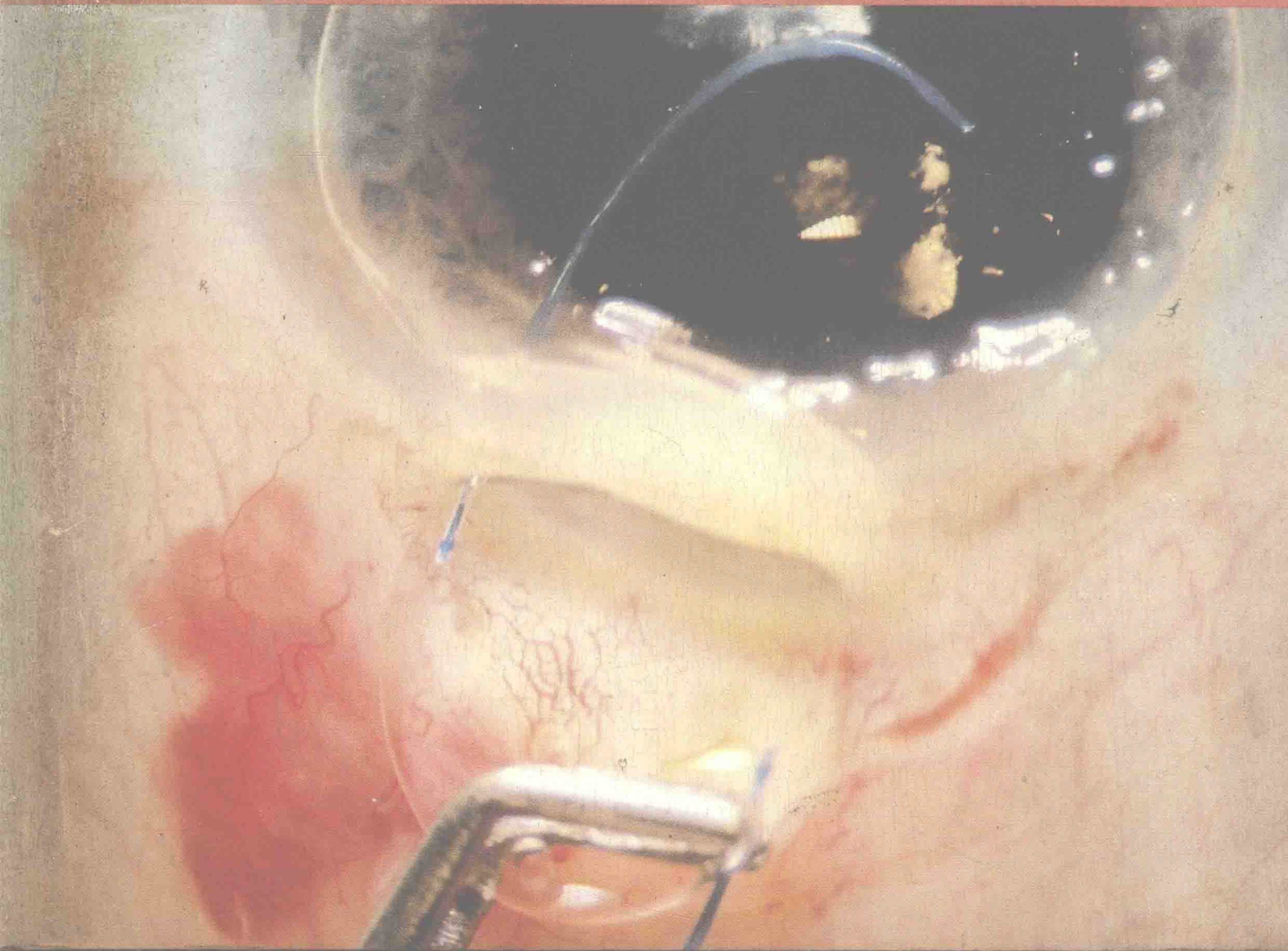

Intraocular lens implantation

TECHNIQUES AND COMPLICATIONS

Clayman · Jaffe · Galin

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Preface

No one doubts that the quality of vision obtained with an intraocular lens implantation more closely resembles that of the phakic eye than the vision obtained by any other known method. However, because intraocular lens implant surgery is more complex than a routine cataract extraction, its history has been exciting, often frustrating, but finally rewarding. There have been abortive attempts at intraocular lens implantation dating back to the early eighteenth century, but it was not until 1967 that ophthalmic surgeons in the United States began performing implant surgery in appreciable numbers. Although implant surgery is not an American innovation, the United States has become the central stage for it.

