Chapter 8
Surgical Steps

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Many steps of cataract surgery must be approached differently in the pediatric population compared to the adult population. Anatomical features of younger eyes such as the elastic anterior capsule, soft nucleus, decreased scleral rigidity, and adherent vitreous base are just a few factors that necessitate a much altered approach to surgery from that in an adult. The propensity for inflammation, infection, visual axis opacification, and glaucoma in this age group also necessitates tackling certain precautions to minimize potential adverse outcomes. This chapter will provide tips for cataract surgeons to aid in the preparation for tackling the distinct technical aspects of managing the pediatric cataract.

Preoperative Steps

To achieve adequate dilation by the time the patient enters the operating room, the patient should undergo preoperative administration of three rounds of dilating drops while in the preoperative suite. We use a combination of a cycloplegic (cyclopentolate 1%) and a sympathomimetic agent (phenylephrine 2.5%) in our practice. Phenylephrine 10% should be avoided, as it has been associated with tachyarrhythmia and hypertension [1].

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Anesthesia

As with most other pediatric surgeries, pediatric cataract surgery is performed under general anesthesia. Due to the risk of systemic toxicity from excessive absorption of phenylephrine drops, IV access should be obtained promptly to allow for administration of vasodilators if necessary [2]. More modern inhalational anesthetics such as desflurane and sevoflurane have been found to be associated with a greater chance for emergence delirium [3, 4]. To reduce this risk, some have tried newer intravenous anesthetics, such as dexmedetomidine, which has anxiolytic, sedative, and analgesic properties. It should be noted that this agent would not be as ideal for strabismus cases, as it can worsen bradycardia from the oculocardiac reflex [5, 6]. For management of the airway, intubation with paralysis may be preferred, as supraglottic devices such as the laryngeal mask airway (LMA) may increase the risk of laryngospasm [7]. Adjunctive topical or subtenon anesthesia has been found to reduce postoperative pain and better satisfaction scores among parents [8, 9].

Equipment, Fluids, and Injectables

Prior to having the patient enter the room, all machinery should be confirmed to be in working order and properly primed. The decision should be made about what irrigation fluid to run through the machine. Balanced salt solution mixed with 0.5 mL of epinephrine 1:1000 to each 500 mL bottle of irrigating solute is preferred for maintenance of mydriasis intraoperatively. All instruments, injections, lens calculations, and the selected intraocular lens (IOL) should be readily available once the case is underway in order to avoid unnecessary delays while the patient is under anesthesia.

Surgical Site Sterilization and Draping

Proper sterilization of the eye surface is important for reducing the risk of infection. Due to lack of evidence that preoperative antibiotics decrease rate of endophthalmitis, this is not recommended as part of the sterilization procedure. Placement of a 5% povidone-iodine drop is recommended due to the higher level of evidence that it reduces conjunctival flora [10]. Following sterilization of the ocular surface with 5% povidone-iodine, the lashes and skin surrounding the eye should be sterilized with 10% povidone-iodine and allowed to fully dry prior to placing the drape. The eye should be draped in a manner that keeps the eyelashes away from the operative field as to reduce the risk of contamination.

