

Pars plana vitrectomy in uveitis in the era of microincision vitreous surgery

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Pars plana vitrectomy (PPV) in uveitis is indicated for various diagnostic and therapeutic indications. With the advent of microincision vitreous surgery (MIVS), the use of PPV in uveitis has increased with a wider spectrum of indications due to shorter surgical time, less patient discomfort, less conjunctival scarring, and a decreased rate of complications as compared to standard 20G vitrectomy. Because of faster post-operative recovery in terms of visual improvement and reduction of inflammation, and reduced duration of systemic corticosteroids, MIVS has gained popularity in uveitis as an adjunctive therapy to the standard of care medical therapy. The safety and efficacy of MIVS is related to the emerging vitrectomy techniques with better and newer cutters, illuminating probes, and accessory instruments. Because of the instrumentation and fluidics of MIVS, PPV is emerging as a safe and useful alternative for diagnostic challenges in uveitis, aiding in earlier diagnosis and better outcome of inflammatory disease, even in the presence of severe and active inflammation, which was once considered a relative contraindication for performing vitreous surgery. However, for surgical interventions for therapeutic indications and complications of uveitis, it is advisable to achieve an optimum control of inflammation for best results. The increasing reports of the use of MIVS in uveitis have led to its wider acceptance among clinicians practicing uveitis.

Key words: Microincision vitreous surgery, MIVS, pars plana vitrectomy, PPV, uveitis, vitrectomy

Uveitis may encompass a wide spectrum of intraocular inflammation, which may be exclusively limited to the eye, or may occur secondarily to an underlying systemic disease. The visual outcome in uveitis is variable, depending upon several factors. While some forms are self-limiting, a severe form of uveitis has potential visual morbidity. The visual damage becomes irreversible, if wrongly diagnosed, or if the treatment is delayed or inadequate. While the clinical phenotypes play the most important role in the work up of uveitis followed by ocular imaging, baseline laboratory investigations (immunological, serological, radiological) are often indicated to corroborate the clinical findings. These investigations may be required more extensively in cases with atypical presentations or poor response to conventional treatment, involving intraocular sampling (of aqueous or vitreous humor) to rule out an intraocular infection or malignancy.

Sampling of aqueous humor by anterior chamber paracentesis is indicated in infections predominantly involving the anterior segment (such as viral, fungal, tubercular, or toxoplasmic uveitis) or to study the intraocular immune reactions in various infectious and non-infectious uveitis.^[1-5] It is a quick, minimally invasive surgical procedure that can be performed in the outpatient setting, and has the advantage of being repeatable on subsequent visits. However, it provides only a small amount (up to about 0.1 mL to 0.15 mL) of the intraocular fluid, which is its major limitation, restricting only one or two tests to be done. Moreover, in eyes with predominantly posterior uveitis or significant vitreous

involvement (and minimal anterior chamber inflammation), aqueous sampling has a limited role and contributes occasionally.^[6-8]

Vitrectomy enables to obtain a large volume of vitreous fluid. Vitrectomy in uveitis may be indicated for both diagnostic and therapeutic purposes to diagnose and treat several sight-threatening inflammations of the eye.^[9-11]

Method of Literature Search

The PubMed and Ovid electronic databases were searched to identify potential studies for this review. The following keywords and Medical Subject Headings (MeSH) were used: "Uveitis," "Microincision Vitrectomy," and "MIVS." Detailed search criteria were "Micro incision vitrectomy surgery" and "Uveitis" or "Micro incision vitreous surgery" and "Uveitis" "MIVS" and "Uveitis" or "Small gauge vitrectomy" and "Uveitis" OR "23G PPV" and "Uveitis" or "25G PPV" and "Uveitis" or "27G PPV" and "Uveitis" or "Diagnostic PPV" and "Uveitis" or "Therapeutic PPV" and "Uveitis", Filters: Humans. References of the relevant studies that were identified were also reviewed to identify other potentially related articles. Articles with non-human subjects or including cadaveric data and articles that were not in English were excluded. As this was a literature review and patient charts were not reviewed, there was no need for Institute Review Board approval.

