 Edited by George A. Williams

Single Incision, Outpatient Fluid/Gas Exchange

There exist occasions when an outpatient office fluid/gas exchange is preferred over returning a patient to the operating room. These situations involve an aqueous filled eye that had previously undergone vitrectomy but now could benefit from the effects of an almost complete posterior segment gas fill. Common indications include recurrent vitreous hemorrhage, failed macular hole repair, and recurrent nontractional retinal detachment. Multiple techniques have been described in the last three decades to accomplish this goal. Without delving into an exhaustive history of the techniques, they can primarily be divided into the number of needles used (one vs. two) and head/body positioning. Each permutation has inherent advantages and disadvantages.

Landers et al[1] described an early, manual one-needle pars plana method. This style is commonly referred to as a "push–pull" technique and involves a 10-mL to 20-mL syringe that has been filled with a near isoexpansile gas concentration attached to a 26-gauge to 30-gauge needle. The needle generally is placed through the most dependent portion of the pars plana into the vitreous cavity. While keeping the syringe cylinder and needle steady, the plunger is pushed and a volume of gas enters the eye. This is followed by pulling the plunger to create a vacuum to remove fluid from the vitreous cavity into the syringe. The advantages are low cost and the ability of a single pair of hands to perform the exchange. Disadvantages including patient's pain induced by alternating high and low pressure, cataract, retinal incarceration, hypotony-related complications such as suprachoroidal hemorrhage and corneal edema, vacuum-induced collapse of the sclera with a needle in the eye with damage to intraocular structures, surgeon hand fatigue, difficulties related to keeping the needle and syringe stable during the pushing and pulling, and inadvertent removal of the needle from the eye requiring risky and difficult repeat penetration of the globe in a hypotonous state.

Two-needle manual techniques were developed and minimized some of the difficulties associated with the single-needle techniques. They use a superior, gas-filled syringe and needle penetrating the pars plana along with an inferior syringe and needle penetrating the pars plana with or without the plunger removed. Gas is injected while fluid egresses inferiorly either through a passive pressure gradient or through active vacuum induced by a second person pulling on the inferior plunger. The advantages to this technique include a greater control of the intraocular pressure with less chance of hypotony-related complications, including the patient's pain induced by intraocular pressure variations. The disadvantages include having an additional needle in the eye that can cause damage and a need for more than one pair of skilled hands to coordinate the maneuvers. An example of this technique is detailed and illustrated by Charles et al.[2] Kleiner[3] created a single-needle device with two attached tubes to perform a push–pull technique through the single incision. This device is not currently in common use.

The other major variable in outpatient fluid–gas exchange is the position of the head and body. This article will limit discussion to those in which the patient is either supine or in the lateral decubitus position. The goal of either or a combination of both of these procedures is to place the temporal pars plana dependently to facilitate the drainage of fluid from the vitreous cavity. When the patients are left supine, they must rotate and maintain their head on a head support 90° toward the operative eye, possibly augmented by lateral gaze in the same direction. When the lateral decubitus approach is used, the patients are placed on their operative side for the duration of the procedure with a device such as a pillow for head support. In the author's experience, these are difficult positions for most patients to assume and steadily maintain. Additionally, both require placing the operative eye near the apparatus used to support the head, limiting the space in which the surgeon's hands may move.

In response to these needs and difficulties, the author has developed and uses a technique that allows for a single penetration of the sclera with a 23-gauge trocar and 4-mm cannula (Alcon, Fort Worth, TX; www.alconsurgical.com; part number 8065751585) that can be performed with the patient in a seated position and primary gaze. A 23-gauge dual bore cannula (Medone Surgical Inc, Sarasota, FL; www.medone.com; part number 3239) is used for the fluid–gas exchange after the trocar is removed. The technique is described in detail below.

From the Vision America, Homewood, AL and The University of Alabama at Birmingham Callahan Eye Hospital, Birmingham, AL.

The author has no financial or conflicts of interests to disclose.

Reprint requests: Robert W.H. Mason, MD, 250 State Farm Parkway, Homewood, AL 35209; e-mail: RWHMason@gmail.com

Technique

The patient is placed in a supine recumbent position on a tilting examination chair. The conjunctiva is first anesthetized with topical proparacaine 0.5% drops followed with topical lidocaine 4% drops. The patient's periorbita and ocular surface are cleansed with betadine 5% using sterile technique. A lid speculum is placed beneath the lids. Approximately 0.3 mL of lidocaine 2% with epinephrine is now injected, and the 30-gauge needle is attached.

Using the sterile inside the 30-gauge needle cover, the needle is bent 90° with the bevel moved toward the bend. The patient is asked to look upwards and a cotton tipped applicator is used to displace a portion of the patient's inferior bulbar conjunctiva superotemporally. The bent 30-gauge needle is now placed bevel up on the inferior bulbar conjunctiva and held in steady position. The conjunctiva and tenons that were displaced in the step above are now drawn over the needle tip without moving the tip. With epinephrine, 0.3 mL of lidocaine 2% is now injected, and the needle is carefully withdrawn. The lid speculum is removed.

A sterile drape with a precut hole for the operative eye is placed. The peripheral aspect of the drape is fastened to the headrest with 1-inch tape superiorly so that it will not fold over the sterile field with gravity when the patient is rotated upright. Next, an Opsite sterile adhesive sheet is placed over the precut hole and the patient's lids. This is opened with scissors in the patient's palpebral fissure, and the lid speculum is reinserted.

