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NOTES ON CATARACT EXTRACTION.

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A prominent ophthalmologist was performing a cataract operation. An accident happened; there was some hesitation and delay, and the eye was lost. After it was all over the operator said: "I knew what to do, but I forgot." It seemed to me a good thing to know what to do and not to forget; and so these notes were prepared.

The late Dr. C. R. Agnew, of New York, who was justly celebrated for his skill as a cataract operator, used to say that during an operation the operator should watch his patient to divine what he is going to do next—comparing the operator and patient to two pugilists or fencers. Before the patient squeezes or makes some other sudden injurious movement of the eye, he may hold his breath, or there may be some ill-defined expression of the face which can be recognized in time—prepared is forearmed.

Many successful operators advise: Avoid unexpected movements which startle the patient; patient squeezes and

harm follows. Tell the patient when you are going to touch the eye. Do not take the patient by surprise. Operator should obtain control of the patient by mild or severe measures. Obtain patient's confidence by touching the eye and asking, "Does it hurt?" Take care in using cocaine long enough—till anæsthesia is produced—from 10 minutes to 2 hours. Lessen anxiety of the patient by cheerfulness. Omitting speculum and fixation forceps lessens squeezing. Do not keep the eye open long at a time.

Short operation: In time the eye becomes sensitive. One should remember that the endurance of the best patient is limited. Patient should be advised to breathe naturally, for when he holds his breath he may squeeze out the vitreous, etc.

During the past five years I have been making notes on the following points connected with *cataract extraction*, according as fact, experience, reading or suggestion prompted—all the time, however, revising the notes (intended solely for practical purposes)—as accumulated information or study led me to think they needed.

1. FAVORABLE CASES: Cannot count fingers; whole lens opaque; no red reflex. Can count fingers; fundus indistinct. Sclerosed [sclerosed lens, the shadow by oblique illumination is on the same side as the light.] lens cloudy; no clear spaces between striæ; color, white, yellow, red, black. Projection good; tension normal; the other eye healthy; absence of disease which is apt to be in the cataractous eye; myopia, retinitis, choroiditis, etc.

2. UNFAVORABLE CASES: Immature cataract; clear spaces between striæ; front part of lens clear and can or *cannot* count fingers; wait or do Förster or Pooley. Tension + or —. Opacity cornea; post synechia; myopia; pterygium; conjunctivitis; blepharitis; dacryo-cystitis; nasal catarrh with and without discharge; disease in the other eye which is apt to be in both; ill health; obesity. Hypermature cataract; small nucleus difficult to remove, and front part of the vitreous is usually fluid. Projection faulty or no perception of light; do not operate.

3. PREPARATION OF PATIENT: Bowels moved the day before and the day of the operation; bath. Train the patient to obey orders; to look down, up, right, left, and not to squeeze the eye shut—very important. Patient should become accustomed to handling. Nervous patients; wait till nervousness passes off.

4. INSTRUMENTS: *Speculum* not used if patient cannot be controlled; vitreous may be lost, etc. Manipulations can be made as easily as during the removal of a foreign body from the cornea. The operation without speculum or fixation forceps has advantages: Absence of nervous strain from the presence of the speculum and fixation forceps; patient is less apt to squeeze lids and lose vitreous; less local shock, and wound consequently heals better; speculum and fixation forceps irritate the eye; accidents fewer; less straining of the recti muscles, and the globe is not drawn backward into the orbit—a cause of loss of vitreous, hæmorrhage, etc.

Graefe Cataract Knife: Narrow, hollow ground. Back and edge should be straight, or the aqueous escapes before the counterpuncture is made. Sharp on the point and the whole length of the edge; should be tested just before using by operator himself. A dull knife is often used, and is a frequent cause of failure.

Speculum—Retractors—Strabismus Hook: Care not to press on the globe with instruments used to separate the lids during operation; if patient squeezes, lift the speculum from the globe, or the vitreous will be lost and the operation be a failure.