Intraoperative Steps

1. *Stabilize the eye*: The position of the eye should be in a stable, primary position. If a patient is not paralyzed by anesthesia, the patient's eye may supraduct under light anesthesia due to Bell's phenomenon. One method for stabilization of the eye position is with the use of a traction suture placed underneath the superior rectus muscle with 4-0 silk. It has been suggested that a potential downside of this technique is violation of the superior conjunctiva, which may jeopardize the success of potential glaucoma filtering surgeries in that area [11, 12]. However, traction sutures are placed quite posterior to the location of an ideal bleb, and no study has focused on the impact of a traction suture on filtering surgeries. In our own experience, the presence of former traction suture has not hindered the success of subsequent trabeculotomies or glaucoma drainage device placement.
2. *Paracenteses*: The paracenteses (side ports) may be made in the clear cornea, limbus, or sclera. To allow for as much intact anterior conjunctiva as possible, the authors prefer clear cornea incisions. Positioning the incisions superotemporally and superonasally allows for them to be protected from trauma and environmental sources of infection by the upper eyelid. The paracenteses should ideally be equally sized and spaced at least 4 clock hours apart for better access to the lens capsule and cortex in subsequent steps. The incisions should be made just large enough to allow passage of instruments to guard against anterior chamber collapse, which is more common in pediatric eyes than in adult eyes. If 20-gauge instruments are to be used, then the paracenteses should be created with a 23-gauge microvitreoretinal (MVR) blade. Alternatively, a 15° or 1.0 Sideport blade can be used to create the paracenteses. The depth of entry of the 15° blade can be titrated to the preferred size. Since the phacoemulsification handpiece or similar such large instrument is not required in pediatric surgery, the incisions can be kept small until the point at which the intraocular lens (IOL) needs to be inserted. At this later point, one of the paracenteses can be enlarged, as discussed below.
3. *Trypan blue (optional)*: After construction of the paracenteses, the decision should be made about whether trypan blue is needed for improved visualization of the anterior capsule. Cases have been reported in adults of inadvertent posterior capsule or vitreous staining with trypan in cases of zonular weakness, which can lead to obscuration of the red reflex. Therefore, caution should be taken to not overfill with trypan in cases of suspected zonular weakness or after use of iris hooks [13] (Fig. 8.1).
4. *Ophthalmic viscosurgical device (OVD) injection*: High molecular weight (cohesive) OVD is preferred to low molecular weight (dispersive) OVD, as it can more effectively deepen the anterior chamber and flatten the anterior capsule during anterior capsulorrhexis formation, thus reducing the risk of an anterior capsule radial tear. High molecular weight OVD is therefore injected prior to the creation

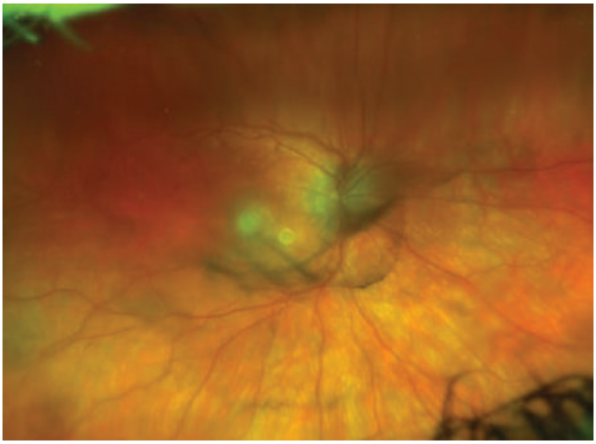

Fig. 8.1 Trypan blue staining of the vitreous on postoperative day 1 following lensectomy, IOL insertion, and anterior vitrectomy

of the anterior capsulorhexis, especially when a manual capsulorhexis is planned. The high-viscosity cohesive agent we use is Healon GV (AMO, USA).

5. *Anterior capsulorhexis*: The proper creation of the capsulorhexis is a critical step to ensuring a well-centered and stable IOL. In adults, a capsulorhexis that is continuous and curvilinear (continuous curvilinear capsulorhexis, CCC) is considered ideal for resisting radial tears. The same principles apply in children: the anterior capsulorhexis should be continuous, round, and centered in order to withstand the stress of IOL implantation and to allow for a well-positioned IOL:

   (a) *Manual capsulorhexis*: The performance of a manual capsulorhexis in children has unique challenges related to the elastic nature of the anterior capsule in young eyes, which increases the tendency for a radial tearing force. The technique for a capsulorhexis involves creating a small tear in the center of the anterior capsule and using microincision capsulorhexis forceps to grasp the leading edge of the flap and pull toward the center of the capsule. The leading edge should be picked up with frequent small grasps with a pulling force toward the center of the pupil to prevent a tear or enlargement of the anterior capsule. The start of the capsulorhexis should be smaller in diameter than the target diameter of the capsulorhexis, as the tendency is for the resulting capsulorhexis to be larger than originally intended and stretch. High molecular weight OVD can be injected frequently into the anterior chamber to flatten the anterior capsule and aid against forces that contribute to a radial tear of the anterior capsule.

   (b) *Vitrectorhexis*: While manual capsulorhexis is considered the gold standard for capsulorhexis formation due to its resistance to capsule tearing [14], the manual technique is highly challenging and requires microincision forceps, which are not always readily available. An alternative to manual capsulorhexis was described by Wilson et al. and involves the use of the vitrectomy cutter to create the anterior capsular opening, a technique referred to as vitrectorhexis. One advantage of vitrectorhexis in pediatric eyes is that both anterior capsulorhexis and lens aspiration can be performed sequentially with the same instrument, thus minimizing the number of entries into the eye.