Inserting the trocar and valved cannula at the 6-o'clock pars plana is identical to the insertion in the operating room for a pars plana vitrectomy. A 3.75-mm marker is used to identify the pars plana. The conjunctiva is displaced from this point with a sterile cotton tipped applicator. The trocar and valved cannula are inserted at about a 20° angle into the vitreous cavity. The trocar is withdrawn.

A 10-mL syringe is filled with a nonexpansile concentration of sterile gas and a 23-gauge dual bore cannula is attached. The dual bore cannula is inserted into the vitreous cavity through the valved cannula. Because the gas is injected into the eye, fluid from the vitreous cavity egresses through the dual bore cannula and onto the drape. This process is continued until no further fluid egress occurs with the dual bore cannula minimally inserted into the valved cannula (Figure 1). The pressure of the eye is palpated with the cannula, and gas is inserted or removed as necessary to achieve normal pressure. The valved cannula is removed with 0.3-mm toothed forceps while counter pressure is applied adjacent to the sclerotomy with

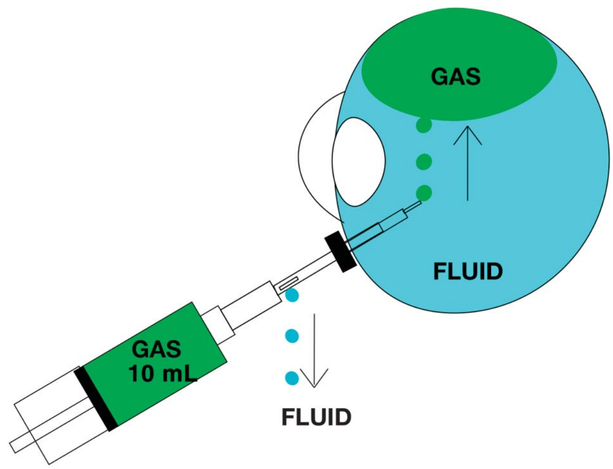

Fig. 1. Injection of nonexpansile gas and retrieval of vitreous fluid with a 23-gauge dual bore cannula through a 23-gauge valved cannula through the pars plana inferiorly.

C O L O R

a cotton tipped applicator. The speculum and drape are removed. The patient is given a topical antibiotic to use for 3 days.

Discussion

The single incision, outpatient fluid–gas exchange offers a safe, controlled, well-tolerated, and simplified method over the existing outpatient fluid–gas exchange techniques. The author has now used this technique on five eyes with uncomplicated promising results. The vitreous cavity is consistently filled with an adequate volume of at least 80% gas. Hypotony-related complications during the procedure are avoided by using a steady elevated intraocular pressure to drive fluid through the small gauge inner egress cannula within the dual bore device. This appeared to be well tolerated by patients without a retrobulbar block. During instances of inadvertent, premature dual bore cannula removal from the vitreous cavity, the dual bore cannula was simply reinserted without the difficulties involved with penetrating the sclera of a hypotonous globe. The valved cannula maintained the intraocular pressure. The procedure was successfully performed with the patient naturally sitting with their head in neutral position and eyes in primary gaze. However, it can be performed in a supine patient with the head rotated 90° or in the lateral decubitus position, if a crowded globe anatomy makes the described inferior approach difficult.

The use of a drape was chosen as part of the aseptic technique. However, it was somewhat cumbersome to secure and could potentially be eliminated. The amount of vitreous fluid released onto the patient was only around 4 mL and was well tolerated. A simple towel could be placed on the patient to absorb this effluent.

The 23-gauge valved cannula introduces control and flexibility to the outpatient fluid–gas exchange procedure. It allows insertion and removal of a cannula without pressure on the globe, shearing of tissue, or hypotony. Compared with the smaller single plane of scleral contact in the setting of a 26-gauge to 30-gauge needle piercing the sclera, the area of scleral contact with the valved cannula is larger and on 2 adjacent perpendicular scleral planes. This allows for more concurrent vectors of force to be applied by the valved cannula across the sclera and hypothetically increased control of the globe by the surgeon's hands. Furthermore, the procedure is performed with a single cannula and one physician, potentially reducing the risks of multiple needles manipulated by multiple pairs of skill hands such as crystalline lens damage or retinal incarceration. In the absence of a dual bore cannula, either of the previously mentioned push–pull or dual needle techniques can be performed with valved cannulae.

Future considerations include the use of a shorter valved cannula to increase the amount of vitreous fluid that can be scavenged. The dual bore cannula length could be shortened to match that of the valved cannula. A fluid collection system to contain the effluent could be fashioned. Lastly, a modified dual bore needle coupled to a dual chamber (one gas and one fluid with gas vent) syringe could be created such that a valved cannula is unnecessary. The vitreous fluid is captured in a second chamber of the same syringe that holds the gas.

ROBERT W.H. MASON, MD

References

1. Landers MB III, Robinson D, Olsen KR, Rinkoff J. Slit-lamp fluid-gas exchange and other office procedures following vitreoretinal surgery. Arch Ophthalmol 1985;103:967–972.
2. Charles S, Katz A, Wood B. Vitreous Microsurgery. Philadelphia, PA: Lippincott Williams & Wilkins; 2002:162.
3. Kleiner RC. A new device for performing fluid-gas exchanges. Arch Ophthalmol 1988;106:421–422.