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General Considerations

A. Pars plana vitrectomy in uveitis: Historical perspectives

The beneficial role of pars plana vitrectomy (PPV) in uveitis was established almost four decades ago when improved visual outcomes were reported following PPV and lensectomy in uveitis. The authors postulated the therapeutic effect of removal of the vitreous gel alone.^[12]

Since then, PPV has been increasingly used for managing complications of uveitis with favorable outcomes.^[13-18] In addition to its therapeutic effect, the benefits of conventional 20-gauge (G) PPV were later established in terms of providing intraocular samples for diagnostic testing in clinically challenging cases.^[9,10] However, the invasive nature and potential adverse effects of 20G PPV (such as risk of surgically induced intraoperative complications and postoperative exacerbation of intraocular inflammation) restricted its use as a primary intervention to very severe cases of uveitis, such as those with high suspicion of intraocular malignancy, or those with no or poor view of the retina.^[19,20]

Subsequently, following reports of small series indicating its usefulness in the form of a decreased inflammatory activity and a decreased flare up of uveitis after vitreous surgery, along with visual gain as an additional benefit, the role of vitrectomy broadened.^[9-11] In recent years, the advent of microincision vitreous surgery (MIVS) further addressed this concern due to its advantages over 20G PPV. For optimal post-operative results, quiescence of inflammation in the eye is desirable for at least three months for any elective surgery in uveitis. But PPV is often indicated, particularly for diagnostic purposes, in eyes with active disease, for which MIVS has emerged safe and efficacious.^[21-25] It also has a wide spectrum of complicated uveitis cases among therapeutic indications.

B. Microincision vitreous surgery: Historical perspectives

Since the first PPV in 1971, the three-port (vitreous cutting, infusion, and illumination) 20G vitrectomy remained the standard technique for PPV for more than two decades till the introduction of MIVS. Following the introduction of smaller 25G instrumentation for pediatric eyes and 23G vitrectomy probe for primary use in vitreous and retinal biopsies,^[26,27] the widespread use of the 25G system began only after Fujii *et al.* introduced the transconjunctival 25G (0.5 mm) trocar/cannula-based instrumentation in 2002.^[28] As an alternative, Eckardt developed 23G (0.7 mm) vitrectomy instrumentation in 2005.^[29] The MIVS further evolved with introduction of smaller 27G (0.4 mm) instruments by Oshima in 2010.^[30]

The quest towards smaller instrumentation is based on the premise that smaller gauge instruments would increase the safety of vitreoretinal surgery and reduce post-operative inflammation and discomfort and shorten the recovery time.^[31] Studies have shown reduced complication rates following MIVS as opposed to 20G vitrectomy.^[32,33] Thus, surgeons are today routinely performing MIVS even in complex scenarios of vitreoretinal diseases (such as giant retinal tears, advanced proliferative vitreo-retinopathy, diabetic tractional detachment, retinopathy of prematurity, etc.) and complications of uveitis (cataract with uveitis, dense vitritis, vitreous hemorrhage, tractional or rhegmatogenous retinal detachment, and subretinal biopsy).^[25,34-38] Phacofragmentation is also now possible using 23G instrumentation. Smaller ports have made it easier and safer to now perform a four-port PPV, enabling the use of a chandelier

in bimanual surgeries.^[39] Apart from the reduction in size of the incision, there have been changes in the direction of entry from perpendicular incisions to oblique incisions to biplanar incisions.^[40,41] Valved cannulas have been developed which help to maintain a more constant intraocular pressure (IOP) throughout surgery and reduce turbulence.^[42] Introduction of dual pneumatic cutters has helped achieve cutting rate of around 8000–10000 cuts per minute. Higher cut rates significantly reduce traction on the vitreous, a factor of considerable significance when dealing with uveitis eyes with active intraocular inflammation.^[43]

The MIVS has reduced the chances of complications such as iatrogenic retinal tears.^[32] There were some initial concerns of an increased rate of endophthalmitis following sutureless incisions. However, recent studies have allayed these concerns.^[44] Despite a learning curve, the advantages of MIVS have outweighed the pitfalls.

