CATARACT SURGERY AND ITS COMPLICATIONS

NORMAN S. JAFFE, M.D., F.A.C.S., F.I.C.S.

THIRD EDITION

CATARACT SURGERY AND ITS COMPLICATIONS

NORMAN S. JAFFE, M.D., F.A.C.S., F.I.C.S.

Clinical Professor of Ophthalmology, Bascom Palmer Eye Institute,
University of Miami School of Medicine;
Chairman, Department of Ophthalmology, St. Francis Hospital,
Miami Beach, Florida

THIRD EDITION

with 1283 illustrations

The C. V. Mosby Company

ST. LOUIS • TORONTO • LONDON 1981

THIRD EDITION

Printed in the United States of America

The C. V. Mosby Company
11830 Westline Industrial Drive, St. Louis, Missouri 63141

Library of Congress Cataloging in Publication Data

Jaffe, Norman S 1924-
Cataract surgery and its complications.

Bibliography: p.
Includes index.
1. Cataract—Surgery. 2. Cataract—Surgery—Complications and sequelae. I. Title. [DNLM: 1. Cataract extraction. 2. Cataract extraction—Adverse effects. WW260 J23c]
RE451.J33 1980 617.7'42059 80-19355
ISBN 0-8016-2404-5

C/CB/B 9 8 7 6 5 4 3 2 1 01/B/013

Foreword

No other surgical specialty has been so dominated by a single operation as has ophthalmology by cataract extraction. It is estimated that more than 400,000 such procedures are performed annually in the United States, and many times that number are done throughout the world.

Cataract extraction is a simple, but extremely delicate, procedure. It is amazing that beginning residents may perform their first four or five cataract extractions without a flaw, and that thousands of such procedures may be performed in cataract camps, in about five minutes for each operation, with relatively good results. Yet I am sure that ophthalmologists who find it necessary to undergo the operation themselves seek the best cataract surgeon they know, for they realize that the success of each operation depends on the proper performance of every step of the procedure. The number of significant complications that can occur is astonishing.

The improvement in results and in the management of complications during the past 25 years has not been attributable so much to the increased mechanical skill of the physician as to the development of more efficient techniques and better safeguards such as sedation, the ability to lower intraocular pressure, antibiotics, and instrumentation, including the operating microscope.

One might wonder how a single person could write a book about cataract surgery and its complications when a panel of experts can spend 8 hours a day for 5 days and still not cover the subject. Dr. Jaffe has done this by being selective in his emphasis of subject material. Yet he has extended his coverage widely, from the decision of when to operate and the psychologic preparation of the patient to the management of postoperative behavioral disturbances. Since each ophthalmic surgeon will have a favorite technique for cataract surgery, this area has been summarized on the basis of principles; yet, since all surgeons encounter major complications if they operate frequently enough, the physiologic basis for normalcy and the histopathologic alterations encountered as a result of the complications have been discussed in detail. The discussion here is almost encyclopedic, and very little could be added to this most scholarly and critical review of all surgical complications during or after a cataract extraction.

Probably the outstanding characteristic of this book is the author's ability to select critically the important contributions to the management of cataract problems. These are analyzed and evaluated on the basis of his vast experience as ophthalmic surgeon and consultant. Greatest attention is given to those areas that he has personally investigated, among them postoperative astigmatism, the management of impending and actual vitreous loss, late rupture of the face of the vitreous, postoperative endophthalmitis, hyperosmotic agents, and intraocular lens implantation.

Dr. Jaffe initiated the popularity of intraocular lenses in this country in 1967. It has been through his leadership that the surgical techniques and the materials for implantation have been constantly improved. Even more important has been his firm insistence that rational guidelines for lens implant surgery be maintained to ensure an orderly growth of this modality of cataract surgery. He has set an example for young ophthalmologists by energetically following the

postoperative course of his patients. His statistical presentations have been voluminous. His colleagues have often heard him say, "We want facts, not opinion." Without question, the American Intra-Ocular Implant Society has been of immense service to the public, primarily through Dr. Jaffe's great energies and capabilities.