Fixation Forceps: The teeth are sometimes imperfect, and fail to grasp the conjunctiva.

Cystotome: Sharp on the point and some distance from the point. A sharp cystotome is rare. (a) A dull cystotome causes a lacerated wound of the capsule, a wound that causes inflammation and opacity of the capsule; capsule opaque, poor vision. (b) A dull cystotome does not readily open the capsule, and efforts are often made to remove the lens when the capsule has not been sufficiently opened;

capsule ruptured by pressure and vitreous lost, and poor vision obtained. (c) A dull cystotome may dislocate the lens during capsulotomy, and the subsequent removal of the lens be difficult.

5. ANÆSTHETIC: *Cocaine*, 2 per cent. to 4 per cent. Time used, 10 minutes to 60 minutes +; the more nervous the patient, the greater the congestion of the eye, the longer is the time necessary to anæsthetize. With increased tension of the eye-ball, as in glaucoma, a longer time is necessary. Cocaine acts better when the patient keeps the eyes shut, and when used in both eyes. Anæsthesia when the pupil begins to dilate.

Objections to the Use of Cocaine: Reduces intraocular tension; dries and hardens the cornea; predisposes to keratitis; predisposes to secondary hæmorrhage, superficial and intraocular; use as little as is necessary.

Advantages of Cocaine: Convenience; less apt to have loss of vitreous, prolapse of iris and primary hæmorrhage.

Ether or *chloroform* should be used when the eye is so congested that the cocaine will not produce anæsthesia and the patient is intractable.

Objections: Vomiting afterwards may cause prolapse of the iris and even loss of vitreous; superficial *primary hæmorrhage*.

6. ANTISEPSIS: Instruments, except the knife, should be kept in boiling water for one hour; all dipped in alcohol 95 per cent. just before using. Bichloride 1-3000 to skin of lids and to eyelashes; never inside the eye; has been followed by suppuration of the cornea. Mucus removed from the conjunctiva with warm boracic acid. Boiling water dulls the edge of sharp instruments; cleanliness is better than strong, irritating antiseptic solutions. An operator with clean finger nails is usually lucky.

7. SECTION: Peripheral; above.

Corneal Section—Indicated: Large cornea.

Advantages: Less apt to have loss of vitreous or prolapse of the iris; absence of superficial hæmorrhage.

Objections: Removal of lens more difficult and section is bruised more.

Scleral Section—Indicated: Small cornea, large lens and in the operation with iridectomy.

Advantages: Lens more readily removed; section is consequently less bruised; periphery of iris can be removed better.

Objections: Loss of vitreous greater; superficial hæmorrhage; prolapse of iris is more likely to occur(?)

Conjunctival Flap: The section which includes considerable conjunctiva has less danger from secondary infection.

Size of Section: Almost one-half of the corneal circumference; better too large than too small. If the section is too small, the removal of the lens is difficult and produces injurious traumatism to the whole eye; the removal of cortical matter is difficult. Section too small causes: Irido-cyclitis; suppuration of cornea; prolapse of iris, etc. Smooth section heals better. Bruised section causes secondary prolapse of the iris. Slanting section is made with the knife parallel to the plane of the iris.

Advantages: Less apt to have loss of vitreous; healing better; with iridectomy, periphery of iris removed better.

Objections: More difficult to remove the lens.

Steep section is made with the knife held more perpendicular to the cornea; has the advantage that the lens and cortex can be more easily removed.

Objections: Wound gapes; loss of vitreous promoted.

A combination of the slanting and steep section is often made; the slanting section until just before withdrawal of the knife, when the section is finished with the knife cutting perpendicular to the cornea.

How to Prevent Premature Escape of Aqueous: In making the section, always hold the back of the knife gently down until the counterpuncture is made; the back of the knife should be straight. Avoid splitting the cornea; enter the anterior chamber with the knife held perpendicularly to the cornea.