We recognized early the efficacy of intraocular lens implantation and were confident of its future wide popularity and acceptance. This conviction sustained us during the years of formidable professional and bureaucratic opposition. What we did not predict was the evolution of cataract extraction and lens implantation. The intracapsular method is steadily being replaced by the extracapsular method, and the lens implants that failed terribly in the 1950s and early 1960s are now the most popular lenses in use, albeit in modified designs.

Several factors have contributed to the evolution of lens implant surgery. First there was the introduction of phacoemulsification, a technique of cataract extraction initially irrelevant to intraocular lenses, whose great advantages were a small incision and rapid patient rehabilitation. As an aside, phacoemulsification was a variant of extracapsular cataract extraction, and the profession slowly became aware of certain panocular benefits of this type of surgery. In the meantime, the European pioneers were the pacesetters for the United States, and they inspired the widespread popularity of the iris-fixated intraocular lenses with which their names are associated. The exception was Choyce, whose lens was angle fixated. Although iris-supported lenses now appear headed for certain obsolescence, we must be grateful for their introduction. They rescued the field of lens implantation from a tragic experience and created a revival of enthusiasm for this procedure.

In the middle 1970s most implant surgeons in the United States were using intracapsular cataract extraction techniques and iris-fixated intraocular lenses. This combination did not satisfy all the patient requirements of rapid visual rehabilitation and unrestricted life-style, nor was it suitable for all patients. Furthermore, the necessity of coping with a bulging anterior hyaloid face and placing a fixation suture or bending a fixation clip sometimes turned a routine cataract extraction into a formidable surgical exercise. How much easier it was to slide an anterior chamber lens into the anterior chamber, instead of contending with iris retraction in the face of positive vitreous pressure. It was for this reason that the interest in anterior chamber lenses grew—in other words, the profession evolved a lens type that simplified the surgery and hence benefited the patient.

Analogous to this was the situation with posterior chamber intraocular lenses. When Shearing introduced his lens in late 1977, the perfect match was made between phacoemulsification and an intraocular lens which required an extracapsular technique. This uniplanar lens could be inserted through a modestly enlarged phacoemulsification incision, without the anterior chamber collapsing because its uniplanar design easily slipped through the incision without prying it apart. Moreover, implant length was not a factor, as in anterior chamber lens implants. Of course, there were surgeons performing routine extracapsular cataract surgery, without emulsification, who were using two-plane intraocular lenses of the Binkhorst iridocapsular and Worst Platina type. Implant insertion is considerably easier with Shearing-type posterior chamber lenses, and fixation is better; these extracapsular cataract surgeons slowly gravitated to posterior chamber lenses. Why? Because it was the type of lens that simplified surgery. Concurrently, medical instrumentation was improving with the development of better and more versatile microscopes and automated techniques of extracapsular surgery.

Where is this taking us? We feel that the drift is to extracapsular cataract surgery and specifically to small incision surgery such as phacoemulsification, with the insertion of uniplanar intraocular lenses capable of being introduced through a relatively small incision. Because the length of anterior chamber lenses is an added intraoperative factor to consider, we believe that posterior chamber intraocular lenses will slowly gain the favor of the majority of surgeons. The advantage of small-incision cataract surgery with uniplanar intraocular lens implantation for rapid patient physical and visual rehabilitation is obvious, but the ultimate expression of minimum patient inconvenience and minimum disruption of patient life-style is the astonishing growth of outpatient cataract surgery. With promising laser techniques on the horizon, noninvasive cataract surgery may be feasible.

Progress in cataract surgery and intraocular lens implantation over the past 30 years has been astonishing. Rapid physical and visual rehabilitation has become almost routine. Yet, the details of technique are increasing at a rapid pace. This atlas describes the principles underlying these techniques and is based on our years of experience. We do not describe every technique, nor every lens, nor every complication.

