Fasanella Modern Advances in Cataract Sur

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MODERN ADVANCES IN CATARACT SURGERY

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This book is dedicated not to a single individual
but to all those persons who have made it possible.

It is dedicated to my patients, especially one, A.B.;
it is dedicated to my teachers, especially E.B.S. and E.M.A.;
it is dedicated to my staff, especially B.J.M.
and to my family, especially P.

Preface

In the last few years certain changes have taken place in surgery of the cataract. Drugs like alpha-chymotrypsin to cause zonulolysis and urea and mannitol in treating cases complicated by glaucoma have proved to be valuable assets in the successful outcome of procedures related to cataract extraction. Nystatin and amphotericin B* have played an increasingly useful role in cases with fungal disease. New instruments such as the light coagulator and the operating microscope have been designed to facilitate the technic of cataract surgery. New sutures and needles have been introduced which ensure easier and better wound closures. The practice of removing both cataracts in a patient during one hospital admission is not new and is gaining popularity in certain areas of the United States, although generally it is not favored.

Nevertheless, while these new trends have removed some problems formerly presented in cataract surgery, they are not foolproof. Constant re-evaluation is needed to avoid the pitfalls which will be met in all advances. For example, if alpha-chymotrypsin is improperly used, it may lead to complications such as wound separation; likewise, the light coagulator can cause damage to the cornea and the retina if it is handled improperly.

* Nystatin and amphotericin B as antifungoidal agents in ocular infection.

This book is meant to be practical and is written for the practicing ophthalmic surgeon. Because the literature is so voluminous and because critical evaluation is necessary in view of overzealous statements, an attempt has been made to interpret for the busy practitioner the various authoritative views which are justifiable in the present state of our knowledge. Based on practical experience an attempt also has been made to delineate the various steps that should be taken in cataract surgery. Not all of the old procedures have been abandoned or replaced. There is still room for the employment of such procedures in certain specific conditions. But in almost every case, the material is based on questions that have actually been asked at lectures and meetings. These have been regrouped to fit the sequence of cataract surgery steps. In addition, some problems for which there are no definitive solutions at this time have been included. Also included are articles by Phinizy Calhoun, Joaquin Barraquer, Benedetto Strampelli and Wolfgang Höpping and G. Meyer-Schwickerath. Also introduced is the work of T. Krwawicz, who, by his method of extracting intumescent lenses by the application of low temperature, offers a new approach which may make possible a greater number of intracapsular extractions.

The compiling of this book has been made possible by the work of many people in this field and by those with whom we have exchanged ideas. It is almost impossible to list all of them but we fully realize that any value that this book may have rests on the fact that we have been associated with these people.

R. M. FASANELLA

Acknowledgments

A surgeon turned writer cannot be objective enough to detect his own faults and, as is customary, must rely on his friends to read his material with a critical eye. I owe a debt of thanks to my busy colleagues who sacrificed their time to review portions of this book. Grateful acknowledgment is hereby made to Dr. H. Saul Sugar for his help with Glaucoma and Cataracts; to Dr. Frederick C. Cordes for his generous assistance with Congenital Cataracts; to Dr. Wilfred Fry who was kind enough to review Corneal Dystrophy and Cataracts; to Dr. Morton Rosenthal for his assistance with Myopia and Detachment; and to Dr. Louis Nahum who was of great help editorially.

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I have been fortunate in having the services of the well-known illustrator, Mr. Robert Bray Wingate, A.B., M.S., who has had extensive experience in ophthalmic art at the Ocular Research Unit of Walter Reed General Hospital, Washington, D. C.

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R. M. F.