C. Microincision vitreous surgery: Applications in uveitis

Prior to the era of MIVS, a 22G needle was used for performing vitreous aspiration biopsy through the limbus or pars plana to yield a large volume of vitreous, but was associated with a high risk of retinal tear or detachment due to vitreous traction.^[45] This has been overcome by the automated cutters of the vitrectomy systems that allow controlled vitreous removal that is much less traumatic and restoration of the ocular volume by the fluid.^[46] The increased vitreoretinal adhesions in the presence of intraocular inflammation or infection predisposes the eye to iatrogenic complications. Both the inflamed retina and ciliary body are avoided by the placement of cannulas in the pars plana during MIVS. Further, it facilitates smaller surgical incisions, a decreased surgical time, better control of IOP, greater maneuverability of the surgical instruments, and a good yield of the vitreous sample. For these reasons, MIVS has found wide use in uveitis, both for diagnostic as well as therapeutic purposes. While the three-port MIVS remains the standard approach for vitrectomy, a single 23G port can be safely made for obtaining an undiluted vitreous sample.^[46] A fine needle aspiration cytology of retinochoroidal lesions can be performed using a two-port MIVS.^[47] A chandelier light is used for illumination through one of the ports and a 24/23G needle can be introduced through the other port for obtaining a sample. The vitreous thus obtained can be subjected to cytology, interleukin assays, polymerase chain reaction (PCR) for various pathogens and even culture. The standard three-port MIVS is preferred in uveitis to clear the media opacities, reduce the load of inflammatory mediators in the vitreous cavity, to obtain a retinal biopsy and to increase the yield of vitreous sample for analysis.^[25] Some these specific situations include vitreo-retinal lymphoma [Fig. 1],^[48-50] intermediate uveitis,^[51,52] amyloidosis,^[53,54] sarcoidosis,^[55] acute retinal necrosis,^[56-57] endophthalmitis [endogenous [Fig. 2], or exogenous],^[58] intravitreal/subretinal cysticercosis [Fig. 3],^[59-60] and chronic endogenous/autoimmune uveitis.^[23] Sequelae requiring MIVS once the active uveitis is over, include vasculitic vitreous hemorrhage, tractional/secondary rhegmatogenous detachments, epiretinal membranes, cystoid macular edema (CME), macular hole, etc.^[21,22,61-65] When combined with anterior segment surgeries, such as phacoemulsification and intraocular lens implantation, or trabeculectomy, MIVS has been reported to be safe and feasible in eyes with posterior uveitis for removal of cataract and pathologic vitreous, producing visual gain without any obvious complications.^[66-69]

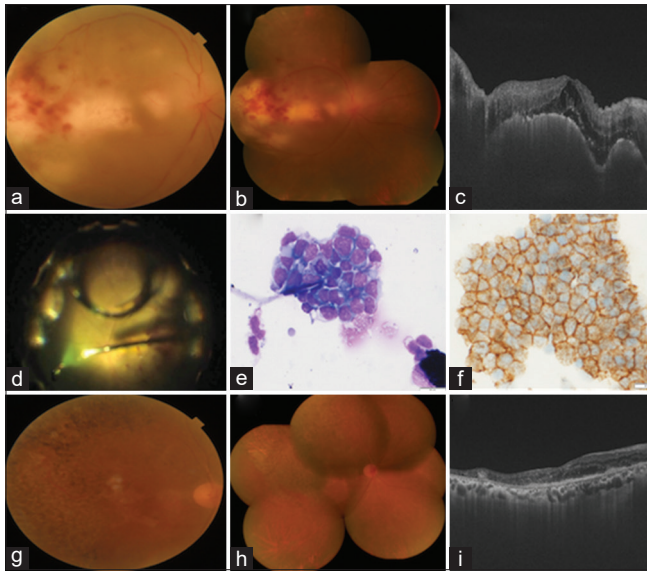


Figure 1: Right eye subretinal lesion (a) with optic disc edema (montage, b), with OCT showing disorganization of choroidal architecture with massive sub-RPE deposits along with subretinal and intraretinal fluid (c), underwent diagnostic MIVS in which an undiluted vitreous sample was collected under air (d). Vitreous cytology and immunohistochemistry confirmed B-cell lymphoma (e and f). Following systemic chemotherapy and intravitreal rituximab injections, the fundus showed complete resolution of subretinal deposits and disc edema (g and h), with normalization of retinal and choroidal architecture on OCT (i)