Measures to Avoid Cutting the Iris: Prevent straining

of patient. Pupil not dilated. Prevent premature escape of aqueous. After the counterpuncture is made, while holding the heel of the knife stationary, cut rapidly upwards with the point until the edge of the knife is beyond the margin of the pupil; then cut with the heel of the knife. If the iris falls over the edge of the knife, free it by turning the edge of the knife forwards and manipulate gently, trying to bring the point of the knife up first. No success; finish the section, and if the iris is very much bruised or cut, do an iridectomy.

Section gapes when: Tension of the eyeball is +. Lens swollen. Patient looks down.

When to Stop and Postpone the Operation: Puncture wrong. Escape of aqueous as soon as puncture is made. Counterpuncture difficult; point of knife dulled by making puncture. Unruly patient squeezing during section; section left with a bridge; not completed at the top; wait till the patient is quieted, or use ether or chloroform to finish. (Very unruly patients will squeeze out the whole interior of the eye as soon as the section is completed); lift the speculum from the globe.

8. IRIDECTOMY:

Operation Without Iridectomy: In selected cases results are better than where iridectomy is done. Large corneal section. More difficult to remove lens and debris. Pupil not dilated. Primary prolapse of the iris always occurs; may return spontaneously after closing the eye, or by warm or cool water syringed against the iris, or by use of the spatula.

Operation with Iridectomy: Section more in sclera. Small iridectomy better than large.

Indicated: Cataract complicated with posterior synechia, myopia, choroiditis, etc. Tremulous iris. Difficult expression of lens from rigid pupil or tough capsule. Iris severely wounded during section. Prolapsed iris not easily returned. Lens dislocated before or during extraction(?) Vitreous lost before lens removed. Wound gapes showing decided + tension. Chronic glaucoma. Best results obtained by doing iridectomy months or years before the extraction.

9. FÖRSTER'S OPERATION FOR RIPENING CATARACT:— Small iridectomy above; scleral opening with lance knife; massage of the lens with a blunt-pointed strabismus hook, by rubbing over the cornea—pressing the cornea well against the lens; lens ripens 1 week to 3 years.

Objections: Vitreous more apt to be lost during extraction. Scoop to extract lens oftener necessary. Patient may lose self-control at the extraction. All have considerable cortex. Tendency to iritis. Results vision not so good.

Förster not indicated: Sclerosed lens; cataract in myopia; soft cataract.

Pooley's Operation for Ripening Cataract without Iridectomy: Pupil dilated with atropine; corneal section; results worse than Förster. (Perfect results have been obtained, $\frac{2}{8}$, after the lens had been ripened by Förster's and Pooley's operation).

10. LACERATION OF CAPSULE: Can be done with knife before the counterpuncture is made; objectionable. Capsule tough; do iridectomy; lens hard to express and vitreous may be lost. Peripheral capsulotomy (H. Knapp).

Advantages. Prevents prolapse of capsule; less plastic iritis.

Disadvantages: Remnants of cataract shut up in capsule; secondary operations usually necessary; wrinkling of capsule may occur.

Free central laceration of capsule is followed by the best results.

Laceration of posterior capsule after the lens is removed, to obviate secondary operations, is not always successful; danger loss of vitreous.

If there is clear lens substance, puncture lens with cystotome and rotate the lens cautiously on its antero-posterior diameter to separate the lens from the capsule.

Capsule is put on the stretch by slight pressure on the globe.

Cystotome should be sharp.

Avoid dislocating the lens during laceration capsule.

11. REMOVAL OF THE LENS, *Difficult:* When the cyst-

otomy is not sufficient; *lens dislocated*; large lens; small lens; capsule tough; section too small; rigid pupil; posterior synechia; vitreous fluid; unruly patient.

By Pressure: Pressure always gentle and continuous. Begin by pressure with spatula at lower border of cornea, pressing directly *backwards* until the lens appears in the wound; then follow the lens out with gentle pressure of the spatula passing upwards over the cornea. Counterpressure on sclera above the wound is a great help, but it is not usually necessary, and may cause loss of vitreous. If the upper border of the lens becomes lodged behind the section, apply pressure above the wound to cause the lower border of the lens to rotate upwards and be delivered first.