The vitrector should be ideally supported by a Venturi pump, as a peristaltic pump will not cut the anterior capsule as easily. The vitrectorhexis involves a bimanual technique through the paracenteses. The settings of the vitrector should be set to a low cutting rate (150–300 cuts per minute) and a high aspiration rate (300 mmHg). An initial tear in the anterior capsule is not required for the vitrectorhexis technique. Rather, the vitrector can be positioned with its cutting port facing posteriorly at the center of the anterior capsule. The vitrector is used to engage the anterior capsule to initiate a small opening in the center of the anterior capsule which can then be radially enlarged to the desired diameter of the capsulorhexis with care to maintain as rounded edges as possible. Even if the capsulorhexis is initiated manually, the vitrector can be used to rescue the capsulorhexis if a radial tear is made during manual formation of the capsulorhexis. Despite the relative ease and convenience of vitrectorhexis, we prefer a manual capsulorrhexis whenever possible, with the exception of in young infants (<7 month old). In these young patients in whom an IOL will not be placed, the concern for a radial tear is greater due to the greater elasticity of the anterior capsule. Also, since such infants will likely not receive an IOL, there will be less stress made on the capsulorrhexis due to IOL insertion.

(c) *New techniques for capsulorhexis*: An example of a newer manual technique for creating the CCC in pediatric cataract surgery is the two-incision push-pull technique (TIPP), described by Nischal [12]. In this technique, after the anterior chamber is inflated with OVD (without hyper-inflating), the anterior capsule is punctured at the superior and inferior ends of the CCC with either an MVR blade or cystotome. The superior flap is then pushed inferiorly, and the inferior flap is pulled superiorly with microincision forceps until the tearing edges meet each other centrally.

(d) *New devices for capsulorhexis*: Certain new devices may reduce zonular tension and decrease the risk of capsulotomy extension. Examples of devices include the Kloti diathermy unit (Oertli Instruments, Berneck, Switzerland), Diacapsutom (ERBE Elektromedizin GmbH, Tuebingen, Germany), PEAK-fc probe (pulsed electron avalanche knife; Carl Zeiss Meditec, Jena, Germany), and the Fugo blade (Medisurg Ltd., Norristown, Pennsylvania, USA), which have been suggested to be favorable for use in adult cases. Examples of assistive technology include femtosecond laser-assisted cataract surgery for creating the CCC in cooperative children under topical anesthesia [15].

6. *Avoid hydrodissection*: In adults, hydrodissection is generally performed in order to help with cortical cleanup. However, hydrodissection should be avoided in children, as it may cause rupture of the posterior capsule if there is a preexisting defect in the posterior capsule that is not visualized preoperatively.

7. *Lens aspiration*: Lens removal in the pediatric population rarely requires phacoemulsification due to the softer consistency of the pediatric lenses, which can be readily aspirated. As with adults, the lens can be removed by coaxial (through a single side port) or bimanual techniques (through separate irrigation and aspiration through two side ports). However, single port irrigation/aspiration (IA) can make subincisional cortical removal highly difficult and requires a larger incision. Therefore, a bimanual approach is preferred, which allows for better anterior chamber stability as well as more flexibility in switching the handpieces between the two side ports to access all quadrants. The bimanual technique can be performed either with separate irrigation and aspiration handpieces (Fig. 8.2a) or with a vitrectomy handpiece along with an anterior chamber maintainer, such as the Lewicky AC maintainer (Bausch & Lomb) (Fig. 8.2b). Regardless of which technique is used, it is important to aspirate as much OVD from the anterior chamber as possible prior to aspirating the lens in order to avoid impaction of the OVD onto the trabecular meshwork [12]. One advantage of an aspirator for lens removal is the smooth, rapid removal of lens material and fairly low risk of damage to the lens capsule.

When using the vitrector for lens aspiration, the same instrument can also be used to perform vitrectorhexis, irrigation/aspiration, posterior capsulorhexis, and anterior vitrectomy, thus minimizing having to switch instruments and repeatedly enter and exit the eye with instruments. The settings of the vitrector should be changed for the individual steps according to the manufacturer guide. The surgeon can elect to use an irrigator handpiece through the second incision or the anterior chamber maintainer. Since the Lewicky is a stationary device, the dominant hand can be used to hold the vitrector while the nondominant hand stabilizes the eye with forceps. In situations in which there are significant densities in the lens, the bimanual IA technique (Fig. 8.2a) offers an advantage over the Lewicky-vitrector technique (Fig. 8.2b), since the irrigation can be directly manipulated inside the eye such that both instruments can work together to mechanically break down the cataract between the two tips.