Henry M. Clayman
Norman S. Jaffe
Miles A. Galin

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One
Techniques of cataract extraction

GENERAL PRINCIPLES

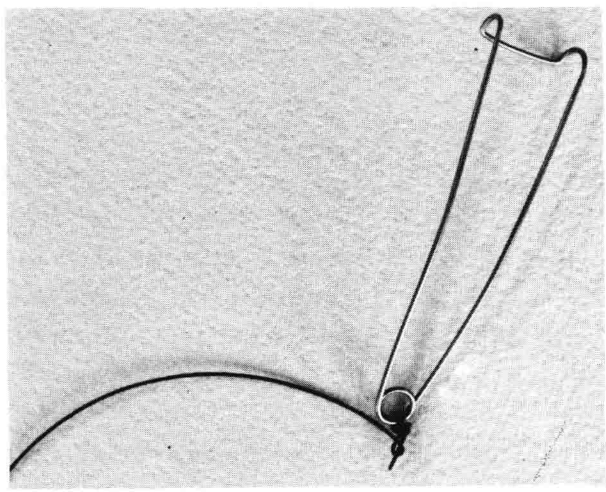
The purpose of this chapter is to give methods by which a safe intracapsular cataract extraction (ICCE), extracapsular cataract extraction (ECCE), or Kelman phacoemulsification (KPE) can be performed on the premise that an intraocular lens (IOL) will then be inserted. The variations in techniques and instrumentation are numerous, and we make no attempt to describe them all. We present examples of methods that we have found safe and effective. Our omission of a specific procedure or instrument is not intended to reflect unfavorably on ophthalmic surgeons whose views may differ from ours. Furthermore, we are avoiding a discussion of anesthesia in ophthalmic surgery, since the reader will find this covered by sources cited in the bibliography. All maneuvers are described with the assumption that the surgeon is right-handed.

Operating microscope

Before detailing the various types of cataract surgery, we wish to state unequivocally that the surgery described in this atlas requires the use of the operating microscope. The surgeon may have to use both hands simultaneously and for this reason would desire a foot-controlled microscope. At the time of this writing the Zeiss Op Mi6 or 6S with "X-Y" motion is our choice for the performance of sophisticated anterior segment surgery.

Prior to the cataract operation by whatever methods, there are several common considerations. The first is the concept of surgery on the "soft eye," which is of paramount importance in intracapsular cataract surgery and becomes less important as one moves to extracapsular cataract surgery and then to phacoemulsification. One might say that the topic becomes less crucial as the incision gets smaller; nevertheless it is always important. Methods of producing a soft eye include digital pressure, ocular compression by balloon devices, hyperosmotic agents, and carbonic anhydrase inhibitors—each alone or in combination. We shall assume that the eye has a satisfactory intraocular pressure commensurate with the procedure being undertaken, prior to the start of the operation. Next is the selection of lid retractors of which there are many types. We recommend the Jaffe lid retractors (Fig. 1-1), which are sufficiently adjustable and malleable to conform to any peculiarity of the patient's physiognomy.

A



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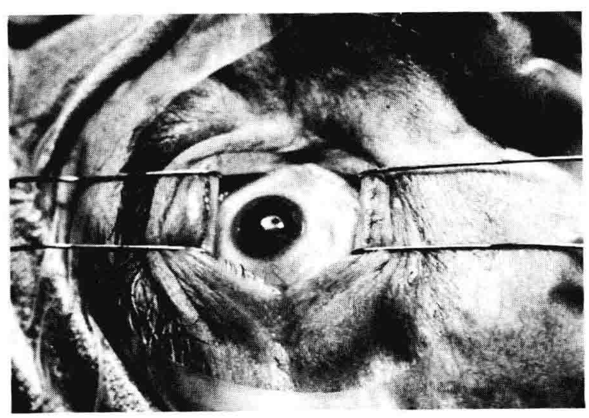

Fig. 1-1. A, Jaffe lid retractor. **B,** Jaffe lid retractor in situ. (From Jaffe, N.S.: Cataract surgery and its complications, ed. 3, St. Louis, 1981, The C.V. Mosby Co.)