This book, since its first edition, has been the leading teaching text on cataract surgery of this generation, and it remains a credit to the author.

A. Edward Maumenee, M.D.

Preface

Old concepts change, and new ideas are plentiful in all fields of science and medicine. Cataract surgery and its complications are no exception. I have attempted to be highly selective in modifying older concepts and in including those changes that have gained wide acceptance and new modalities that promise to survive.

It will be apparent that this work is not intended to be an atlas of cataract surgery. Techniques in cataract surgery are presented as method guidelines on which the principles of this operation are based. The emphasis is clearly on complications. Whenever possible, I have made an attempt to correlate the pathogenesis, pathophysiology, and clinical picture of the seemingly endless number of complications that may confront the cataract surgeon. I hope this will provide a rational approach to their management.

Once again, as in the second edition, the innovator of a method has contributed a guest chapter. In addition to Dr. Charles D. Kelman's chapter on phacoemulsification is a chapter on keratophakia and keratomileusis, written by Dr. José I. Barraquer, the acknowledged pioneer of this technique.

It will undoubtedly be apparent to many readers that some subjects have received a greater emphasis than others. These represent areas of my special interest and widest experience. No single surgeon can speak authoritatively about every facet of surgical methods and complications. Nor can every aspect of the subject be covered. To avoid the high cost of an extremely large volume, certain topics such as anatomy, embryology, and the optic correction of aphakia have been omitted.

The major task of keeping abreast of the dynamic changes in cataract surgery is nearly indescribable. I am continually reminded that the responsibility of this and future editions is almost a full-time occupation. Whatever the effort, I have been more than adequately compensated by the gratitude expressed by both residents in ophthalmology and experienced practitioners. What more can one ask?

Norman S. Jaffe

Contents

PART ONE

CATARACT SURGERY AND SPECIAL TECHNIQUES

1 The decision to operate, 3

2 Healing of the wound, 15

3 Surgical technique, 32

4 Postoperative corneal astigmatism, 92

5 Intraocular lens implants, 111

6 Phacoemulsification, 187
CHARLES D. KELMAN

7 Keratomileusis and keratophakia in the surgical correction of aphakia, 199
JOSÉ I. BARRAQUER

8 Subluxation and dislocation of the lens, 221

9 Cataract surgery combined with glaucoma surgery or keratoplasty, 231

10 Postoperative care, 245

PART TWO

COMPLICATIONS OF CATARACT SURGERY

11 Major operative complications, 251

12 Anterior chamber depth abnormalities, 274

13 Hypotension, 282

14 Choroidal detachment, 293

15 Aphakic pupillary block, 302

16 Glaucoma in aphakia, 317

17 Corneal edema, 329

18 Cystoid macular edema (Irvine-Gass syndrome), 357

19 Alterations at the posterior pole of the fundus, 374

20 Vitreous changes, 394

21 Hemorrhage, 409

22 Endophthalmitis, 429

23 Uveitis, 465

24 Retained lens material, 480

25 Iris prolapse, 500

26 Epithelial invasion of the anterior chamber, 505

27 Fibrous ingrowth, 537

28 Corneal endothelial proliferation, 551

29 Detachment of Descemet's membrane, 567

30 Retinal detachment in aphakia, 576

31 Behavioral disturbances, 589

PART ONE

CATARACT SURGERY AND SPECIAL TECHNIQUES

CHAPTER 1

The decision to operate

During the past 40 years, a much more liberal approach to the indication for cataract surgery has occurred among opthalmic surgeons, resulting in some criticism from those who maintain that this more liberal interpretation is not medically, socially, and economically justified. Nevertheless, a poll taken on this subject among ophthalmologists would likely show that opinions vary from never removing the cataract (no matter the state of maturity) as long as the opposite eye enables the patient to "get around" to removing the cataract if it "bothers" the patient (no matter what the state of the good eye).