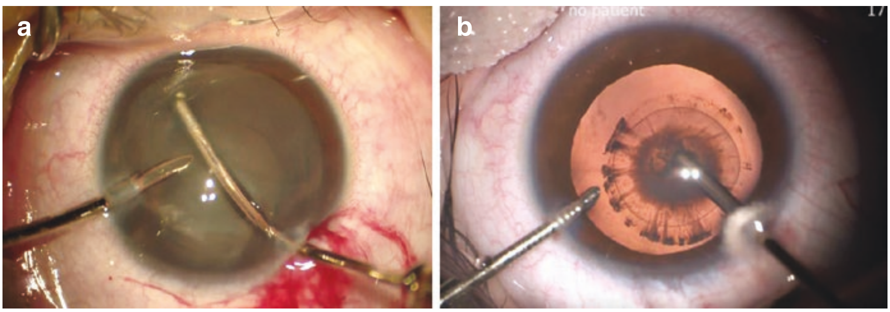

Fig. 8.2 (**a**) Bimanual technique for lens removal with a separate irrigation handpiece (left) and aspiration handpiece (right). (**b**) Bimanual technique for lens removal with a separate Lewicky anterior chamber maintainer (left) and vitrectomy handpiece (right)

Regardless of which bimanual technique is used, it is important to check that the irrigation cannula is patent by turning on infusion prior to entry into the anterior chamber. Having the irrigation cannula turned on during entry into the anterior chamber also prevents the OVD inside the anterior chamber from refluxing into the irrigation cannula and clogging its opening. Starting the irrigation rate at 30 generally allows for acceptable maintenance of chamber depth, but the rate may need to be increased depending on aspiration rate or chamber depth.

Our technique for lens aspiration using the vitrector or aspirator handpiece involves placing the handpiece under the edge of the capsulorhexis into the capsular fornix and increasing the aspiration until the cortex enters the port. For Venturi pump machines, complete occlusion of the tip is not needed to bring the cortex into the tip. Conversely, the peristaltic pump machines require that the surgeon occludes the aspiration tip to allow for an increase in the vacuum to the maximum level that is preset on the machine. Once the cortex is engaged, the tip is then moved slowly toward the center of the bag to detach the cortex from the capsule. We prefer to remove as much cortex from the periphery in as many quadrants as possible before removing the central nucleus in case there is a posterior capsular defect centrally. When only the subincisional cortex remains, it may be helpful to switch the handpiece to the opposite side port to achieve an optimized angle for removing the remaining cortex.

One of the key features to remember during pediatric cataract surgery is that complete removal of all cortical material is significantly more critical in children than in adults, as the cells that are left behind can be highly mitotically active. These cells have a high tendency to proliferate and cause visual axis opacification that may even require a subsequent operation to remove. To prevent this common complication, extra care should be taken to remove all visible lens material.

8. *Posterior capsulorhexis*: In young children undergoing cataract surgery, visual axis opacification is nearly guaranteed to occur if the posterior capsule and anterior vitreous are left intact. The anterior vitreous is believed to act as a scaffold for lens epithelial cells to migrate and form a secondary membrane. Therefore, to further prevent visual axis opacification, the center of the posterior capsule and the anterior vitreous should be removed at the time of cataract surgery in younger children. If posterior capsulorhexis is not performed at the time of cataract surgery, then a neodymium-yttrium-aluminum garnet (Nd:YAG) laser posterior capsulotomy could be performed in the clinic setting once posterior capsular opacification occurs, which happens usually 18 months to 2 years after initial surgery. If performed at the time of surgery, the posterior capsulorhexis should be made about 1 mm smaller in diameter than the anterior capsulorhexis in order to ensure centration and stabilization of an IOL, if placement of an IOL is planned.