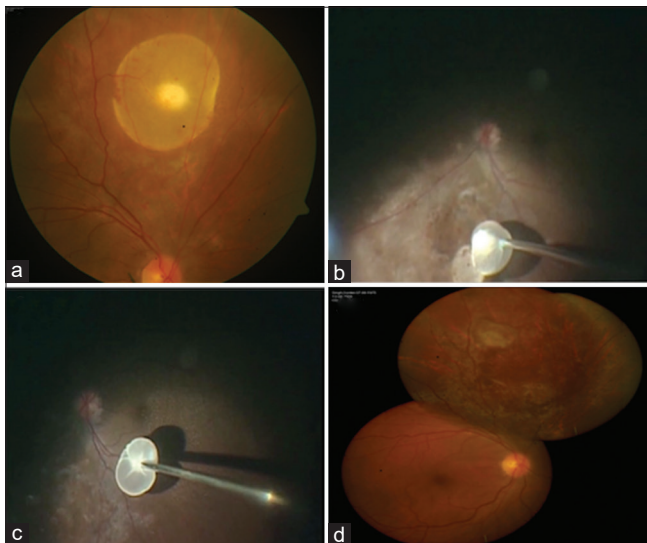


Figure 3: A case of subretinal cysticercosis (a) underwent MIVS for removal (b and c). Postoperatively, the vision was 6/6 at 2 weeks follow up, with lasered retinotomy superiorly (d)

Diagnostic MIVS in Uveitis

These include indications where sampling of vitreous is required and critical for testing, such as cases with following features:^[25]

- a strong suspicion of intraocular malignancy;^[9,11,48-50]
- a strong suspicion of intraocular infection where clinical clues are non-contributory;^[10,16]
- intermediate, posterior or panuveitis of unknown etiology,

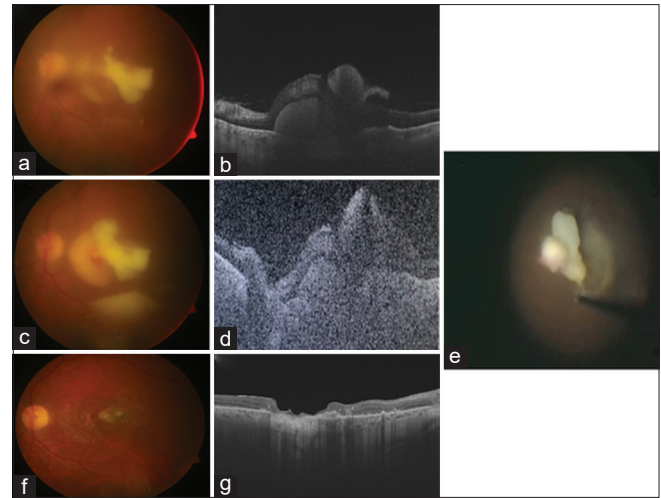


Figure 2: Fundus photo (a) and OCT (b) showing a sub-macular abscess in a case of chronic Hepatitis C with compensated liver cirrhosis and urinary tract infection, suggestive of endogenous endophthalmitis. The lesion worsened 3 days later as seen clinically (c) and on OCT (d). Urine culture grew *Klebsiella pneumoniae* (sensitive to piperacillin and resistant to ceftazidime). Following therapeutic PPV, and intravitreal injection of piperacillin (e), the sub-macular abscess resolved (f) with a macular scar (g)

