

is maintained. A single or double layer of moist bichlorid gauze is then placed over the eye and the screen adjusted. After six hours we have a right to presume that union is well established, so at this juncture the gauze is removed and the screen readjusted.

I allow my patients to sit up throughout their convalescence; the recumbent posture is conducive to a state of nervous restlessness, to say nothing of more aggravated symptoms, all of which concur to interfere with uneventful healing. These patients are more submissive and quiet when they are permitted to sit in a comfortable chair; however, they are forbidden to walk unguarded around the room for the first and second days.

This feature in the management of the convalescent stage is especially advantageous in those patients who, in a state of senility, are predisposed to hypostatic congestion of the lungs during rest in recumbent position, or what is equally as frequent, to chronic bronchial catarrh with cough, or to some bladder trouble.

Again, not infrequently we are confronted on the second or third day or later with the onset of iritis or cyclitis. Whether these complications are due to some non-pyogenic bacteria which have entered into the eye during or after the operation or to a chemical irritation, or what is more probable to the iris being encroached on by the jagged edges of the capsule or by some unremoved particles of lens substance, it matters not. As the eye is not a perfect sphere, being longer in its anteroposterior axis than any other, it is impossible for a bandage to be applied, no matter how carefully, so that it will not disturb the relation of the iris with that of the edges of the capsule or with some particles of the lens substance which may have been left, so long as the eye is permitted to move from one position to another. Certainly a mechanical irritation is more liable to set up under the constant disturbance of such relations than while the eye is undisturbed in its position under the natural influence of the lid only. In my experience the unbandaged freedom of the eye has seemed decidedly to hasten recovery and to minimize the complications.

In conclusion, I will relate briefly the history of one case, which will illustrate the treatment and the results which may be obtained by adopting the methods outlined in this paper. The deduction and conclusion at which I have arrived were not based alone on my own cases (except that of allowing the patient the pleasure of sitting up if desired), but on an ample observation while attending Professor Sattler's clinic at Leipsic in 1902; having obtained like results in seventy cases in my own practice subsequently, I have become a staunch advocate of the method here outlined.

A patient, aged 64, was operated on at 10 a. m. January 12. An iridectomy and also a conjunctival flap about 2 mm. in length was made, a double layer of wet bichlorid gauze was placed on the lid and the wire screen applied as shown in the accompanying illustration. At 6 p. m. I removed the dressing, instilled one drop of atropin and readjusted the screen, leaving off the gauze. The patient was put to bed. At 9 a. m. the next day the patient was allowed to sit up in a reclining chair as on the previous afternoon. On the third day the patient was allowed to move about in the room, the fourth day to walk about in the house, the fifth day to return home, seventy-five miles away. After five weeks the patient returned for refraction. Vision = 20/27. In two months vision = 20/25.

It is important to use a drop of atropin when first examining the eye after the operation. Every one who employs a bandage will admit that the early use of atropin is justifiable on account of the frequent occurrence of an iritis, for it is important to obtain a dilated pupil

before redness of the eye takes place, or before any adhesions between the iris and the capsule, which, when set up, is often of from two to four weeks duration. These complications tend to produce an exudation which interferes with good vision, and are aggravated, if not produced, by the constantly disturbed relation of the iris with its adjacent parts during the movement of the eye when bandaged. If the eye is left protected by the lid and screen only, and atropin is used when the patient is first seen after the operation, such complications do not often occur, and if they do are very slight.

OPERATIONS FOR SECONDARY CATARACT.*

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The ideally perfect cataract extraction should consist of a method involving a minimum of risk, without sequelæ demanding subsequent interference to obtain good vision.

The extraction of the opaque lens within its capsule appeals to us all, but the consensus of opinion regards this operation as not safe as a routine method. Most ophthalmic surgeons extract cataracts without the capsule, leaving the latter to cause subsequent operative measures necessary in the majority of cases.

Various capsular forceps have been devised to obviate the formation of secondary cataracts. With the forceps the attempt is made to remove the anterior capsule within the area of the pupil, so as to secure a clear opening after the removal of the opaque lens. I have never been able to satisfy myself that the forceps had rendered subsequent secondary cataracts less numerous than when the cystotome had been used, but this may have been the fault of the operator. The percentage of secondary operations varies with the education and calling of the patients.

Taking the statistics of cataract extractions done in different ophthalmic hospitals for a given year, and the secondary operations done within the same period, it will be found that 50 per cent. require subsequent interference in order to get good vision. The majority of these patients are of the laboring class, who do not need very acute vision, so that if the statistics were gathered from an educated, intelligent class the percentage would be 75 per cent. The most expert operator, no matter how perfect the technic, using capsular forceps and washing out the débris, can not avoid secondary cataracts in the majority of his operations.