   In determining whether to perform primary posterior capsulectomy versus Nd:YAG laser at a later date, the patient's age, cooperation of the child in sitting for laser, and availability of Nd:YAG laser are taken into consideration. The Nd:YAG laser is more challenging in children than in adults due to their level of cooperation as well as the relatively greater thickness and robust formation of the posterior capsular opacification that occurs in children. Thus, higher amounts of energy are required for Nd:YAG in a child, and there may be a need to repeat the procedure due to subsequent closure of the posterior capsule opening. Khokhar and colleagues recommend performing primary posterior capsulotomy in patients up to 8 years old and anterior vitrectomy in patients up to 6 years old [16] to prevent visual axis opacification.

Similar to the anterior capsulorhexis, the posterior capsulectomy may be performed either manually or by vitrectomy. The manual technique confers similar advantages to that of the anterior CCC in terms of resistance against a capsular tear:

(a) *Manual posterior capsulorhexis*: The technique is similar to the anterior capsulorhexis in that a cystotome is used to puncture the posterior capsule and capsulorhexis forceps are used to grasp and pull the posterior capsule in a circular motion to create a capsulorhexis of the desired size. However, maximizing safety of the manual posterior capsulorhexis differs from the anterior capsulorhexis in that underfill (as opposed to overfill) of the eye with OVD is preferred in order prevent forces that would cause the posterior capsulorhexis to tear outward. Additionally, to protect the anterior vitreous face during capsulorhexis, OVD can be injected into Berger's space after the initial puncture of the posterior capsule with the cystotome [12].

(b) *Posterior vitrectorhexis (anterior vs posterior approach)*: Many surgeons choose to perform vitrectorhexis rather than the manual method for posterior capsulorhexis, especially if there is a plan to perform anterior vitrectomy. Settings for the posterior vitrectorhexis and subsequent anterior vitrectomy should be performed with the vitrector set to a high cut rate (>2500 cuts/minute) and low vacuum (less than 150 mm Hg). The posterior vitrectorhexis and anterior vitrectomy can be performed through the anterior approach (through the original limbal or clear corneal incision) or through a posterior approach (pars plana). Surgeons who are accustomed to performing anterior segment surgery often opt for the limbal approach due to greater familiarity with this approach. Also, the limbal approach spares the conjunctiva from manipulation and possible scarring. However, a disadvantage of the limbal approach is the potential for greater traction on the vitreous base compared to the pars plana approach. If the surgeon decides on performing the limbal approach, then the IOL insertion must occur after the capsulorhexis in order to allow space for the instruments to reach the posterior capsule through the anterior chamber without interference from the IOL:

    (i) *Limbal approach*: The vitrector should be placed with the cutter facing down in order to engage the posterior capsule centrally before moving outward in a circular motion. The posterior vitrectorhexis through the limbal approach must be performed prior to IOL insertion in order to gain access to cut the posterior capsule from the limbus.

(ii) *Pars plana approach*: In the pars plana approach, the IOL should be inserted first into the capsular bag. The OVD that was used to fill the bag for IOL insertion should then be removed prior to the posterior vitrectorhexis. In order to access the pars plana, an MVR blade is used to make an incision about 2–3 mm posterior to the limbus (2 mm for patients less than 1 year old, 2.5 mm for patients 1–4 years old, and 3 mm in patients over 4 years old) [17], while the anterior chamber maintainer or irrigation cannula remains in the anterior chamber. Creating the incision for the vitrector can either involve using a trocar or an MVR blade. The trocar or MVR blade is placed obliquely through the conjunctiva and sclera after the conjunctiva is displaced; the trajectory for insertion is as if aiming toward the optic nerve and then flattening to progress into the mid-anterior vitreous cavity. If using a trocar, the microcannula is left behind as the trocar is removed. The vitrector is then placed into the incision with cutter facing up in order to engage the posterior capsule.