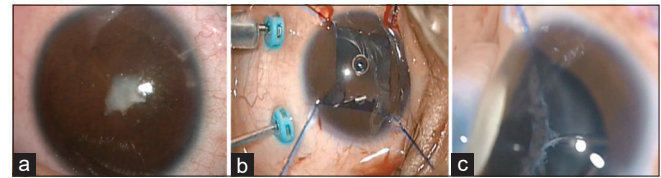


Figure 4: A case of chronic uveitis in juvenile idiopathic arthritis with complicated cataract (a). Pars plana lensectomy with vitrectomy (MIVS) using iris hooks (b) and removal of cyclitic membrane led to significant visual improvement (c)

where conventional clinical signs and laboratory tests have failed to determine the diagnosis;^[13,17-19,51,52]

- poor or no response to conventional treatment (antibiotic/corticosteroid/immunosuppressive agents);^[19,20,23]
- dense or severe vitritis with poor or no view of retina;^[35,36,53]
- uveitis with atypical clinical features or phenotype;^[19-21]
- acute, sight-threatening uveitis with negative laboratory investigations, to prevent irreversible visual loss;^[13-16,20]
- acute or chronic endophthalmitis (exogenous or endogenous).^[16,23]

Vitreous sampling

In the era of Endophthalmitis Vitrectomy Study, a single 20-G sclerotomy was described by Doft and Donnelly in 1991 for performing vitrectomy-assisted vitreous biopsy, as an alternative to needle aspiration biopsy.^[70] Under direct visualization, the vitreous is collected by manual aspiration through the automated vitreous cutter. This technique yields small vitreous sample, and is not the preferred method in MIVS era, also due to lack of wide angle viewing. Collection of an undiluted vitreous sample by a three-port vitrectomy involves risk of hypotony and choroidal hemorrhage, as the infusion is kept off to avoid dilution. To address this issue and to maintain IOP, an innovative use of perfluorocarbon

in the infusion port while obtaining undiluted vitreous with the cutter was reported by Quiroz-Mercado *et al.* in 2005 in 20 eyes.^[71] The cost of the perfluorocarbon and the need for freezing the sample for perfluorocarbon removal were the major limitations, although it provided large amount of undiluted vitreous. A much safer and preferred method is to use continuous air infusion, which provides up to 1.5 mL of undiluted vitreous sample without any safety compromise.^[72,73] However, air injection during early stage of vitrectomy invariably leads to fish-egg phenomenon and can compromise the visibility during surgery, especially while working with phakic and pseudophakic eyes. Hence, these procedures should be conducted by experienced or trained vitreo-retinal surgeons.

While some surgeons perform an automated aspiration with the machine, many prefer manual aspiration using a syringe connected to the aspiration tube for better control. As the continuous air infusion maintains the physiologic intraocular pressure, this provides the surgeon a good control during the procedure.^[72] A higher duty cycle with a low-cut rate maximizes the vitreous yield as the cutter remains open for a longer time, allowing a larger bite of the vitreous.^[74,75] However, it may increase the risk of iatrogenic retinal break/s due to increased traction in already inflamed eye, globe collapse and other associated complications. It is preferred to use high cut rate and lower suction.

Once the desired amount of undiluted vitreous sample is obtained (usually about 0.5 mL, and up to about 1 mL), the fluid infusion is turned on.^[73] This is followed by diluted vitreous collection and completion of vitrectomy as per the pre-operative plan. Eyes with posterior vitreous detachment (PVD) already present fare better in terms of iatrogenic retinal breaks, as compared to those where PVD is induced during PPV.^[74]

The undiluted vitreous is preferred for cytology for optimal results.^[76,77]

Microbiological tests

Vitreous samples have a limited positivity rates of smear (66% gram positivity) and culture (44.45–66.7%) in endophthalmitis.^[15,16,78] Smears provide a rapid diagnosis of an infective etiology and help in initiating specific therapy. Cultures should be declared negative only after 4–6 weeks.