Secondary membranes or cataracts may be divided into simple and complicated. The former consists of a thin, diaphanous veil, which, owing to folds or rumpling of the anterior capsule, seriously interferes with good vision. The latter varies in degree from an opaque membrane within the pupillary area to the most dense mass which shuts off all communication between the chambers. The density of the membranes depends on the cortical lens matter left after the extraction, the cellular proliferation of the anterior capsule and the inflammatory deposit due to iritis, etc. In the complicated cases, we must add incarceration, prolapse of the iris and considerable loss of vitreous humor.

A secondary operation should not be performed until the eye has fully recovered from the effects of the cata-

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ract extraction. When the extraction has been performed *secundum artem*, with uneventful healing and no sequelae, a period of six weeks is quite long enough to elapse prior to further interference, when necessary.

Not infrequently conditions are encountered in which the eye does not become perfectly free from inflammation and interference becomes imperative where delay would mean disaster. Dense exudate resulting from protracted iritis, completely occluding the pupil, preventing all communication between the chambers of the eye and extensive incarceration (or prolapse of iris) call for surgical relief. Otherwise the eye goes on to disintegration. Such conditions keep up the inflammatory process and the surgeon is forced to interfere sooner than would ordinarily appear justifiable. Operating under these conditions does not always give a permanent opening, but, even so, the traction on the iris is removed and some communication is secured between the two chambers, so that after complete quiescence does take place some visual power may be obtained by further operative measures.

There are three sources of danger in operating on secondary cataracts, as follows:

1. Infection.
2. Traumatism.
3. Relighting inflammation due to the extraction.

To my mind, the danger of infection is the least formidable of the three, provided the usual necessary aseptic technic is carefully observed.

Traumatism is usually due to the choice of the wrong procedure in securing an opening through the obstructing membrane. The objective point is a clear pupillary opening, and to secure this no method ought to be employed that simply depends on tearing. I firmly believe that most of our disasters following secondary operations are due to traumatism resulting from improper methods. We should never attempt to tear dense or tough obstructing membranes. Always cut them, inasmuch as the tearing means traction on the iris and ciliary processes, with glaucoma, or iridocyclitis, or panophthalmitis, as a result.

The chief danger is due to overhaste in operating before the eye has fully recovered from the effects of the cataract extraction. The eye is in the state of passive congestion and it takes but little to relight an active inflammatory process.

Not infrequently the surgeon is importuned by the patient to operate soon after the cataract extraction—he lives at a distance—he must return to work—he is anxious to see, etc. Further, as time goes on, the secondary membrane often becomes more dense. However, experience teaches us the wisdom of being patient until there is but little chance of reaction following the second operation, provided the correct method is chosen.

Chiselden was the first to make an artificial pupil, about 1728. He introduced a knife needle on the temporal side one and one-half lines from the clear cornea into the posterior chambers, pushed the point through the iris about one line to the outer side of pupil, carried the knife across the anterior chamber to inner angle and cut through iris to the original point of cutting, a sufficient distance to secure an opening. The iris on temporal side was permitted to remain intact up to the point of the knife-needle entrance into anterior chamber. This was done in cases of occluded pupil, following couching operations.

Gendron performed a corneal incision, having ob-

served that a single line cut was not enough for visual purposes.

Baron Wenzel performed, instead of the straight-line incision, a flap, and removed a small piece of iris. To do this he introduced a pair of scissors into the anterior chamber.

Scarpa did an iridodialysis, and removed by cutting or tearing any capsular membrane within the area of the opening.

Professor Maunoir, of Geneva, in 1802, performed the first iridotomy. He used scissors with cutting blades fifteen to eighteen mm. long, one blade probe-pointed, and the other sharp-pointed. The blades were bent forward near the joint 140 degrees. The closed scissors were entered through a corneal opening into the anterior chamber. They were then opened and slightly tilted with the sharp blade below. Then this was pushed through a suitable place in the iris tissue and the cut or cuts made as desired.

Various operators during the last century devised knife needles to operate on secondary membranes.

Bowman's method consists in the use of two needles and does not depend on cutting—it simply tears.

De Wecker, in 1873, devised his pince ciseaux, which is practically Maunoir's idea, only seventy years later.

