty.<sup>2-5</sup>

We report how to overcome occluded red reflexes in select patients with vitreous hemorrhage, and we describe a surgical technique that uses a 23-gauge illuminated infusion chandelier for cataract extraction.

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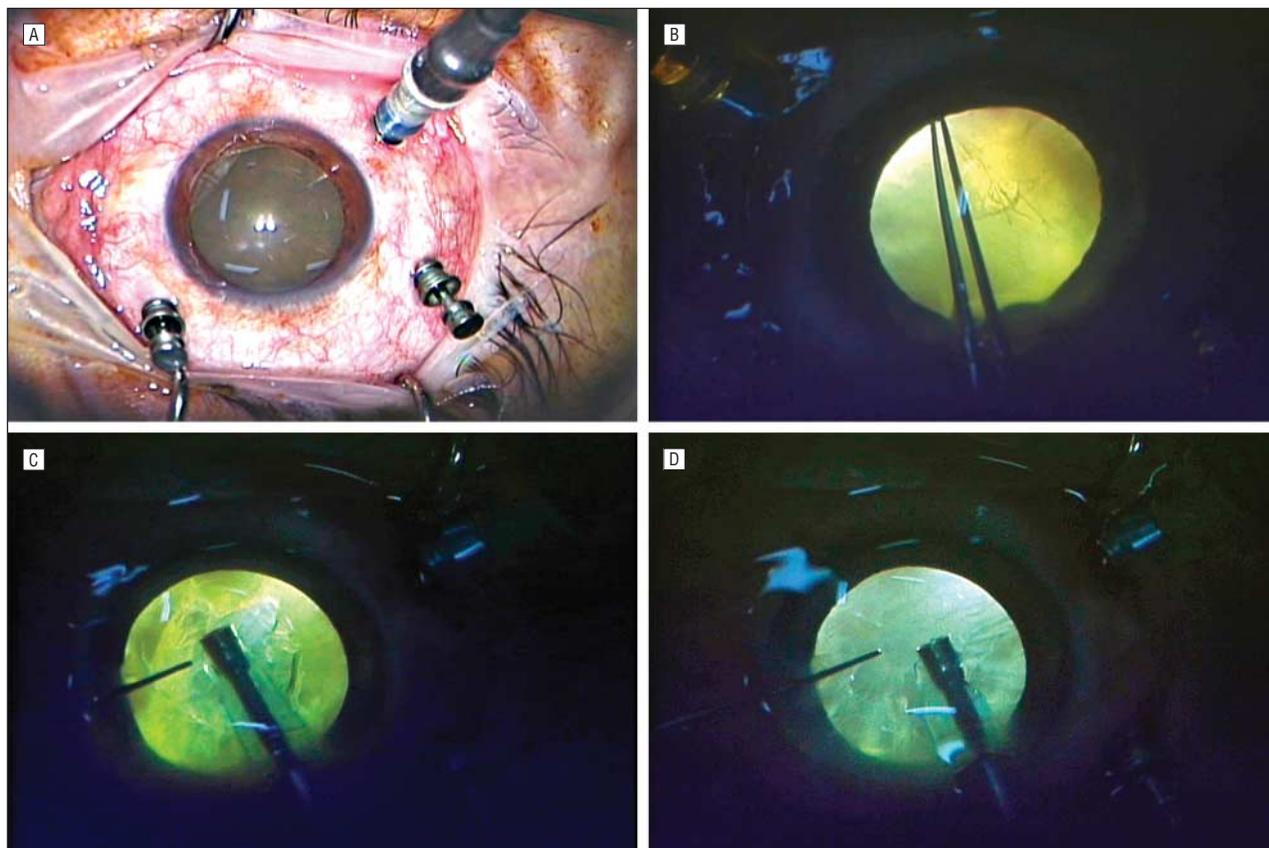
## METHODS

Six consecutive patients (6 eyes) with proliferative diabetic retinopathy underwent combined surgery of phacoemulsification and 23-gauge sutureless vitrectomy. All operations were performed by one of us (K.S.C.). First, 3 sclerotomies were conducted using the 2-step Eckardt 23-gauge vitrectomy system (Dutch Ophthalmic Research Centre, Zuidland, the Netherlands) 3 mm from the corneal limbus. After the cannula was inserted through the sclerotomy wound in the inferotemporal area, the 23-gauge illuminated infusion chandelier (Synergics USA, Inc, O'Fallon, Missouri) was introduced into the vitreous cavity through the trocar. A 3.0-mm clear corneal incision was made at the 11-o'clock position, and viscoelastic (Dycovisc; Alcon Laboratories, Inc, Fort Worth, Texas) was injected into the chamber. The light on the chandelier infusion cannula was then turned on to enhance the red reflex and to obtain better visualization of the lens structure without the light of an operating microscope in a dark room. A mercury vapor light source (Photon II; Synergics USA, Inc) was used for the chandelier infusion cannula (2200 lumens/hazard watt). Continuous curvilinear capsulorhexis was performed with a