Molecular tests

The PCR-based molecular diagnostics provide a rapid diagnosis and have been extremely useful in the diagnosis of viral retinitis, toxoplasmic chorioretinitis, tubercular uveitis, *Propionibacterium* spp., fungal/bacterial endophthalmitis, etc.^[24,25,57,61,79–81]

Cytopathology

A cut rate of 600 cuts per minute is helpful for a good vitreous specimen for cytological analysis for intraocular lymphoma or other malignancies.^[82] The availability of an ocular pathologist is critical to receive these samples for a quick analysis to avoid cellular degeneration. Cellular characterization by cytology is also helpful in diagnosing non-malignant conditions.^[83]

Flow cytometry and immunohistochemistry

Identification of cell surface markers by fluorescence-activated cell sorters (FACS) provides additional information about cellular constituents in vitreous specimens.^[84] Immunohistochemical

staining for cell markers provides phenotypic characterization, and supports the cytological diagnosis of lymphoma (B cells) or non-infectious uveitis (T cells).^[84]

Antibody determination

Detection of intravitreal antibodies with quantitative determination is helpful in infectious uveitis (viral, *Toxoplasma gondii*, etc).

Cytokine analysis

It provides adjunctive information, especially in intraocular lymphoma. An IL10:IL6 ratio of more than 1 is considered highly suggestive of intraocular lymphoma.^[82] Cytokine in vitreous are potential targets as biomarkers of various ocular diseases.

Chorioretinal biopsy

The paucity of data on chorioretinal biopsies (CRB) reflect the rarity of its use. This is due to the complex nature of the surgical procedure with risk of serious complications (like vitreous hemorrhage, suprachoroidal hemorrhage, and retinal detachment) and the fact that a diagnosis is often possible with less invasive techniques.^[85,86] Nonetheless, in select situations a CRB may be necessary, namely:^[85,86]

1. To exclude intraocular neoplasm (masquerade syndrome, e.g., intraocular lymphoma, choroidal metastasis)
2. Progressive sight-threatening retinal or choroidal lesions unresponsive to therapy
3. To identify causative organism/neoplasm in an immunocompromised patient with uveitis
4. Sight threatening involvement of the second eye despite treatment
5. Negative vitreous analysis after multiple diagnostic biopsies/vitrectomies.

20G PPV for performing CRB has been the preferred approach for many years with a very few studies on CRB using the MIVS platform.^[86–90] Use of 27G PPV for CRB has been shown to yield positive diagnostic results in about 89% cases if the lesion size was larger than 0.8 mm.^[87,89] Recently, intra-operative optical coherence tomography has shown that it may improve the diagnostic yield of CRB by providing real-time information of biopsy site and depth. It also helps to examine the margins of the biopsy site at the end of surgery thereby ensuring complete retinal attachment.^[88]

Therapeutic MIVS in Uveitis

Clearing of media (vitreous) opacities and improvement in visual acuity are the main goals of therapeutic vitrectomy in uveitis. A significant improvement has been reported following MIVS in terms of vitreous haze (as early as the next postoperative day),^[25] and in posterior as well as anterior segment inflammations in sarcoidosis (at one week and one month, respectively).^[22] Visual benefits following MIVS have been reported by majority of studies as early as next postoperative day, and at all subsequent visits.^[9,10,12,19,21,22,91] Multiple factors (debulking of inflamed and opacified vitreous, use of concomitant corticosteroids for uveitis, reduction of CME and combined cataract removal) play a role in visual gain after MIVS.

As removal of vitreous (using any gauge) does reduce inflammation, a recent study has reported clinical resolution (as

well as angiographic evidence) of focal posterior segment lesions in eyes undergoing MIVS.^[91] Although the precise mechanism is not known, the decrease in inflammation may be attributed to removal of infectious antigens and inflammatory mediators (cytokines/chemokines) by vitreous debulking. In intermediate uveitis, PPV has been proposed as a valuable alternative to medical therapy.^[52] While majority of studies have reported benefits in terms of resolution of CME, development of new episode of CME after MIVS has been reported in chronic endogenous/autoimmune uveitis.^[23]