Superior rectus suture

A superior rectus suture should be used to rotate the eye as required; this may be placed transconjunctivally or under the conjunctival flap. In the former method the globe is rotated down and slightly posteriorly. With toothed forceps (e.g., Lester forceps) held in the left hand, conjunctiva, Tenon's capsule, and superior rectus muscle are grasped at the 12 o'clock position approximately 10 mm posterior to the limbus. A 4-0 silk suture is then passed beneath them and out through the conjunctiva (Fig. 1-2). This maneuver is aided by slightly lifting the forceps held in the left hand. The correct placement of the suture is ascertained by pulling it inferiorly, whereupon the globe should rotate downward. In a deep-set eye with a fornix-based conjunctival flap, it may be prudent to place the superior rectus suture under the flap, thus retracting the conjunctiva with the traction suture and enhancing exposure. In this case the forceps held in the left hand are passed under the flap, the tendon of the superior rectus muscle is grasped, and the globe rotated downward. The suture is then passed under the muscle insertion. In either method the long ends of the suture are kept out of the operative field by being looped under the nasal arm of the superior lid retractor.

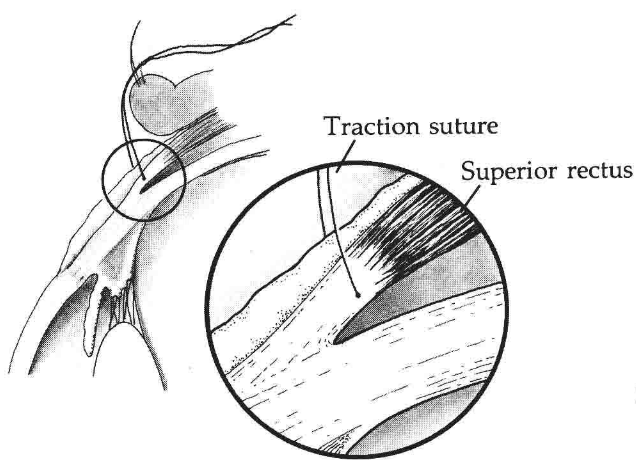

Fig. 1-2. Superior rectus suture.

Conjunctival flap

We will assume that the surgeon will perform either a fornix- or limbal-based conjunctival flap. The former (Fig. 1-3) is performed by grasping the conjunctiva and Tenon's capsule with fine-toothed forceps at the limbus and "buttonholing" it with Westcott scissors to the bare sclera. The *closed* scissors are then passed laterally through the buttonhole to the left under the conjunctiva and Tenon's capsule following their limbal insertion. The scissors are opened, which lyses the adhesions of Tenon's capsule to the sclera. The scissors are then withdrawn and reinserted with the proximal blade under the conjunctiva and Tenon's capsule at their limbal insertion and the other blade over the insertion. When the scissors are closed, a neat fornix-based flap without tags will result. This maneuver is continued to the right and left depending on the size flap required, which in turn will depend on the operative procedure contemplated. Lateral incisions at the extremities of the flap are options that will permit the flap to be retracted further posteriorly.

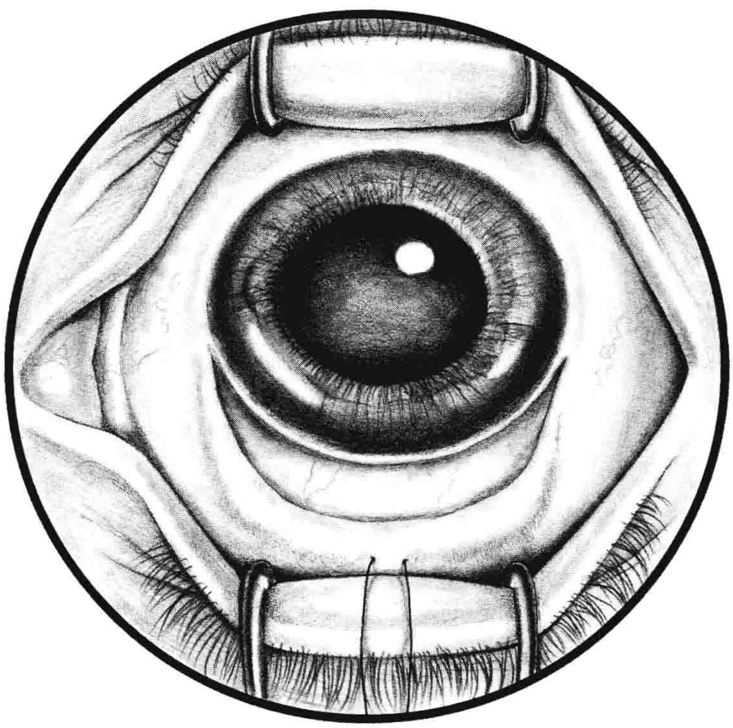

Fig. 1-3. Fornix-based conjunctival flap.