By Scoop Extraction: Always employed when the vitreous is lost before the lens is removed. Always do an iridectomy first. Indicated also when the lens is dislocated considerably; vitreous fluid (?); pressure extraction difficult (?).

12. REMOVAL OF CORTICAL MATTER:

Advantages: Lessens iritis; good vision obtained without secondary operations. Too prolonged efforts to clear the pupil may be followed by bad results—from loss of vitreous, severe iritis, suppuration of the wound, secondary prolapse of the iris.

Methods: Massage of the cornea with the spatula, from periphery to the centre (from above as well as below, etc.), forces cortex into the pupil. Pressure backwards on upper edge of the wound, section gapes and cortical matter flows out when aqueous is present. Close the eye and wait, which allows aqueous to reaccumulate, and massage again when necessary. Close the eye and rub the lids gently over the cornea with a rotatory movement—keep edge of lids away from the wound to prevent infection from eye-lashes. Syringing against the wound with warm boracic acid solution. Instruments in the anterior chamber to remove cortical matter are objectionable, although sometimes of advantage. Pupil black and patient counts fingers; cortical matter generally sufficiently removed.

13. BANDAGE AND DRESSING: Bandage of white flannel

or gauze. Changed twice daily. Bichloride (1 : 3000) dressing; cotton wet with solution. Indicated when patient unruly and objects to dry dressing, and in chronic conjunctivitis, pterygium, dacryocystitis; to prevent infection.

Dr. Chisolm's Dressing: Operated eye only closed with sticking plaster; no dark room; patient not in bed. Has the advantage that healing takes place with slight conjunctivitis and photophobia.—*Bandage* omitted when patient's restlessness is increased by wearing it, and ice cloths used. Bandage causes conjunctivitis, and should be left off after wound is well closed. Too tight bandage keeps the wound open. Bandage especially indicated: Prolapse iris; re-opening of wound; keratitis (?)

14. ACCIDENTS WHEN OPERATING:

If the section is too small; enlarge with scissors.—Avoid pricking skin of nose or lids with the point of the knife.—Vitreous lost, serious. If lost before lens removed: Iridectomy and coop extraction. Lost after lens removed: Close the eye at once and bandage. Not necessary to cut it off.

Causes of Loss of Vitreous: Straining of the patient; pressure too great in expelling the lens; tension +; dislocation of the lens.—Prolapse of iris: Reduced spontaneously, by massage, by syringing, by spatula. Not reduced: Do iridectomy.—Iris cut during section: Iridectomy may be advisable.—Prolapse capsule, difficult to recognize: appearance of gelatinous thread. Danger of infection. Occurs in extraction with or without iridectomy.

Hæmorrhage: Superficial hæmorrhage is caused by wounding iris or conjunctiva. Sudden reduction of tension causes superficial and deep hæmorrhage. Wait after section is made. Bright's, tendency to hæmorrhage. Eye-ball, with tension below normal, favors hæmorrhage. Blood removed from anterior chamber by massage, irrigation, moist cotton against wound, by forceps. Slight superficial hæmorrhage is not dangerous to the eye. Severe superficial hæmorrhage is followed sometimes by suppuration of the cornea, by severe iritis, and by thickening of the capsule.

Deep Hæmorrhage: Preventive: Large doses bromide.

Symptom preceding: Deep seated severe pain. At once give hypodermic of morphine in the temple; vomiting and prolapse of iris may follow a few hours later. Deep hæmorrhage may force out vitreous and retina; eye-ball may be lost.

Collapse of the Cornea: Causes: Lack of tone in corneal tissue; patients debilitated. Loss of one-third or more of the vitreous may result in suppuration of the cornea.

Dislocation of the Lens during Extraction: Caused often by a dull cystotome. Push lens back to pupil with cystotome when possible. Try very gentle pressure; if vitreous presents, do iridectomy and scoop extraction.