9. *Anterior vitrectomy*: Once the posterior capsulorhexis is completed, removal of the anterior vitreous should again be performed with the vitrector set to a high cut rate and low vacuum. The anterior vitrectomy is performed immediately following the posterior capsulorrhexis without having to remove the instruments. In order to achieve adequate anterior vitrectomy, the surgeon should ensure that the tip of the vitrector is swept around the underside of the posterior capsule, reaching the entire circumference of the capsule with the cutter facing downward. Once the anterior vitrectomy is completed, it is important to remove the vitrector only after the irrigation has been turned off. Doing so ensures that the irrigation does not push hydrated vitreous out the same tract as the vitrector as it is withdrawn from the eye. If one is unsure that all vitreous strands are removed from the anterior chamber, intracameral triamcinolone (Triesence®) can be injected into the anterior chamber, staining vitreous strands that would otherwise be difficult to detect. If the sclerotomy sites show signs of leakage after removing the cannula, then the sclerotomy should be closed with a buried 8-0 vicryl suture.
10. *Main wound*: In preparation for IOL insertion, one of the paracenteses needs to be enlarged – most preferably the one on the side of the surgeon's dominant hand. Surgically induced astigmatism has been found to be similar between clear corneal and scleral incisions [18]. Enlargement of the paracentesis can be achieved with a microkeratome entering through the paracentesis in the plane of the iris. If a single-piece foldable IOL is to be inserted with a cartridge, the size of wound needs to range from 2.2 to 3.0 mm, depending on the IOL and cartridge design. The microkeratome used may either be sufficient for the wound size with a single pass, or additional enlargement on the sides of the wound may be necessary to allow for insertion of the cartridge being used.

11. *IOL insertion*: If one chooses the limbal approach for the posterior capsulorrhexis and anterior vitrectomy, then the IOL still needs to be inserted into the capsular bag. Once the vitrector and irrigation are safely withdrawn from the eye, high molecular weight OVD should be injected into the space between the anterior and posterior capsules in order to inflate the peripheral remains of the capsular bag. The OVD should be injected into multiple quadrants to separate the anterior from the posterior capsule and allow for ample room for the IOL to be inserted. A single-piece foldable hydrophobic IOL (SN60WF, Alcon Laboratories) is the most commonly used lens by the authors. After filling the cartridge for the injector system with high molecular weight OVD, the IOL is loaded into the cartridge. Once loaded, the cartridge passes through the main wound with the bevel down while the surgeon's other hand stabilizes the eye with forceps. The plunger is twisted to allow the leading haptics to be guided into the inflated peripheral capsular bag. It is important to keep the IOL as level with the plane of the capsular bag as possible as to not allow the IOL to be inadvertently injected through the posterior capsular opening. The IOL should be injected slowly and with a trajectory toward the anterior capsule and away from the posterior capsule as much as possible to achieve proper placement. Once the IOL has been completely injected, a Sinskey hook can be used to dial the trailing haptics into the bag if it is in the anterior chamber. Alternatively, the IOL can be injected into the sulcus, and it can then be dialed slowly into the capsular bag in a controlled manner using the Sinskey hook.

    For surgeons who prefer pars plan posterior vitrectorhexis, the IOL should be inserted first into the bag. The bag must again be filled fully with high molecular weight OVD prior to lens injection into the bag in order to not allow the IOL to cause a defect of the posterior capsule as it is being injected. The OVD can then be aspirated with the posterior capsule still intact and therefore without fear of engaging the vitreous:

    (a) *Optic capture*: As discussed in Chap. 13: Primary Lens Placement, posterior optic capture has been found to reduce opacification of the visual axis and lens decentration in children, although this may not necessarily result in improved best-corrected visual acuity (VA) [19]. To perform optic capture, the IOL is implanted into the capsular bag as described above. The edge of the optic is then slid behind the posterior capsulorhexis using a Leister hook circumferentially [20]. A change from round- to elliptical-shaped posterior capsule opening indicates successful capture. It should be kept in mind that an appropriate posterior capsule for optic capture is one that is continuous (therefore, it was ideally created manually), and it should also be well-centered and optimally sized (1 mm smaller than the IOL optic). Alternative means of optic capture include (1) capturing the IOL through both the anterior and posterior capsulorhexis with the haptics in the ciliary sulcus and (2) reverse optic capture with the haptics in the bag and optic in the sulcus. The former is performed when the anterior capsulorhexis is compromised and is therefore inadequate for placement of the haptics in the capsular bag. The latter is useful when a tear exists in the posterior capsulorhexis, which makes the bag inadequate for placement of the IOL within the capsular bag.

(b) Alternatives to in-the-bag IOL: In-the-bag IOL insertion is preferred to other locations of IOL fixation due to decreased risk of glaucoma, damage to endothelial cells, and risk of cystoid macular edema. However, there are times in which in-the-bag insertion is not possible, and the lens must be placed in the sulcus (when there is sufficient capsular rim), or the IOL must be fixated to the iris or sclera.