Ophthalmic surgery has progressed far beyond the era of the old extracapsular extraction when it was almost mandatory to wait until vision was reduced virtually to light perception. The key factors favoring a bolder approach to surgery include the following:

1. Establishment of intracapsular lens extraction
2. Reduction of the incidence of unplanned extracapsular lens extractions
3. Reduction of operative loss of vitreous
4. Refinement of planned extracapsular cataract extraction
5. Introduction of phacoemulsification
6. Improvement in intraocular lenses and lens implant surgery
7. Improvement in cataract spectacles and contact lenses
8. Availability of anti-infectious and anti-inflammatory agents
9. Improvement in sutures and instrumentation
10. Improvement in results

These factors are discussed in other sections of the book. They have brought the patient a long way from the days when patients had to suffer through years of visual impairment before the cataract was "ripe" enough for surgery.

This whirl of technological advances has had an intoxicating effect on American ophthalmology. A dilemma faces every responsible ophthalmologist. The lay press, on the one hand, has heightened public expectation by making the most heroic surgical procedures appear conventional. Consumer groups, on the other hand, label new advances as bordering on human experimentation.

No rigid rules can be imposed on any surgeon or on every patient. Nevertheless, a painstakingly honest approach to the following question must be undertaken. Will the operation benefit the patient? The needs of the patient and not the ability to perform a technically perfect operation is the main consideration. Most elderly, inactive individuals can get along reasonably well with advanced nuclear sclerosis that reduces their visual acuity to 20/80 in the better eye, since they may retain adequate reading ability. However, a relatively small posterior subcapsular opacity may be very disabling even though distance visual acuity in the darkened examination room is 20/40 to 20/50. These patients read poorly and are practically helpless when crossing streets facing the sun. The increasing rigidity and miosis of the pupil with advancing age compound the difficulty. Many tragedies have resulted because cataract patients cannot meet the most imporant physical requirement for a license to operate a motor vehicle: adequate corrected distance visual acuity (usually 20/40 in the better eye).

There are many situations where a relatively small cataract in the axial position may make it impossible for the patient to earn a livelihood. Young patients whose pupils constrict briskly on attempted near vision are especially affected.

In planning cataract surgery on the second eye, one should be aware of any operative or postoperative complications in the first eye. These mishaps show an annoying tendency to repeat. One should be extremely conservative in considering surgery on the one-eyed patient. If the first eye was lost as a result of cataract surgery, surgery on the second eye should be delayed as long as possible. One may be slightly less conservative if the first eye was lost as a result of other nonoperative causes (trauma, infection, and so on).

These considerations are always tempered by the personal experience of the cataract surgeon. Surgeons confident in their surgical ability are likely to be influenced by this confidence in the approach to surgery. On the other hand, a surgical failure in a one-eyed patient is likely to have a sobering influence on the surgeon for the rest of that surgeon's professional life.

The surgeon should never lose sight of the fact that the aphakic eye with 20/20 corrected visual acuity often renders the patient more disabled than a phakic eye with 20/50 to 20/60 acuity. The limited field of vision with aphakic spectacles is an important problem in patients of all ages. If contact lens problems are anticipated because of extreme nervousness, hand tremor, arthritis, ocular allergy, and so on, the surgeon must approach surgery with greater caution. If an intraocular lens implantation is planned, the surgeon must appreciate the greater complexity of the procedure. Every surgeon wishes for the opportunity to reconsider the decision to operate for at least one patient.

There is a wide variance in opinion concerning the advisability of performing cataract surgery on both eyes during the same period of hospitalization. Bilateral cataract surgery on the same day is risky and warranted only in the rarest circumstance. Many surgeons have successfully removed cataracts from both eyes several days apart. The arguments in favor of this are as follows: one hospitalization, one convalescent period, avoidance of the problem of monocular aphakia, and convenience related to employment. These surgeons claim that the advantages outweigh the potential hazards: the risk of causing damage to both eyes by infection and injury, the risk of a late complication in the first eye such as expulsive hemorrhage, the risk of complications that tend to be bilateral such as cystoid macular edema, bilateral retinal detachments, corneal edema from vitreocorneal adherence, and the greater stress of two operations performed within a short period of time. Although I cannot document it, my impression is that the incidence of complications is higher. I prefer to postpone surgery on the second eye until I have assured myself that the first eye has fulfilled my expectations. Too often, I have learned something from the surgery on the first eye or from the months after the surgery that I have used with benefit on the second eye. However, I concede that circumstances may occur that favor a short interval between surgery on the two eyes. In spite of this personal preference, I am also aware that there is nearly an equally divided view on whether bilateral cataract surgery should be performed only days apart in each eye or whether a longer interval is more prudent.