**Table. Patient Demographic Characteristics**

Patient No./ Sex/Age, y	Eye	Diagnosis	BCVA		Follow-up, mo	Remarks
			Preoperative	Postoperative		
1/M/61	Right	VH, PDR	3	0.2	3	Membranectomy, PRP
2/F/64	Left	VH, PDR, PFVM	1	0.4	3	Membranectomy, PRP
3/F/71	Left	VH, PDR, SRH	2	2	2	Octafluoropropane, Avastin
4/F/68	Left	VH, PDR	2	0.8	2	PRP
5/M/46	Right	VH, PDR, PFVM	1	1	3	Membranectomy, PRP
6/F/47	Left	VH, PDR, DME	1.6	1.3	2	PRP

Abbreviations: BCVA, best-corrected visual acuity; DME, diabetic macular edema; PDR, proliferative diabetic retinopathy; PFVM, proliferative fibrovascular membrane; PRP, panretinal photocoagulation; SRH, subretinal hemorrhage; VH, vitreous hemorrhage.



**Figure.** Chandelier retroillumination–assisted cataract extraction. A, A 23-gauge illuminated infusion chandelier is introduced into the vitreous cavity. B, Illumination from the posterior side improves visualization of the anterior capsule and facilitates successful continuous curvilinear capsulorhexis. The lens nucleus (C) and residual cortex (D) are clearly observed.

cystotome and capsular forceps. After cataract extraction was completed, a foldable intraocular lens was implanted in the bag under chandelier retroillumination. Pars plana vitrectomy followed the cataract extraction. Membranectomy, endolaser photocoagulation, and intraocular gas or oil injection were performed selectively.

## RESULTS

Cataract extraction was performed in 6 patients (6 eyes) using the 23-gauge illuminated infusion chan-

delier. The mean (SD) age of the 4 women and 2 men in the study was 59.5 (10.6) years (range, 46-71 years). The cause of vitreous hemorrhage was proliferative diabetic retinopathy in all patients. The mean follow-up period from diagnosis to surgery was 2.92 months. Patient characteristics are shown in the **Table**. Surgery was successfully performed in all patients. The 23-gauge illuminated infusion chandelier, which was implanted in the sclera, markedly enhanced the red reflex so

that the lens structures, especially the lens capsule, could be seen more clearly. Continuous curvilinear capsulorhexis and phacoemulsification were performed without difficulty under chandelier retroillumination. Excellent visualization of the posterior capsule was obtained during polishing (**Figure**). The posterior capsule remained intact and the intraocular lens was inserted into the bag in all patients. There were no intraoperative or postoperative complications.

As cataract extraction techniques have advanced, clinicians have performed pars plana vitrectomy and cataract surgery in a combined pattern.<sup>6</sup> The advantages of combined surgery have been reported in several studies.<sup>6-8</sup> These include good visualization of the posterior pole during vitrectomy and shorter postoperative recovery time. Patient discomfort may also be reduced and cost will be decreased because only a single operation is necessary.<sup>6-8</sup> However, there are also disadvantages in combined surgery. For example, operating time is increased. As a result, the inflammatory response may be stronger after surgery.<sup>9</sup> Furthermore, combined surgery is technically difficult to perform as vitreous hemorrhage can compromise the red reflex necessary to facilitate cataract extraction. Several methods have been described to observe the lens capsule more clearly in such a difficult situation.

Yamamoto et al<sup>2</sup> described the double visualization technique in patients with cataracts and vitreous hemorrhage. In this technique, the lens capsule is first stained with trypan blue, and phacoemulsification is performed under illumination using a conventional endoilluminator. Although we did not use this staining technique, the light from the 23-gauge illuminated infusion chandelier improved visualization of the lens structures enough to facilitate successful continuous curvilinear capsulorhexis. The 23-gauge illuminated infusion chandelier has another benefit in that the instrument does not need to be held and thus offers a hands-free view. We believe that this is an advantage vs the conventional light pipe-style endoilluminator in that both hands are available for performing the cataract operation. In a facility that does not have a 23-gauge illuminated infusion chandelier, however, a conventional endoilluminator can substitute for the 23-gauge illuminator with an assistant to place and hold the endoilluminator to enhance the visibility.

The endoilluminator-assisted technique was first described in a pa-

tient with an intumescent cataract.<sup>10,11</sup> Since then, Nishimura et al<sup>3</sup> applied it to a patient with a corneal opacity. Oshima et al<sup>12</sup> invented a 27-gauge chandelier endoilluminator and described a technique using a 25-gauge transconjunctival chandelier endoilluminator for cataract surgery in patients with severe bullous keratopathy.<sup>4</sup> In our method, we applied the endoilluminator-assisted technique to patients with vitreous hemorrhage. We used a 23-gauge illuminated infusion chandelier inserted through the sclerotomy site made for the vitrectomy. As an effect of illumination from the posterior side, we were able to safely and easily perform continuous curvilinear capsulorhexis and phacoemulsification with good visualization of lens structure, thickness, and depth. Retroillumination also improved visualization of the posterior capsule and facilitated visualization of the epithelial cells and capsular cells, making polishing easier and reducing the risk of posterior capsular opacity formation. Furthermore, sclerotomy is one of the required steps in vitrectomy, so there is no extra work when using chandelier retroillumination.