12. *OVD removal and wound closure*: OVD can be removed using bimanular IA handpieces or a single-port technique with the double-barrel Simcoe cannula. Prior to introduction of either of these devices, the anterior chamber should be stabilized as much as possible with closure of the paracentesis and wound. With the OVD still in the eye, the main wound should be closed with three interrupted 10-0 vicryl sutures or a “figure 8” cross-stitch. The final interrupted suture in the wound is left untied until after all of the OVD has been removed. If the single-port technique with the Simcoe is to be used, then the paracentesis should be closed with a single interrupted 10-0 vicryl suture as well. Through the open part of the main wound, the Simcoe cannula is introduced with low aspiration (rate of 20) for removal of OVD from the bag with care as to not flip or destabilize the IOL. After a satisfactory amount of OVD has been removed, the third interrupted suture in the wound is finally tied, and knots can be buried.
13. *Injectables*: In order to limit the incidence of endophthalmitis following cataract surgery, some surgeons have adopted the use of intracameral perioperative antibiotics, either as an additive to the irrigating solution throughout the case or as an injection at the end of the case. Use of intracameral antibiotics is preferred by the authors, as there has been substantial evidence supporting its effectiveness in preventing endophthalmitis in adult cataract surgeries [21]. The use of intracameral moxifloxacin is convenient due to its availability as a preservative-free eye-drop solution (Vigamox®), which can be readily diluted 1:1 with balanced salt solution for injection of 250 μg in 0.01 mL solution [22]. Other commonly injected intracameral antibiotics include cefuroxime and vancomycin.

    To prevent postoperative inflammation, intracameral steroid (Triesence®) or subconjunctival steroid (dexamethasone) should be delivered prior to the end of the case.

Postoperative Steps

Following the conclusion of a case, some surgeons opt to place an additional drop of 5% povidone-iodine onto the surface eye for endophthalmitis prophylaxis. Finally, an antibiotic and steroid ointment is placed into the eye before patching the eye until the following day.

Case 1

A 13-year-old male patient developed a hyphema and, eventually, a traumatic cataract of the right eye following blunt injury from a rock 1.5 months prior to presentation. Presenting visual acuity (VA) to our service was 20/200, and examination revealed traumatic mydriasis due to multiple sphincter tears and a dense stellate anterior subcapsular and posterior subcapsular cataract. B-scan and fundus examination revealed no pathology. The decision was made to proceed with cataract extraction and placement of an IOL as well as pupilloplasty. The surgical approach was as described above. Trypan blue was injected into the anterior chamber, which led to appropriate staining of the anterior capsule but also obscuration of the red reflex due to presumed posterior migration of trypan blue. Despite difficulty with the view, the cataractous lens was removed and an IOL placed safely in the bag. Pupilloplasty was then successfully performed. Figure 8.1 depicts an Optos photograph of the patient's fundus 1 day after surgery, with trypan blue still staining the vitreous following lensectomy, IOL insertion, and anterior vitrectomy. The trypan staining resolved by postoperative week 1.

Comment This case serves to caution the reader about the potential hazard of the use of trypan blue in cases of weak zonules as discussed above. Situations of which to be aware of this possible complication include cataracts following trauma or prior intraocular surgery. Slow and deliberate injection can prevent overfill of the chamber and avoid posterior migration of the stain.

Case 2

A 4-year-old boy presented after a failed school vision screen. His family history was notable for a younger brother who had undergone bilateral cataract surgery at ages 4 and 6 weeks. On exam, vision was 20/50 uncorrected in the right eye and 20/70 uncorrected in the left. Slit lamp exam revealed mild lamellar lens opacities, the left greater than the right. Cycloplegic refraction was −1.50 diopters (D) in the right eye and −2.25 D in the left eye. Dilated exam was within normal limits. The child was prescribed glasses and returned for follow-up 3 months later. VA at that time of follow-up was 20/25 OD and 20/30 OS. Several months later, he returned with complaints of decreased vision and photosensitivity, and VA was 20/40 and 20/70 after an updated cycloplegic refraction. The decision was made to proceed with cataract extraction and IOL implantation of the left eye.

The surgical approach in this case was similar to that described above. Following instillation of trypan blue, the anterior chamber was inflated with OVD. Using a cystotome needle, the anterior capsule was pierced, and a small flap was created. The microincision forceps were able to be passed through a 1.0 mm paracentesis, and a continuous curvilinear capsulorrhexis was created. The lens was aspirated, and a single-piece SA60AT 15.5 D lens, target plano, was placed in the bag. A posterior capsular opening was created through a pars plana approach.