There is also a wide diversity of opinion on the need for cataract extraction in the second eye of an elderly patient after successful cataract surgery on the first eye. Although I am aware that many ophthalmologists do not share my view, I am less conservative here. It is my opinion that if the patient had binocular visual function before the onset of cataracts, he will enjoy better visual function if both cataracts are removed. However, if the patient functions well for his needs and is minimally disturbed by the handicaps of monocular aphakia, I would not recommend surgery on the second eye. If the patient wears aphakic spectacles (with a balance lens before the phakic eye) and is suffering from the usual perceptual difficulties associated with monocular aphakia, I would recommend surgery on the second eye. If the patient has successfully managed a contact lens in the sole aphakic eye, cataract surgery on the second eye may not be necessary. The situation with intraocular lenses is discussed in Chapter 5.

PREOPERATIVE PHYSICAL EXAMINATION

Before planning cataract surgery, the surgeon must be made aware of the physical condition of

the patient. This is best accomplished by requesting that the patient seek consultation with his personal physician. In many instances it is advisable to share the responsibility of the patient's hospitalization with his physician. This makes it convenient for the latter to supervise the patient's medical status.

Cataract surgery has progressed to the point that only a rare patient need be refused surgery because of physical disability. However, the surgeon must exercise good judgment when considering surgery on feeble, aged, and infirm individuals. Cataract surgery is usually unjustified on a patient with an overwhelming medical problem such as a terminal stage of malignancy. If an intelligent medical workup is obtained, most temporary contraindications may be eliminated.

If the patient is a diabetic, control should be adequate and the diabetic status monitored during the hospital stay. One should never neglect to inquire whether the patient is taking anticoagulation therapy. This therapy should be eliminated to allow the prothrombin level to return to normal before surgery. Severe anemia should be corrected, high blood pressure reduced, and all signs of congestive failure eliminated. Respiratory problems such as bronchitis and asthma should be controlled. The genitourinary tract should be investigated for infections and other problems. Prostatic hypertrophy is no contraindication to surgery because the patient will be permitted early ambulation. With the current popularity of administering hyperosmotic agents preoperatively, it is advisable to employ an agent with relatively little diuretic effect (glycerin) rather that one that might require an indwelling catheter (mannitol). Dental and otolaryngologic consultations should be obtained when indicated. The surgeon should also consider the patient's emotional status. A surgical procedure should not be undertaken on a depressed patient or one whose peptic ulcer is active or whose colitis is uncontrolled.

There is no better ally to the ophthalmic surgeon than the competent internist who has followed the patient for years and is familiar with his personal habits, his idiosyncrasies to drugs, his allergies, and his current medication regime. It is important to know whether systemic steroids or antibiotics may be used safely in case of postoperative complications or as a prelude to surgery when indicated. I have a special medical clearance form to be filled out by the patient's personal physician. The physician may check a box affirmatively or negatively regarding a desire to observe the surgery and aid in the medical management of the patient while in the hospital. The physician also provides a list of the patient's medications to be used during hospitalization and is asked to sign the form. I confess that other than for medicolegal reasons I have rarely found this beneficial for the patient.

Many hospitals today require certain minimum laboratory tests on every admitted patient. Other tests may be performed as indicated by the results of physical examination or as recommended by the patient's internist.

A careful medical history is obtained, and a physical examination is performed on admission. This may be performed by house staff personnel, the patient's internist, or both.