At present there are three methods generally used in performing secondary cataracts, as follows:

The knife needle, preferably Knapp's, for thin membranes. The narrow Graefe cataract knife for thick bands or dense pupillary deposits.

The forceps scissors for all cases when the knife is likely to cause dangerous traction.

The choice of an operative procedure must be entirely guided by the characteristics of the obstructing membrane. In dealing with a thin, diaphanous membrane—which, owing to wrinkled, crumpled or pleated surface, does not give satisfactory vision—we choose a knife needle and perform a discission. The knife needle must have a slight taper of the shank toward the handle to prevent the escape of aqueous; the cutting edge should have a convex surface six mm. long and not to exceed one mm. in breadth. The pupil ought to be fully dilated and the membrane cut within its area.

Enter the cornea at the upper or outer limbus with the needle and, as T-shaped incisions are to be made, cut the membrane entirely across its upper third. Then carry the needle down to the lowest margin of the pupil and cut upward to the center of the first incision. Two cuts are made—the first in the horizontal, the second in the vertical plane. If a conical form of opening is preferred the two incisions make a right angle at the center of the proposed pupil.

Frequently a tough or resilient band prevents either one of these discissions in the manner indicated. No attempt should be made to cut these obstructing bands with the knife needle, for they do not cut without exerting a dangerous amount of force on the iris and ciliary processes. Make the incisions in the point of the thin, clear membrane giving the largest clear surface.

It has been my fortune to have seen five cases where these tough, resilient bands caused glaucoma. Four of these cases were in my own practice. On two of them I had operated for cataracts and performed secondary operations and avoided cutting the tough bands. The first case became blind from glaucoma at the end of the second year following the last operation. The second had good sight for four and a half years, when she returned with a subacute attack of glaucoma, which lasted two

months. A free division of the band saved some sight. The third case was a needling of the right lens done in Russia to enable the young man to escape military duty. I saw him eighteen months after the needling and, as he did not wish to have any operation performed, nothing was done until two years later, when I found the eye blind T + 2—simple glaucoma. The fourth case was that of a young boy with a traumatic cataract, where four years after the injury the lens had absorbed and an attack of acute glaucoma set in. Another ophthalmic surgeon made an iridectomy upward, but this did not stop the process until I cut freely a tough, broad band that was exposed by the upward iridectomy. The fifth was Dr. Dwight Hunter's case, in which some months following a successful cataract operation the patient returned to the doctor with an acute attack of glaucoma, which rapidly disappeared after a broad band, which was stretched across the pupil, was severed by Dr. Hunter.

The full extent of the thickened capsular bands is very difficult to determine. Owing to iritic adhesions, full mydriasis is not possible. In none of these cases, however, was there either incarceration or prolapse of capsule, lens or iris, as far as I could see.

Looking this matter up I find that Priestley Smith has referred to a case in which a band from corneal cicatrix to ciliary processes caused glaucoma.

In my first two cases of glaucoma caused by capsular bands I failed to recognize the connection, but within a very short interval the third case presented in which an iridectomy had been made without benefit. The iridectomy showed a broad capsular band indicating evident tension, but in cutting this the severed ends immediately sprang apart. In other words, the conclusion was forced on me by the third case that the overlooked, apparently trivial, thickened capsule was the cause. How many of my previous cases of glaucoma were similarly caused I can not tell.

Bowman's method of operating on dense capsular membranes consisted in the use of two needles. The cornea is penetrated in the vertical or horizontal plane at the outer and inner third of its diameter. The point of each needle is gently pushed through the center of the proposed opening in the capsular mass. Then the handle of each needle is elevated and slowly approximated, splitting the thickened membrane. The immediate result is a vertical or horizontal opening through the secondary cataract, which subsequently is apt to become small. This operation by many authors is considered quite safe. They base their approval on the fact that by the use of the two needles the traction on the iris and ciliary processes is removed. This I deny, inasmuch as the operation is essentially a tear with the pull in the line of cleavage. The tougher the membrane the greater the pull on the iris, etc., exerted at right angles to the movement of the plane of the needles. In other words, to split the secondary cataract as the needle's points are separated, the opening is made at the expense of traction in the line of cleavage on the ciliary processes.

There is another method of operating on these dense secondary cataracts which is advocated at the present time by a number of able ophthalmic surgeons.

The cornea is penetrated near the limbus with a thin Graefe cataract knife, the cutting edge of which is directed to the iris and carried across the anterior chamber to the nasal side. The knife point is pushed through the iris into the vitreous humor and the iris and secondary

membrane are cut toward the temporal side. In cutting an opening the knife handle must be elevated and the back of the blade is held in close contact with the cornea opening, which is to act as a fulcrum and prevent the escape of aqueous. The movement is of two kinds—either a sawing motion going more or less deeply into the vitreous, or a drawing of the cutting edge against the membrane. The thick dense membrane requires a sawing motion to cut an opening.