Introduction—The Use of Alpha-Chymotrypsin

A milestone in cataract surgery was the report of the Committee on the Use of alpha-Chymotrypsin which was presented at the 64th Annual Session of the American Academy of Ophthalmology and Otolaryngology, October 11-16, 1959, in Chicago. Here a national survey on the facility of cataract extraction and on operative and immediate postoperative complications with the use of the enzyme is best summarized in the introduction and summary by Derrick Vail, M.D., the Chairman of the Committee.*

We have heard from Dr. Schwartz that this enzyme isolated by Kunitz and Northrop has been available since 1933. It is a protein and thus is capable of producing an allergic reaction in the eye in sensitized individuals. Clinically, however, this seems to be more of a theoretical than a practical consideration, although such a possibility must be borne in mind and cases of allergic reactions following systemic use have been reported. Alpha-chymotrypsin is a proteolytic enzyme, having a specificity of action at certain peptide bonds, but it is capable of hydrolyzing other bonds such as esters, amides, hydroxyamides, hydrazides, and even carbon-carbon bonds. The optimum pH for maximum velocity of hydrolysis of protein and synthetic substrates by alpha-chymotrypsin is usually between 7 and 9.

Certain enhancers and inhibitors of the enzyme have been discovered. Among the enhancers is calcium chloride, sometimes used in the vehicle for ophthalmic use. It should be borne in mind that while calcium chloride may enhance the effect of the enzyme, it also may prolong its activity. Further investigation of this point must be carried out.

Among the inhibitors are DFP and beta-phenyl-proprionic acid. What, if any, practical use will develop from this information is hard to see at this stage of our knowledge.

Dr. von Sallmann helped us very much when he reported that he was unable to produce an allergic reaction in animals experimentally sensitized to this enzyme by installation or by injection subconjunctivally, or in the anterior chamber, or in the vitreous. This evidence supports wide clinical impressions.

His studies on the effect of this substance on the corneal endothelium are of great importance to us. His illustrations show these effects beautifully. However, we are told that the injection of a 0.9 per cent solution of sodium chloride by itself will produce the same type of injury, although to a lesser degree. In other words the addition of alpha-chymotrypsin is a slight increment in potential damage to the endothelial cells. This is important in considering the question of the cause of striate keratitis, which is found more frequently when alpha-chymotrypsin is used than otherwise.

However, when the enzyme reaches into the corneal stroma through extensively damaged endothelium, a heavy opacity results. Such opacities also occur with a 0.9 per cent solution of sodium chloride. The corneal changes are of a transient nature as a rule, and Dr. von Sallmann concludes that it was

* Vail, Derrick: Report of the Committee on the Use of alpha-Chymotrypsin in Ophthalmology, Summary, Trans. Am. Acad. Ophthal. Otolaryng. *64*:54, 1960.

improbable that a specific enzymatic action was the cause of the lesion. Using a different technic, which may or may not be a factor, David Shoch and his co-workers found no evidence of endothelial damage in the eyes of twenty-four rabbits. This discrepancy in the findings needs to be resolved.

Finally, Dr. von Sallmann confirms the histologic findings of the St. Louis workers, Ley, Holmberg and Yamashita, who showed by electromicroscopic studies that the zonule fibers are fragmented by the action of the enzyme.

Dr. Maumenee gives us a horrifying picture of what happens when the retina is placed in a solution containing 150 units of alpha-chymotrypsin. However, this concentration and the duration of exposure exceed, by far, the same factors when alpha-chymotrypsin is employed in cataract surgery.

Maumenee's report shows that the supporting structure of the retina is more sensitive to the enzyme than is the rest of the retinal tissue. This damage occurs when alpha-chymotrypsin is injected into the vitreous of an experimental animal. This may have some clinical importance in suggesting that the enzyme should not be used in cases of fluid vitreous or subluxated lens, or where the hyaloid membrane is not intact.

Dr. Troutman's report involved an enormous amount of analytic work on the questionnaires and is still somewhat incomplete. However, enough facts have been gathered to warrant the following conclusions:

1. The incidence of striate keratitis is greater when the enzyme is employed. We believe that this is due largely to mechanical injury to the endothelium by instruments, either forceps or erisophake (about equal incidence). The marked decrease in the depth of the anterior chamber consequent to the forward dislocation of the lens means much less room for manipulation and a greater chance for rubbing or scraping of the endothelium of the cornea than otherwise. The deleterious action of a solution, either of saline solution or alpha-chymotrypsin, upon the corneal endothelium must be considered a part of this problem. The preparation of the solution and the vehicle used may also play a part. As yet we don't know.