PREOPERATIVE OCULAR EXAMINATION

Visual acuity

Visual acuity should be determined for both near and far distance. One should attempt to estimate the degree of visual impairment caused by the lens opacity. Occasionally a patient will have what appears to be a small opacity, but the vision may be reduced to low levels. However, using a direct ophthalmoscope or a Hruby lens, the examiner may observe badly distorted fundus details. This is seen in patients with nuclear sclerosis with a disorganized nucleus and with posterior subcapsular cataracts. If an indirect ophthalmoscope with its greater light intensity is used, this important finding may be missed completely, and the patient may be denied cataract surgery because the media appeared too clear to reduce vision severely. Retinoscopy is also useful in evaluating the media.

The surgeon should suspect the added factor of macular dysfunction if in the presence of nuclear sclerosis near vision is diminished more than far vision, since the opposite is the rule. Axial opacities cause greater impairment of near than of far vision, and they also cause greater disturbance in bright illumination than in dim light. In this regard, one does not properly estimate the patient's disability if the examination is performed in relative darkness. A simple technique is to flash a penlight into the patient's eye while he reads the

vision chart. If the patient has difficulty making out the larger letters, he will have a serious visual handicap outdoors. As mentioned previously, 20/30 visual acuity may be reduced to finger counting in a patient with an axial cataract whose eye is illuminated by a light or in the sun.

These examples emphasize that the surgeon should not be influenced by a number for visual acuity. An acuity of 20/80 for one patient may represent a level of impairment entirely different from that of 20/80 for another patient.

Occasionally the patient will volunteer the statement that the eye under consideration for surgery was always a poor eye. If the cataract does not appear dense enough to reduce vision to the low level found, macular degeneration, optic nerve disease, or amblyopia may be present. There are two useful tests that can be applied. Place a variable-density or a light-polarizing filter (Polaroid) before the eye being tested. If the eye is amblyopic, little or no reduction in visual acuity will be found. If macular degeneration is present, a sharp reduction in acuity occurs. Additional information may be obtained by performing what amounts to a modified photostress test. If the patient's vision is markedly depressed after indirect ophthalmoscopy with use of at least 6 volts of illumination and if it requires an inordinately long time to recover, a maculopathy may be suspected. Amblyopia may be suspected if strabismus is present or if a past history of strabismus is reported. It may also be anticipated if the glasses worn by the patient show considerably more hypermetropic or astigmatic correction in the eye being considered for surgery.

For further testing for amblyopia, two additional techniques are available. If the lens opacity is not too dense and the macular reflex can be observed by the examiner, the fixation pattern can be tested with a visuscope. If the macula cannot be seen clearly, the afterimage transfer test may be used.[1] If the "transferred" afterimage runs vertically through the dot, fixation in the tested eye is centric. If it consistently falls either to the left or right of the dot, fixation is eccentric. Occasionally in cases of deep suppression a contralateral awareness of the afterimage will not be appreciated, and the second eye will not report an afterimage. In this case the test is of no value.

The Haidinger brush test may also provide information concerning the macula if the cataract is not too dense. Since many patients with normal maculas do not appreciate Haidinger's brushes, a negative response is difficult to interpret. However, a positive response is a very favorable sign.

Visual fields

With a cataract of little or moderate density, a careful and accurate visual field examination is possible. Less sophisticated methods must be used when cataracts reduce visual acuity to a range from 20/200 to light perception. The Amsler grid is useful in detecting a central scotoma or metamorphopsia except when vision is diminished to a very low level. Peripheral fields may be tested by the finger counting method or the technique of Kestenbaum.[2] Unless the cataract is very dense the patient should be able to count fingers held 1 foot from the eye at an angle of 45 degrees to the fixation target (examiner's nose or face). Tests used when acuity is reduced to hand movements or light perception are described subsequently.

Intraocular pressure

It is probably superfluous to emphasize the necessity to check the intraocular pressure of the eye, preferably by applantation, before cataract surgery. Glaucoma secondary to an intumescent lens, a phacolytic process, a subluxated lens, uveitis, a hemolytic process, or progressive narrowing of the angle of the anterior chamber will alter the technique of surgery.

Gonioscopy

If the intraocular pressure is elevated, the angle should be visualized. Chronic and subacute narrow-angle glaucoma can be effectively treated by removing the cataract and performing a sector or peripheral iridectomy. The ingenuity of the surgeon is tested when the pressure is above normal in the presence of an open angle or a traumatically recessed angle. This is discussed on p. 231.