When there is a dilated pupil the iris is not cut, or in severing tough resilient bands across an otherwise gauze-like membrane the cutting is entirely confined to the secondary cataract. In many instances the pupil is too small and bound down, so that it is necessary to include the iris in the section, otherwise the opening will be too small. In performing this operation only one incision can be made at a sitting, and in case that cut does not retract its opening will not suffice and a second attempt must be made at some future time. The second incisions must be placed at right angles to the first in order to obtain a sufficient aperture. This operation is not entirely free from danger, due to the traction in cutting through the tough membrane.

Bearing in mind that all traction is to be avoided in cutting through secondary membranes, I know of no method quite so satisfactory in complicated cases as an iridotomy done with the forceps scissors. For the correct performance of this operation two instruments are essential—a narrow, bent keratome (Agnew's) and a forceps scissors. With the keratome an opening is made through the cornea and secondary cataract. The location of the corneal opening depends in the main on the iris. With a mobile intact iris it is necessary to make the corneal incisions 3 to 4 mm. from the limbus. This is especially the case in the young, as the iris quickly contracts after the withdrawal of the keratome and the loss of aqueous humor.

If an iridectomy was done at the time of the extraction the corneal opening may be placed at the limbus. In other words, the corneal opening should be so placed that after the scissors have passed through it into the anterior chamber they may be freely used without the heel of the scissors unnecessarily wounding the iris.

In operating with the scissors when there is a band or bands covering an otherwise gauze-like membrane dilate the pupils ad maximum. Cut the cornea with bent keratome 4 mm. from limbus, carrying the point through the thin secondary membrane 15 degrees below corneal section into vitreous humor. Move the point from side to side so as to enlarge the opening in membrane. Withdraw keratome and insert closed scissors into anterior chambers. Slightly tilt the blades and insert one behind the band or bands to be severed, and the scissors should be carried down to the lowest margin of the proposed pupil. The incisions do not include any iris tissue, but are confined to the secondary cataract within the area of the dilated pupil. It is well to bear in mind that the more extensive the incisions are made the greater the central aperture, which should be V-shaped. In case we have to deal with secondary cataracts complicated with extensive iritic adhesions where the pupil is contracted or occluded the iris tissue must be included in the incisions, otherwise there will not be secured an adequate opening for visual purposes. Place the corneal opening at upper limbus, incise iris as near the corneal incision as possible for free working of the forceps scissors within the anterior chamber. The iris opening should be enlarged laterally 5 mm., either by

keratome or scissors. Then with forceps scissors cut downward from middle of iris opening until the lowest border of sphincter is included. It is usually necessary to include the sphincter below the incision, otherwise the V-shaped opening is not large enough to serve as a permanent pupil.

In dealing with incarcerations or prolapse of iris the lateral incisions must be made with the forceps scissors and carried to inner and outer angles so as to free the iris from all traction. The downward vertical cut must be carried far enough through the sphincter and iris tissue to place the opening in normal position of pupil.

CONCLUSIONS.

Secondary membranes, consisting of capsule, gauze-like in texture, readily yield to a dissection performed with the knife needle under artificial illumination.

Thin secondary membranes, consisting of one or more bands, require different handling. Simply avoiding these bands in performing a dissection with the knife needle is a conservative course that gives a good visual result, followed, however, in some cases by subsequent disaster, due to the traction of the bands on ciliary processes.

Tough resilient bands can be disposed of successfully by the expert use of the thin Graefe knife in one operation by cutting at a right angle to their long axes. Thick, dense secondary membranes within the area of a fairly large pupil can be disposed of by the use of a Graefe knife in two operations, although I do not consider this the best course to pursue.

Bowman's two-needle operation for similar conditions, viz., dense, opaque membranes, covering a fairly large operation field, is mentioned merely to deprecate its use. The essential features of the method depends on tearing the dense membranes.

Judging by my experience in handling all forms of secondary cataracts, other than the thin diaphanous membranes, the forceps scissors affords the safest and most reliable of all instruments. By a judicious use of the De Wecker scissors the toughest membrane can be cut without any traction either on iris tissue or ciliary processes. In all complicated forms of secondary cataracts, occluded pupil, incarceration or prolapse of iris, it is the only instrument of which a proper use combines a minimum of risk with a maximum of benefit.