Comment Manual creation of the capsulorhexis is technically more challenging but, when executed well, is more resistant to radial tears. It should be considered in older children, where larger palpebral fissures, improved control, and less elasticity of the capsule support this technique. Use of microincision forceps (as opposed to Utrata forceps) is essential to allow for maneuverability through a small paracentesis while maintaining chamber stability.

Case 3

A 4-year-old boy with history of posterior lentiglobus of the left eye diagnosed 2 years prior presented for follow-up with progressively worsening vision of his affected eye. He had not undergone surgery previously due to parental concern about general anesthesia, but had close follow-up since diagnosis. His parents reported excellent compliance with patching of the right eye 5 hours a day, 7 days a week. On exam, his vision was 20/25 in the right eye and 20/125 in the left eye. Slit lamp exam of the left eye revealed a spherical protrusion of the posterior lens surface with a speckled opacity in the region of the outpouched lens. Due to continued vision decline, his parents agreed to cataract extraction with intraocular lens implantation of the left eye.

The surgical approach included the creation of a manual CCC followed by lens aspiration through the clear cornea. Due to concern for the presence of a preexisting defect in the posterior capsule, which is common in posterior lentiglobus, the lens material was first removed from the periphery and then in the central area of the lenticular outpouching. After complete lens aspiration, there was a suspicious area that appeared to be an opening in the posterior capsule. As such, the vitrector was kept inside the eye from the limbal incision to initiate creation of a round posterior vitrectorhexis from the edges of the posterior capsule defect and to perform an anterior vitrectomy. An SN60WF 21.0 diopter lens was carefully placed in the bag.

Comment This case illustrates the use of a limbal approach to the creation of a posterior vitrectorhexis. This technique reduced the need to remove instruments from the eye in order to create a posterior capsulorrhexis from the pars plana approach, as there was already a defect in the posterior capsule, and the edges of that defect could simply be used as the start of a posterior vitrectorhexis from the limbal approach. Delaying the creation of the posterior capsulorrhexis in order to switch to the pars plana approach might allow time for anterior vitreous to migrate anteriorly and thus cause traction on the posterior vitreous in a scenario where a posterior capsular defect is already noted at the time of lens aspiration.

Case 4

A 4-year-old boy with history of unoperated persistence of fetal vasculature (PFV) of the left eye presented with a dense white cataract. He had been previously evaluated, but had not undergone cataract surgery. Parents report occasional attempts at patching, with glasses worn full time for protection. Vision was 4/600. This was a significant decline from visual acuity obtained 1 year prior. Dilated exam revealed a dense white cataract with no view of the posterior pole. B-scan confirmed a thin, avascular stalk, with no clear traction on the retina. Decision was made to operate. Extensive discussion of risks and potential limited visual acuity improvement was undertaken.

Approach to the lens was through a limbal clear corneal incision. The lens was easily aspirated using bimanual irrigation and aspiration handpieces. The main incision is enlarged, and an SA60AT 26.5 lens was placed in the bag. The eye was then infraducted by placing traction on the superior rectus stay suture, and a small 2 clock hour peritomy was created from 1:00 to 11:00. Cautery was applied. Three mm from the limbus, a 23G MVR blade was used to enter the pars plana. The 25G vitrector was introduced. The avascular stalk was severed at its attachment to the posterior lens and removed to the midvitreous. This was accomplished without trauma or bleeding and followed by a limited anterior vitrectomy. Then, the vitrector port was turned skyward, and the posterior capsule was engaged. A posterior capsule opening was created 1 mm smaller than the anterior capsule opening.

On follow-up 1 month after surgery, the child had a clear visual axis, well-centered IOL, and a best-corrected visual acuity that had improved to 20/400. Parents reported they had begun to have more success with patching.

Comment This case illustrates the use of a pars plana approach to create a posterior vitrectorhexis. This technique allowed for creation of a posterior capsular opening and removal of stalk in a controlled fashion. By approaching from the pars plana, the risk of anterior vitreous traction was minimized. Approaching the stalk from the pars plana and avoiding having to initially open the posterior capsule as with a limbal approach decreased likelihood of tension on the capsule and allowed uncomplicated removal of the stalk without tearing the posterior capsule.

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