Slit lamp examination

The health of the cornea should be estimated. The presence of an endothelial dystrophy of the Fuchs type influences the prognosis and also the choice of surgery (p. 338). There is no sure way of

distinguishing cases of cornea guttata that remain unchanged indefinitely from those that are merely a prelude to a full-blown Fuchs' dystrophy.

The presence of keratitic precipitates or an active iridocyclitis may be detected. Posterior synechiae and their location should be noted. The presence of a tremulous iris points to subluxation or dislocation of the lens. The iris should be examined for rubeosis, which might indicate a central vein thrombosis concealed by the cataract. The type of cataract and the condition of the capsule can best be evaluated by slit lamp examination.

It is often possible to determine the health of the vitreous. Extensive liquefaction or cellular infiltration is often caused by a posterior uveitis.

Examination of the pupils

If the pupil reacts sluggishly to light on direct stimulation but briskly on indirect stimulation (Marcus Gunn pupil), the prognosis for restoration of central vision is extremely questionable.

The ability of the pupil to dilate adequately should be estimated before surgery. If the pupil demonstrates senile rigidity or fails to dilate adequately because of long-term miotic therapy, a sector iridectomy and marginal sphincterotomies, or both, should be considered. A soft cataract can easily be molded through a small pupil, but attempts to deliver an intumescent lens through an inadequate pupillary opening are fraught with danger of capsular rupture and loss of vitreous.

Fundus examination

Unless the cataract is almost mature, a reasonably adequate fundus examination is usually possible. Developmental anomalies such as coloboma, inflammatory changes, degenerative lesions, and other abnormalities should be noted so that a reasonable preoperative visual prognosis may be offered. The indirect ophthalmoscope with its intense illumination system is invaluable in this regard.

EVALUATION OF THE EYE WITH AN ADVANCED OR MATURE CATARACT

The attempt of the ophthalmologist to predict the visual potential of the eye with a mature cataract is no simple task. Normally, if the eye accurately projects light and can perceive colors, the prognosis for visual improvement is excellent. However, a pathologic condition that prevents the eye from achieving excellent central vision may exist. Unanticipated macular degeneration or partial optic atrophy, for example, may be found after the cataract is removed.

The following information is helpful in estimating the visual potential of the eye with a mature cataract.

History

There is no more valuable information than an accurate report of an examination performed previously by another ophthalmologist. If an ophthalmologist examined the eye in the early stage of the cataract, valuable information regarding the fundus will be available. In the absence of such an examination the patient may be able to supply useful data concerning the vision of the eye before the cataract developed. He may state that the eye turned early in life and never saw well or that the eye was always very nearsighted. However, one should not write off an eye, since this information might merely indicate that a corrective lens or a stronger lens was required for this eye than for the "good" eye.

Light perception

If the eye has no light perception, one may safely assume that a favorable prognosis for visual improvement is nil.

Light projection

The ability to accurately project light is encouraging. It usually informs us that a large retinal detachment or an absolute visual field defect is not present. The test, however, tells us nothing about the condition of the macula.

Two-light discrimination

The ability to distinguish two lights close together is a good sign and informs us a little more about retinal function. The test is best performed with two transilluminator bulbs of equal intensity.

Color perception

If the patient can accurately report colors, it usually indicates that some macular function is

present and that the optic nerve is relatively normal. If the patient cannot perceive colors, the prognosis is poor but not necessarily hopeless. Glaucomatous excavation of the disc, macular degeneration, and a vitreous hemorrhage may cause faulty color perception. One should not depend on normal color perception to indicate a normal macula. It is seldom that a patient with macular degeneration cannot pass the color test.

The possibility of congenitally deficient color perception must be considered. In such a case, the opposite eye will also be affected.