Do not tear secondary cataracts. Always cut them.

Disasters following secondary operations are in the main due to tearing methods in operating. The least danger is from infection.

[THE DISCUSSION ON THE SYMPOSIUM ON CATARACT APPEARS IN THIS ISSUE UNDER SECTION DISCUSSIONS.]

Hawaiian Fever.—According to Chief Quarantine Officer Cofer, malaria and Hawaiian fever are not one and the same disease. Indeed, Cofer states positively that malaria is never present in the Sandwich Islands unless imported, and he also asserts that the *Anopheles* mosquitoes have not been found there. Hawaiian fever is probably, he says, the result of heat, moisture and decaying vegetation. Its pathology is unknown. The onset is sudden with malaise and chill, followed by fever of a remittent type, the temperature ranging from 101 F. to 104 F. The spleen is enlarged and the liver engorged, and occasionally there is icterus. Headache, backache and constipation are accompaniments. Dr. George Herbert reports that in the treatment of this condition quinin is of no value, but the salicylates are of use. Removal from the location, such as going to sea, relieves all the symptoms in less than twelve hours. Dr. W. D. Baldwin believes Hawaiian fever is a mild typhoid or febricula.

THE PHYSIOLOGIC ACTION, ELIMINATION AND THERAPEUTIC APPLICATION OF SODIUM CACODYLATE, USED HYPODERMATICALLY.*

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According to Burlureaux,¹ the credit of the introduction of sodium cacodylate as a therapeutic agent belongs to Gautier, who on June 6, 1899, reported a series of observations in which he (Burlureaux) assisted. During the succeeding four years numberless enthusiastic, not to say extravagant, articles by European observers heralded the drug as a desirable substitute for metallic arsenic. On Jan. 31, 1903, however, T. R. Fraser² gave the drug, so far as English and American clinicians and authors are concerned, its *coup de grâce*, for, with but one or two exceptions, all English and American textbooks on materia medica deny the possibility of the drug, used hypodermatically, having either physiologic action or therapeutic value. In the article alluded to Fraser says:

"The . . . therapeutic effects of arsenic are caused by its pharmacologic action, and if it be so united with other bodies as to be incapable of producing any pharmacologic action or of inducing in large quantities the toxic effects, it can no longer be capable of producing the therapeutic effects in disease which are recognized effects of arsenic. If, therefore, the cacodylates are so inert that they may be given without producing any symptoms of the action of arsenic, it is because the arsenic has formed so firm and stable a union that no dissociating influence in the body is able to set free an arsenic ion from the combination. They are eliminated in such stable combinations that they fail to react to the tests for arsenates or yield arsenum when subjected to Marsh's test."

We are able to show that Fraser's reasoning is based on entirely false premises, for not only has it a distinct pharmacologic action (being decomposed in the body and eliminated in the form of arsenates by the urine, the feces, and probably by the sweat and the breath), and has a toxic effect, but the urine of patients under its influence yields arsenates and reacts to Marsh's test. It also gives many of the therapeutic effects common to the arsenic compounds.

The experimental part of this communication was undertaken with the view of explaining the cause of the many and excellent clinical results which have been obtained in the use of sodium cacodylate hypodermatically. An attempt was made to answer the following questions:

1. IN WHAT FORM DOES THE ARSENIC INJECTED AS SODIUM CACODYLATE BECOME ELIMINATED, AND WHAT IS THE QUANTITATIVE RELATION OF INJECTION TO EXCRETION?
2. WHAT ARE THE PATHS OF EXCRETION?
3. IS THERE A TOXIC DOSE?

In order to obtain an answer to the first question, as to the fate of the injected cacodylate, three patients

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*Sodium cacodylate, $\text{NaAs}(\text{CH}_3)_2\text{O}_2$, is the sodium salt of cacodylic acid, $\text{HAS}(\text{CH}_3)_2\text{O}_2$. Cacodylic acid is dimethyl-arsenic acid derived from arsenic acid, $\text{AsO}(\text{OH})_3$, by replacing two hydroxyl groups by two methyl radicles, forming $\text{AsO}(\text{CH}_3)_2\text{OH}$, also written $\text{HAS}(\text{CH}_3)_2\text{O}_2$.

1. Cacodylates de Soude, Bull. Gén. de Thérapeutique, 1901, clxi, p. 524.

2. The Inefficiency of the Di-Sodic-Methyl-Arsenate as a Therapeutic Agent, The Lancet, 1903, vol. 154, p. 304-5.