A limbus-based flap (Fig. 1-4) varies in width from 2 to 7 mm. The conjunctiva is grasped at the 12 o'clock position in the line of incision with a fine-toothed forceps held in the left hand and tented upward. It is then incised to the sclera with Westcott scissors. As in the fornix-based conjunctival flap, closed scissors are passed through the opening laterally in the line of incision and opened to lyse adhesions. The scissors are withdrawn and reinserted with the distal blade under the conjunctiva and Tenon's capsule. The scissors are closed, which results in a clean, curvilinear edge to the flap margin. Again the size of the flap depends on the proposed operation. Dissection of the flap to the limbus can be continued with fine microscissors and the limbus exposed with a no. 64 Beaver blade, although numerous other instruments can be used.

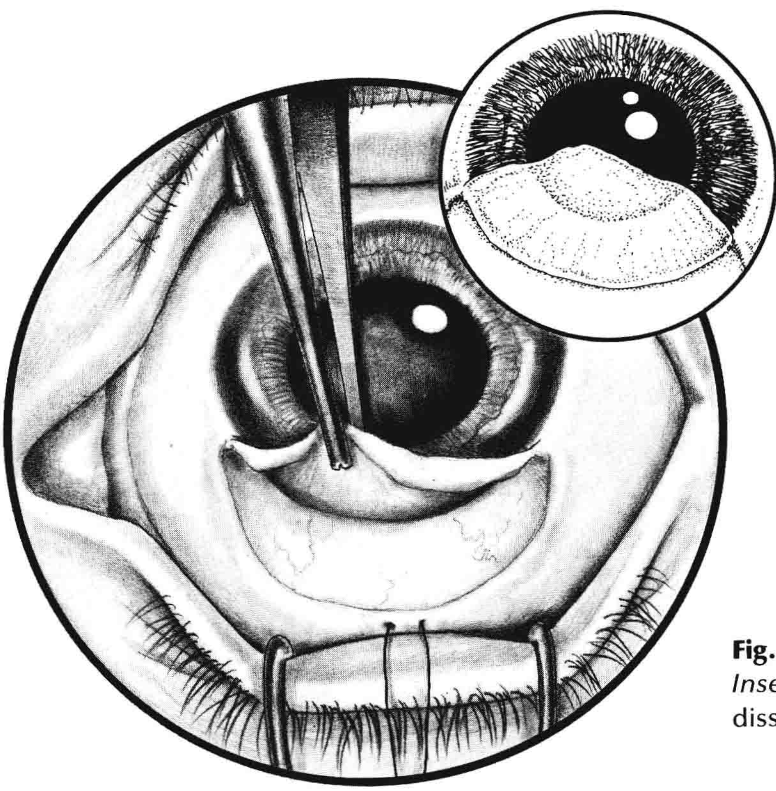

Fig. 1-4. Limbus-based conjunctival flap. *Inset,* Limbus-based conjunctival flap after dissection.

In both types of flaps the dissection is often facilitated by ballooning the superior conjunctiva with a balanced saline or anesthetic solution. Bleeding is contained with the wet field cautery (Fig. 1-5), and further hemostasis may be obtained with cellulose sponges soaked in epinephrine (1:1000) pressed gently on the limbus. Care should be taken not to press the sponges on the cornea since they leave an imprint, thus detracting from the surgeon's view of the anterior chamber—an undesirable situation when an IOL is planned.