2. A 1:10,000 dilution is as effective as a 1:5000 dilution. This finding conflicts with the experience of Barraquer and needs further investigation.

3. Great care must be devoted to the preparation of a fresh solution, the technic and instrumentation of its injection into the posterior chamber, and its removal by irrigation of the anterior chamber two minutes after injection.

4. A very high percentage of surgeons "felt" that the facility of extracting the lens was enhanced by use of the enzyme. This clinical impression was beautifully supported by the double blind study conducted by Dr. Schwartz.

5. One of the most important findings of this statistical study is the marked decrease in the number of ruptured capsules that occurred when the enzyme was employed in the operation on one eye, when compared with the incidence of ruptured capsules that occurred in the other eye of the same individuals when the enzyme was not used. In other words, the use of the enzyme means fewer ruptured capsules.

6. While we cannot be sure, because of the difficulty in getting figures in a comparable control series, we believe that the complications that occur during the operation or during the healing postoperative stage are no greater or no less whether the enzyme is used or not. The one and major exception to this statement is the finding that 0.2 per cent of the total cases had posterior luxation of the lens, a most serious complication, although known to occur rarely in cases in which the enzyme was not used. The figures Dr. Troutman has given us regarding the presentation of vitreous and the actual loss of vitreous seem high, and they probably are, but we do not know what the percentages would be in an up-to-date comparable control series. Theoretically, at any rate, we should expect a higher percentage of loss of vitreous when the enzyme is used, considering that we are dealing with a dislocated lens.

7. Is the incidence of absent or shallow chambers greater when the enzyme is used? This was a difficult question to answer. Much depends on the technic of the operation, i.e., type of incision, whether multiple sutures were used, and so on. Our figures do show an increase of such cases, especially in the

lower age group. Reports in the literature on the use of alpha-chymotrypsin indicate that the wound healing is not retarded, and catgut sutures do not dissolve. More facts are needed.

8. Barraquer and others have mentioned the occasional case in which edema of the conjunctival flap has occurred. Our studies give us no information on this point. Barraquer believes that this is due to (a) incision too far in the cornea and (b) lack of proper wound closure.

9. It is possible that the round pupil operation has fewer complications than result from complete iridectomy. More study along this line is needed.

10. This report cannot tell us anything of the late effects of the use of alpha-chymotrypsin; the time is too short. A further report on this series a year or so from now should be made. We know from Dr. Maumenee's experimental studies that the retina can be damaged by the enzyme when it is injected into the vitreous. We don't know whether the pars ciliaris retinae is injured under the conditions of cataract surgery by seepage of the enzyme into Petit's canal. If it is, a higher incidence of aphakic retinal detachment might be expected. If it isn't, a lower incidence might occur, because the mechanical pull of the zonular fibers is abolished during the operation.

11. Modifications of our present technic and new instrumentation devised to assist us in the removal of the lens in view of the altered conditions because of zonulolysis will undoubtedly occur.

On the basis of the information obtained from this and a partial survey of the growing literature, your Committee recommends that alpha-chymotrypsin should not be used in the surgery of the lens in the following conditions:

1. Cases in which the patient is under twenty years of age.
2. Cases of endothelial dystrophy.
3. Cases of subluxated lenses.
4. Cases of traumatic cataract, especially when vitreous is presented.

Finally, we beg you to remain conservative in your actions regarding the use of zonulolysis until we know much more about it. . . .

With the passage of time, the initial wave of enthusiasm and the hope that this drug might help cataract surgery in all age groups have proved to be overly optimistic, but new vistas in intraocular surgery have been opened up. There are, of course, problems and obstacles ahead, but it has been said that the "impossible takes just a little longer." Fortunately, to explore that small sphere called the eye, there are pioneers such as Ridley, Meyer-Schwickerath and Barraquer.

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