The need for systemic corticosteroids/immunosuppressive therapy in uveitis has seen a decrease following MIVS, avoiding secondary complications arising out of these drugs.^[12,25,52] Oahalou *et al.* reported that preoperative immunosuppressive therapy could be stopped in 44% patients following PPV.^[19] Preoperative oral corticosteroids could be tapered to low dose or altogether stopped in 67.8% eyes.^[25] In eyes with recalcitrant intermediate uveitis, long-term resolution of inflammation was seen in 82% of eyes undergoing PPV as compared to 43% of eyes receiving immunomodulatory therapy, which ultimately required PPV.^[52] Combining MIVS with lensectomy, in eyes with cyclitic membranes, such as those in pediatric uveitis or chronic uveitis [Fig. 4], further suppresses the immune activity in the vitreous cavity, possibly by clearing the inflammatory debris through the trabecular meshwork.^[92]

The potential benefits of MIVS in uveitis against a low risk of major complication related to surgery have encouraged the surgeons to perform an early vitrectomy as a prophylactic measure in a number of conditions. While the earlier reports showed a mixed efficacy, Huang *et al.* reported a reduced rate of retinal detachments in eyes with acute retinal necrosis that underwent an “early MIVS within 30 days” (25%) versus those with “no early vitrectomy” (59%).^[93] On the other hand, Liu *et al.* reported that prophylactic PPV did not improve visual outcome or reduce the rates of recurrent retinal detachments in eyes with acute retinal necrosis.^[94] Eyes with long standing vitreoretinal or choroidal inflammations develop irreversible structural damage in the form of fundus scarring or foveal atrophy. An early intervention by MIVS may reduce the extent of this damage by reducing the severity of inflammation. Further, the adjunctive use of intravitreal or sub tenon steroid injections with potential complications may be limited by an early vitrectomy.

When compared with 20G PPV, MIVS offers an added advantage in glaucomatous eyes by preserving the filtration blebs of a previous surgery or by reducing the conjunctival scar formation for a future possible filtering surgery.^[54,95] The large sclerotomy incision of 20G PPV produces scleral and conjunctival scarring. An improved fluidic system in MIVS reduces the rate of intraoperative bleeding, and is particularly helpful in eyes with fibrovascular proliferations.

MIVS in Pediatric Uveitis

The use of PPV in pediatric patients with uveitis is limited and is often considered as the last therapeutic option (following conventional corticosteroids, and immunosuppressants) due to the high rates of complications and need for general anesthesia. Giuliani *et al.* compared the safety and efficacy of 20G PPV (done in 68% of study eyes) with 25G PPV (in 32% of study eyes) in chronic pediatric uveitis.^[96] Two eyes in 20G

PPV group developed intra-operative retinal tears. None of the eyes in 25G PPV group developed intra- or post-operative complications, and none required additional sutures to close sclerotomies. They concluded that PPV is safe and effective in chronic pediatric uveitis, and the profile of complications is comparable as in adult population.^[96]

Indications for PPV in pediatric uveitis include:

1. Intermediate uveitis- recalcitrant CME, dense vitreous opacities, epiretinal membrane, vitreous hemorrhage, to reduce dose of systemic immunosuppressive therapy;^[96,97]
2. Uveitic hypotony;^[98]
3. Severe uveitic cataract with associated complications like small pupil, hypotony, etc.;^[99,100]
4. Ocular toxocariasis (OT);^[101]
5. Endophthalmitis-traumatic, endogenous.^[96]

In patients of intermediate uveitis, MIVS has been shown to be beneficial for chronic resistant inflammation, CME, dense vitreous hemorrhage, tractional/rhegmatogenous retinal detachment, epiretinal membranes, and to reduce the dose or number of systemic immunosuppressive therapy.^[97] A relatively early PPV is recommended in pediatric uveitis with CME not responding to systemic immunosuppressive therapy.^[97] Hypotony is seen in about 10% of patients with juvenile idiopathic arthritis-related uveitis and needs lensectomy, vitrectomy, cyclitic membrane removal with/without long term 5000 centistroke silicone oil tamponade.^[98] In severe ocular complications of juvenile idiopathic arthritis, an extensive PPV (25G) with cataract extraction can cause a significant improvement in visual acuity.^[99,100] In ocular toxocariasis, the surgical outcomes following 23G or 25G PPV improved the visual outcome, with a guarded prognosis.^[101]