At the conclusion of the procedure a fornix-based flap is pulled down over the incision and will often adhere to its original insertion; or it may be tacked at its extremity to the adjacent conjunctiva with one or two absorbable sutures such as 8-0 Vicryl. The flap should overlap the incision by about 1 or 2 mm and will usually retract back to the limbus within 4 weeks after the operation. A limbal-based flap is pulled back over the incision and sutured to the adjacent conjunctiva with an absorbable suture. Even with the 180-degree limbal-based flap, rarely are more than four sutures required for closure. A very small limbal-based flap such as in phacoemulsification often requires no suture. It is laid back over the incision and is adherent the next day. An alternative to suturing the conjunctival flap is to use a wet field cautery with coaptation forceps. This method works, although conjunctiva to conjunctiva adhesion may be short lived.

The advantages of a limbal-based flap are that the incision is well covered and a "handle" to elevate the cornea is provided. The disadvantages are that it obscures visualization during IOL insertion (especially with intracameral iris sutures (p. 219), and the corneal-scleral sutures frequently draw Tenon's capsule of the flap into the tract during suturing. Furthermore, in the postoperative period it is easier to cut sutures under a fornix-based flap should this be necessary to reduce with-the-rule astigmatism.

A

B

Fig. 1-5. A, Wet field coagulator. **B,** Cauterization of vessels with wet field cautery. Note stream of balanced saline solution *(arrow),* which acts as dielectric between jaws of bipolar forceps.

INTRACAPSULAR CATARACT EXTRACTION

Incision

The literature on the placement of the corneal scleral incision is copious and there is no agreement on the site, on the amount of beveling, or about whether the incision should be uniplanar or multiplanar. The topic is partially summarized by stating that the more corneal the section the more the astigmatism, and the more scleral the section the greater the risk of hyphema. Figs. 1-6 and 1-7 show two views of a uniplanar incision of moderate bevel placed in the surgical limbus. A razor knife is used for the initial incision. A razor knife is sharp on only one side and therefore, if it is applied perpendicularly to the sclera, a blunt and sharp edge are simultaneously present and

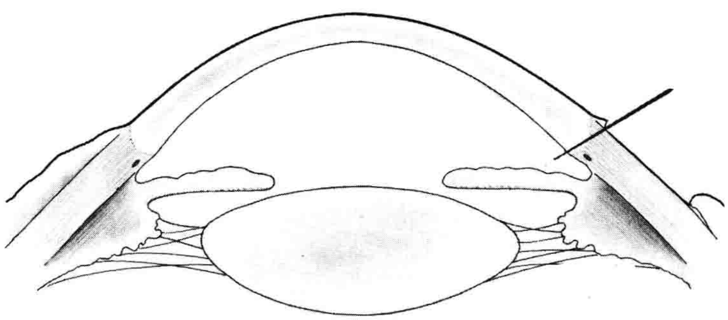

Fig. 1-6. Uniplanar incision showing angulation.

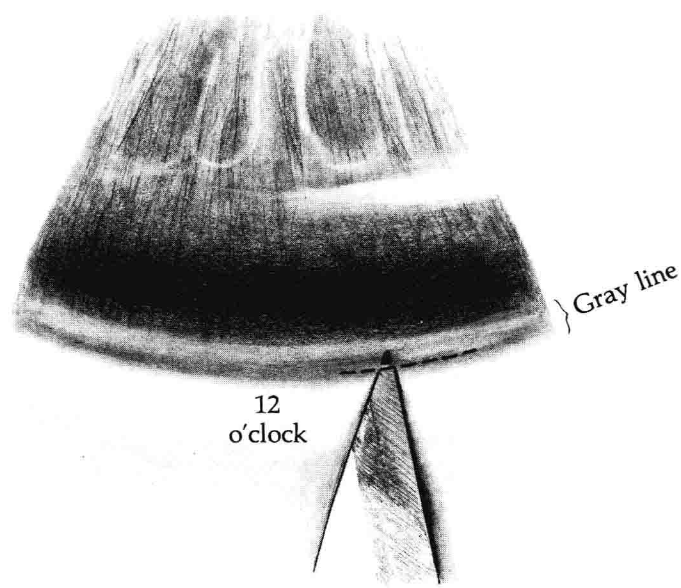

Fig. 1-7. Placement of incision with razor knife in posterior third of surgical limbus.