Entoptic visualization

The entoptic visualization test for estimation of visual potential was described originally by Eber[3] in 1922 and by Friedman[4] in 1931. The light of a transilluminator is pressed against the sclera through the skin of the eyelid while the eye remains closed. The light is gently moved to and fro. An alternate, and perhaps better, method is to have the patient cover the eye not being tested with his hand. He is asked to rotate his eyes so as to expose the temporal portion of the globe of the eye being tested. This eye is left open. The light bulb of the transilluminator is moved up and down close to the globe over the area of insertion of the lateral rectus muscle. The patient is asked to report what he sees. His response should be the equivalent of a pattern similar to the veins of a leaf. The ability to detect this image provides a favorable impression of retinal function. The claim that the patient will be able to detect a patch of choroiditis, his own retinal detachment, or a macular degeneration has proved, in my experience at least, to be somewhat overenthusiastic. However, the test is a good one, is easy to perform, and provides some important information about retinal function. Absence of the pattern is significant only if it is present in the fellow seeing eye.

Maddox rod test

Another reliable test similar in its purpose to light projection is the Maddox rod test. The patient is asked to fixate the light of a transilluminator head at a distance of ⅓ of a meter through a Maddox rod in a trial frame or a hand-held Maddox rod with the opposite eye occluded. If he can perceive a vertical and horizontal bar of light, it indicates good retinal function. A break or distortion in the center of the bar of light may indicate a macular lesion. The test is somewhat more meaningful if it is performed with a red Maddox rod, since it tells us something about color perception. The Maddox rod should also be rotated so the various oblique meridians can be tested. I have found this to be one of the most useful of all tests for retinal function in any eye with an advanced cataract. Occasionally this test may fail in an eye with a totally opaque lens. The patient may report the line to be a string of beads or some equivalent of this. I am aware of a recent case in which the examiner only tested the vertical meridian and after removal of the cataract found a nasal retinal detachment with a large dialysis. Testing various meridians may reveal a retinal detachment or a glaucomatous field defect. The examiner should become very familiar with this test because ability to interpret the response of the patient will improve with experience. I use it on every patient before cataract extraction.

Afterimage transfer test

The afterimage transfer test has been mentioned previously and sometimes is possible in the presence of a mature cataract. But it is less useful for a patient with a mature cataract because it is often too complicated. The contralateral awareness of an afterimage gives some indication of retinal and optic nerve function. Its main use is to test the fixation pattern of the macula in amblyopic eyes. An eccentric transfer of the afterimage indicates that eccentric fixation exists in the amblyopic eye. It tells us little about the condition of the macula, since patients with macular degeneration show centric transfers.

Pupillary response to light

A vital test in a patient with a mature cataract is pupillary response to light. A brisk response to direct light and a similar pupillary reaction in the opposite eye indicate good optic nerve function. A positive Marcus Gunn pupillary response greatly dims the outlook for visual restoration.

Ultrasonography

The use of ultrasonography is becoming widespread and has a unique application in the preoperative examination of an eye with a mature cat-

Fig. 1-1. B-scan ultrasonogram demonstrating presence of retinal detachment in eye with mature cataract. (Courtesy of Dr. E. Fineberg.)

aract. In concert with the tests just described, retinal detachment may be diagnosed (Fig. 1-1) as well as other pathologic conditions such as hemorrhage or a tumor within the eye. This method has become increasingly useful. I generally reserve it for patients with a very opaque lens in whom the responses to the previously described tests are questionable.

Electrophysiology

As utilized in most institutions, electrophysiology refers primarily to the electroretinogram (ERG) and the electro-oculogram (EOG). Both these techniques operate on the general principle of alteration of the electrical potential of the eye by illumination of the retina. Dense cataracts are therefore difficult to quantitate electrophysiologically because of the light filtering and scattering effects of the cataract.