Complications/Limitations

Because of the suture less nature of MIVS, postoperative complications have been a major concern, such as wound leak, hypotony, endophthalmitis, choroidal detachment, and choroidal hemorrhage.^[102] An overall complication rate of 54% has been reported in 20G PPV in uveitis (hypotony 2%, vitreous hemorrhage 2%, retinal detachment 2%, epiretinal membrane 7%, and cataract 51%).^[19] In the early postoperative period of MIVS, transient hypotony is common and most of the cases recover spontaneously.^[25,103]

Complications related to hypotony, secondary to sclerotomy leak, are largely due to faulty surgical techniques. However, extreme hypotony may occur, needing intensive steroids or re-suturing of the scleral ports.^[21] It may infrequently cause hemorrhagic choroidal detachment, a devastating complication that requires a repeat PPV for suprachoroidal drainage.^[25] To avoid this complication, at conclusion of surgery, one must ensure that sclerotomies are not leaking. If needed, it is advisable to suture the sclerotomies, especially in pediatric age group.

Takayama *et al.*, in a series of MIVS in sarcoid uveitis, reported one case of rubeotic glaucoma and none of hypotony.^[22] The rate of postoperative bleeding has ranged from 0% to 4.7%, including recurrent vitreous hemorrhage in one out of 24 eyes in a series (4.2%).^[10,21,22,25]

Varying rates of cataract development or progression (14.6%–51%) have been reported after PPV.^[10,19,21,25]

Kitiratschky *et al.* reported retinal detachment after PPV in 7% eyes and Bansal *et al.* in 2.8% after MIVS.^[10,25] In a series of 74 eyes undergoing 25G PPV for chronic endogenous/autoimmune uveitis, intraoperative complications included retinal detachment (two eyes), iatrogenic retinal break (one eye), lens dislocation into vitreous cavity (one eye), and expulsive choroidal hemorrhage (one eye).^[23] The immediate post-operative complications included high IOP (11%), retinal detachment (6.7%), hyphema (6.7%), chronic hypotony (5.4%), intraocular lens membrane formation (4%), cataract (2.7%), persistent vitreous hemorrhage (2.7%), and choroidal detachment (1.3%). The late post-operative complications included epiretinal membrane (23%), chronic inoperable retinal detachment (6.7%), macular hole (5.4%), phthisis bulbi (5.4%), subretinal neovascular membrane (2.7%), rubeosis iridis (2.7%), and perisilicone proliferation (1.4%). Proliferative vitreoretinopathy has been reported infrequently.^[21,22] An epiretinal membrane developed in 2.8% eyes in MIVS and in 7% eyes in 20G PPV.^[19,25] Worsening of inflammation may occur after MIVS (0.9%), which is transient and responds well to oral steroids.^[25] Other complications (intra- or post-operative) include corneal decompensation/band keratopathy, capsular rupture, hyphema, intraocular lens dislocation, macular scar, optic nerve atrophy, and pupillary block.^[61]

Conclusion

Besides being the standard of care in vitreoretinal (non-inflammatory) pathologies requiring PPV, MIVS has gained popularity in uveitis due to shorter surgical time, less patient discomfort, faster post-operative recovery in terms of visual improvement and reduction of inflammation, and reduced duration of systemic corticosteroids. The emerging vitrectomy techniques of MIVS (better and newer cutters, illuminating probes, and accessory instruments) have enabled safer surgeries, and widened the indications for vitrectomy in uveitis, both for diagnostic and therapeutic purposes. As compared to the pre-MIVS era, the use of PPV in uveitis has increased manifold. The instrumentation and fluidics of MIVS have largely influenced favorable outcomes of vitrectomy in uveitis, making PPV a safe and useful alternative aiding in earlier diagnosis and better outcome of inflammatory disease. The increasing reports of the use of MIVS in uveitis have led to its wider acceptance among clinicians practicing uveitis.

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Conflicts of interest

There are no conflicts of interest.

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