This technique is disadvantageous in that additional endoilluminator exposure is required. Such exposure can cause phototoxic effects to the retina.<sup>13-15</sup> However, we operated on patients with vitreous hemorrhage in whom less light could reach the retina, thereby reducing the risk of phototoxic effects. We also turned off the coaxial microscope illumination to reduce the risk of phototoxic effects and to allow for better visualization. However, we do not believe turning off the microscope coaxial illumination is absolutely necessary; we are aware that most surgeons are not accustomed to performing cataract surgery without coaxial illumination, and the lack of coaxial illumination can also lead to problems by limiting the field of view.

In conclusion, clinicians operating on patients with vitreous hemorrhage and occlusion of the red reflex may benefit from implementation of chandelier retroillumination-assisted cataract extraction, which is safe and enhances visualization of lens structures. Such improvements

in technique may reduce the risk of intraoperative complications.

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## OBITUARY

### Bartley R. Frueh, MD (1937-2010)

The fragility of human life is sometimes most apparent in the randomness of accidental, sudden, and profound loss. Such was the fate of a close friend and colleague, Bartley R. Frueh, MD. A fall down the steep stairs of a local restaurant and the severe head injury sustained from it led to his tragic death the next day, February 16, 2010. Although Dr Frueh retired last year from the University of Michigan and its Kellogg Eye Center, he remained on the active medical staff, seeing patients in the clinic and performing surgery on a regular basis. Dr Frueh and his wife, Cheryl, were enjoying his retirement in myriad activities including an archeological dig outside of Rome last summer as well as several bicycle trips and travels to 24 countries in the past 11 years. Special among the Fruehs' travels were multiple trips to Australia, where Dr Frueh had taken 2 sabbaticals in Melbourne and maintained close ties.

Dr Frueh was a man of many interests outside of medicine. He became intensely interested and knowledgeable in such hobbies as Roman coin collecting, Roman history and archaeology, woodworking, playing the violin, Chinese calligraphy, and collecting Asian art. He built a Ford Model T from a pile of old parts and went on to collect other vintage automobiles. His calligraphy will be exhibited in the newly opened Brehm Tower at the Kellogg Eye Center. A long-standing interest was in shooting pool with a group of friends who met each Wednesday evening for the past 20 years.

Dr Frueh was born and raised in Lakewood, Ohio, and left there to attend Cornell University as a chemical engineering major. He later graduated from Columbia University's medical school. Following his internship and 2 years in the US Air Force as a flight medical officer, Dr Frueh undertook his ophthalmology residency at the University of Michigan. He next went to Birmingham, Alabama, to take a preceptorship in oculoplastic and orbital surgery under the tutelage of the late and world-renowned Alston Callahan, MD. Dr Frueh then joined the faculty of the University of Missouri in Columbia in 1971 until he was recruited back to the University of Michigan to develop an oculoplastic and orbital surgery service.

Starting this new service was no mean feat at the time—1979—since oculoplastic surgery was still a relatively new field and the board-certified plastic surgeons felt that they alone should perform all plastic surgery. Dr Frueh was respectfully tenacious and was able to demonstrate his unique skills and knowledge. Over a few years, the differences that had at first existed between Dr Frueh and the plastic surgery service evolved into a collaborative



Bartley R. Frueh, MD

and collegial relationship that has flourished in our institution. Dr Frueh instituted an accredited fellowship under the umbrella of the American Society of Ophthalmic Plastic and Reconstructive Surgery. He served as that organization's president in 1976. The service Dr Frueh started at the University of Michigan grew and prospered not only clinically and educationally; Dr Frueh strongly emphasized research such that his service today has what

is arguably the most active oculoplastic service in the world in terms of basic research. Recognized for his particular expertise in Graves eye disease and eyelid function and greatly respected for his knowledge of oculoplastic and orbital surgery in general, Dr Frueh was a speaker in great demand to share his knowledge and skills. He was honored widely, including his delivery of the American Society of Ophthalmic Plastic and Reconstructive Surgery's prestigious Wendell L. Hughes Lecture in 1993 and the Kellogg Eye Center's F. Bruce Fralick Lecture in 2003. He published widely—nearly 100 peer-reviewed papers plus 30 additional contributions—covering the gamut of his subspecialty.

Dr Frueh had friends dating to his school days and was diligent in staying in touch with people. He valued his friends and they valued him. The same was true of his professional colleagues and, of course, his adoring family. In addition to his wife, Cheryl, and his mother, Virginia Frueh, Dr Frueh is survived by sons Christopher (Karen) Frueh, Terry (Kerstin) Frueh, Eric (Annette) Sargent, and Cain (Char) Christen; daughters Cherilyn (Cameron) Boswell and Laura Sargent; and 6 grandchildren. He was preceded in death by his father, Lloyd Frueh, and by his son, Dylan Frueh.

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