The focal ERG has been evaluated in testing macular function. However, the stray light problem from the light-scattering effect of a cataract would militate against the use of this test in cataract cases. The ERG is usually absent in total retinal detachment. The classic use of the ERG is in hereditary degenerative retinal disease, with retinitis pigmentosa[5] being the prototype. However, the clinician must obtain a history of night blindness or a family history to think of performing an ERG in these cases. Trauma should lead the clinician to order an ERG because of the possibility of detecting a retinal detachment or siderosis bulbi.[6]

The EOG is probably generated by the retinal pigment epithelium in conjunction with the photoreceptors.[7] The EOG light rise is probably generated at the biopolar cell layer. The EOG would be of less value than the ERG because good visual function for good fixation in the contralateral eye is necessary to accurately perform the test. In addition the light absorbance of the cataract is unpredictable and would interfere somewhat with the test. The EOG could be useful in those hereditary degenerative diseases that have a rather specific effect on the retinal pigment epithelium. The best examples in this group are Best's vitelliform macular degeneration, fundus flavimaculatus, the progressive form of retinitis punctata albescens, and extensive drusenosis.[8] However, the clinician would require a family history to suspect the diagnosis unless the EOG was used as a screening test.

Thus if used intelligently, electrophysiologic testing can add objectivity and increased accuracy in the diagnosis of disorders of retinal function in the face of a dense cataract.

PREPARATION OF THE PATIENT FOR SURGERY

There is no place in medicine where expertise in the art of medicine is more important than in the management of the patient who requires ocular surgery. The preparation of the patient for cataract surgery is nearly as important as the operation itself. It is significant that some ophthalmologists appear to harvest the crop of good patients, whereas others inherit the bad actors. Although there is a wide variance in behavior patterns among patients, it is generally the surgeon who makes the good actor. The introspective physician who is quick to recognize the emotional strengths and weaknesses of the patient on the initial office visit is generally most effective in clearing the barriers to a successful conclusion of the case. However, it is admitted that surgeons vary widely in their abilities to effectively combat the emotional obstacles in their patients.

The surgeon usually has a head start in the initial office visit. The patient has chosen the surgeon because of reputation in the community, because of the surgeon's management of friends or others in his family, or because of the recommendation of his personal physician. It is up to the surgeon to justify this initial confidence. Note how often a patient will speak glowingly of a physician saying, "My doctor takes the time to explain things," or simply, "My doctor talks to you." They rarely say, "My doctor eases my anxieties," but this is what they mean.

The surgeon, in preparing the patient for a cataract operation, must impart the impression that it is a team effort with the surgeon and the patient as the principal players but with the surgeon as the ultracompetent head coach. There is ample justification for minimizing the ordeal of surgery, although forthrightness in discussing the visual potential of the eye after surgery is mandatory. This is the basis of informed consent. This subject has become very complex in recent years. Unfortunately, most cases of legal litigation following a poor surgical result focus on improper informed consent. Therefore the surgeon must make an effort to properly inform the patient about possible complications in language understandable by the patient. This is done for two reasons: one, for the benefit of the patient so that he is placed in a position to make as intelligent a decision as possible in deciding whether he consents to have the surgery performed, and the other, for medicolegal reasons, so that a jury will agree that the surgeon has made a sincere effort to adequately inform the patient. It is a pity that there are no exact guidelines for proper informed consent. Many forms are available. They must be simple, in the language of the nonphysician, and not too long. There are also commercially available documents that include diagrams. These are signed by the patient and, preferable, the spouse or nearest of kin. I am in favor of a universal informed consent form composed by a joint committee of ophthalmologists and attorneys that can be used in all communities. I hope such a form will be forthcoming.

I personally find it rewarding to compliment the patient frequently on his behavior and cooperation. He will usually respond by saying, "Every doctor tells me that." He will then make a special effort to maintain this reputation. It is surprising how often the patient who appears frightened beyond description about the impending surgery turns out to be a model of cooperation during the operation. I regard with suspicion the actor who shrugs off everything and appears to whistle in the dark. He is less predictable.

Surgeons must never lose sight of the fact that they are dealing with the patient as a whole and not with just a particular ailment. Most elderly patients will accept the fact of the cataract as another sign of the aging process. However, the reaction in younger patients is often quite different. They may consider it a sign of premature deterioration in all parts of the body, or may merely react bitterly to its appearance. The surgeon can help by explaining that the premature development of a cataract is not much different from premature graying of hair and that one would not consider a person unhealthy who has gray hair in his twenties. I find it useful to state that there are no blood vessels in the human lens and therefore the cataract is not associated with any breakdown of the cardiovascular system. The