scleral penetration may be difficult. A better method is to grasp the sclera at the 12 o'clock position just posterior to the limbus with a 0.12-mm toothed forceps held in the left hand and to present the razor edge to the sclera slightly obliquely with the sharp edge to the surgeon's right. Gentle pressure is exerted with the knife as it is swung to a perpendicular angle, and the blade will enter the anterior chamber with ease. While the blade is still in the anterior chamber, it is used to extend the incision 4 mm to the right, in the line of the surgical limbus, so that the corneal-scleral section scissors can be introduced. The incision is enlarged to the right to the 9:30 position following the surgical limbus and to the left to the 2:30 position (Fig. 1-8). This will give a 170-degree section (Fig. 1-9) almost corneal at its lateral aspects, which is de-

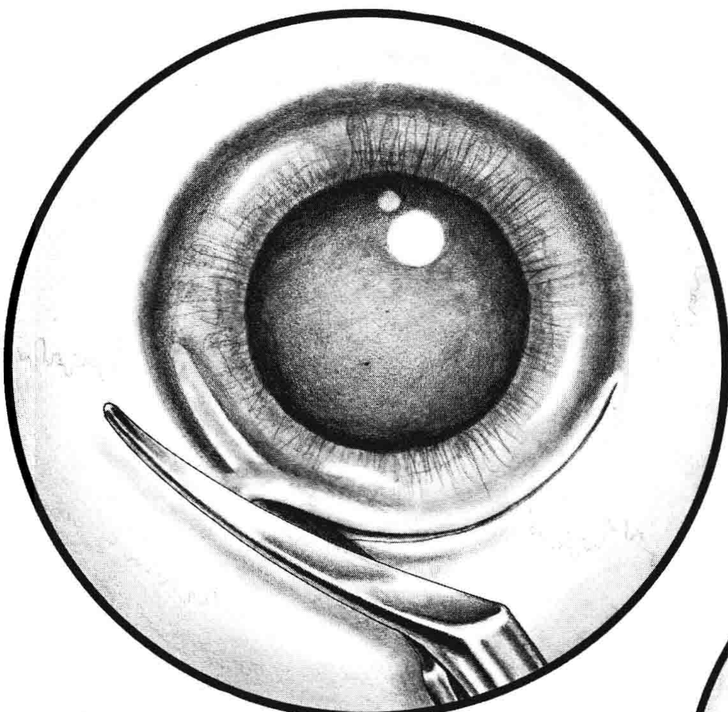

Fig. 1-8. Enlargement of the incision with corneal-scleral scissors.

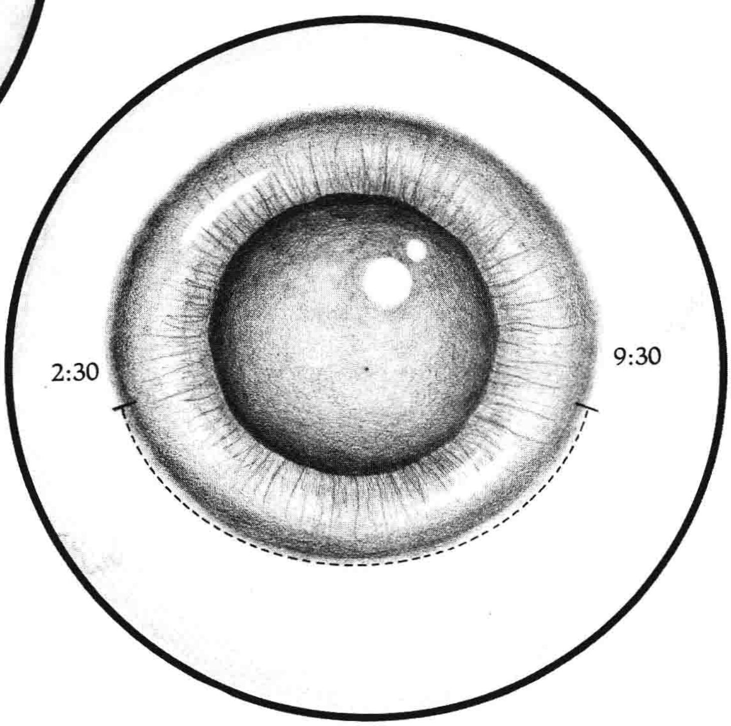

Fig. 1-9. Extent of intracapsular incision.

sirable to prevent bleeding from the long, perforating, lateral blood vessels (Fig. 1-10), and also to minimize with-the-rule astigmatism, monotonously produced when interrupted monofilament sutures are used to close the incision. A safety suture (e.g., 8-0 Vicryl) is placed at the 12 o'clock position through both the corneal and scleral aspects of the incision and looped to the surgeon's left.

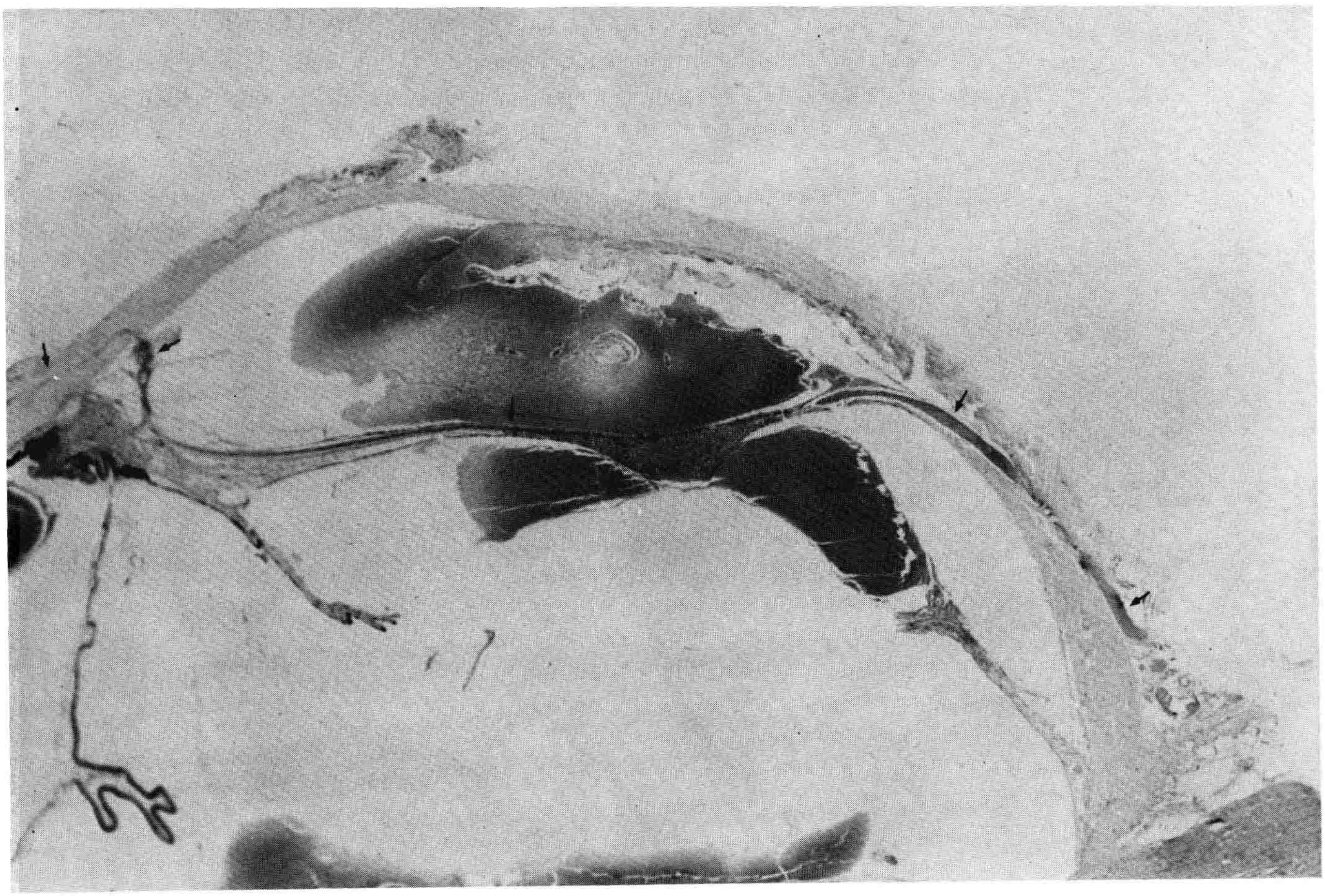

Fig. 1-10. Fortuitous pathology section showing course of long ciliary nerve and vessels *(arrows)*.