15. ACCIDENTS DURING HEALING:

Iritis *always* occurs. It begins early, or after several days, or a week. Pain present or *absent*. Use atropine as soon as the anterior chamber is re-established; hot water by the hour, cathartics, leeches, etc.

Secondary Prolapse of Iris: Occurs at any time, even months after the operation. Pupil is always distorted or displaced in incarceration and in prolapse of the iris. Favored by iritis (swollen iris becomes adherent to the wound); tension of the globe +; tardy union of the wound; restless patient; debris in pupil, blood, cortex; swelling of cornea adjacent to wound; loss of vitreous—iris drawn up behind wound; manipulation of eye; bruising corneal section; straining at stool; debilitated patient—collapse of cornea; bandage too tight—wound opens. Prolapse of iris, after extraction without iridectomy, less dangerous than after extraction with iridectomy. Incarceration and prolapse of the iris during healing has been reduced 24 hours after the extraction and a central circular pupil obtained (Hardy). Iridectomy does not prevent prolapse or incarceration of the iris. Iris in wound is always a channel for infection. Prolapse of the iris may be left alone when there are no symptoms.

Prolapse of Capsule: Wound does not unite. Always remove prolapsed capsule.

Suppuration of the Wound: Very serious. Occurs often without pain. Occurs 12 hours after the operation, and later, even years after.

Causes—not always from outside infection—Nasal catarrh, with and without discharge; chronic conjunctivitis; pterygium; prolapse of the iris; prolapse of the capsule; too strong bichloride eye wash; infection from eye-lashes; debility; alcoholism; restless patient; injury to the eye during sleep; vitreous in the wound; severe hæmorrhage; collapse of the cornea; dacryocystitis; bad sanitary surroundings—foul air.

Prophylaxis: Good results from proper precautions. Treat catarrhal inflammations of eye, nose, and tear passage. Care in cleansing the eye; do conjunctival flap section; wet dressing bichloride cotton changed often, every two hours till wound closed. Pterygium removed before the extraction; or, if not, the section should be made outside the pterygium; bichloride dressing. Prolapsed iris; antiseptic dressing. Debility: quinine, milk punches. Laxatives: fresh air, baths. Alcoholism: do not stop alcohol. Restless patient: do not confine in bed. May have to leave off bandage.

Treatment of Suppuration of the Cornea, sometimes stops the disease and clears the cornea.

Local: Hot water 110°-115° F. by douche to the cornea; very painful, very difficult to carry out, and usually must be done by a physician. Time: at least one hour four times a day. Succeeds. Hot bichloride, galvano cautery, iodoform powder, atropine, pressure bandage, are much less efficient than the constant use of hot water day and night.

General Treatment: Tonics even to apparently robust patients; quinine, feeding, alcohol, etc.—Cystoid cicatrix. Pressure bandage. Iodoform powder dusted on cicatrix.

Glaucoma; Iridectomy:—Panophthalmitis, caused by too early use of the eyes; caused by infection. Enucleation after or before severe inflammation.—Deep hæmorrhage, when preceded by severe pain, may be prevented by hypodermic morphine in temple.—Detachment of retina, also of

choroid, is caused by too rapid operation and by loss of vitreous—Hypæmia: rest in bed, bandage, hot water, atropine.—Hypopyon: bandage, paracentesis. Hot water is often sufficient to relieve, but must be applied by douche.—Opacity of cornea is caused by too strong cocaine, by strong bichloride, by keratitis.—Reopening of the wound is caused by too tight bandage, movements of restless patient, feeble patient.—Sympathetic ophthalmia; operated eye inflamed or painful for some time; enucleation.—Insanity: some elderly patients become insane from the confinement in bed.

16. TREATMENT DURING HEALING: Ice is indicated when bandage cannot be worn; used as long as agreeable to the patient. Hot water bathing benefits iritis and keratitis, and seems to clear the pupil. Atropine always used and as soon as the anterior chamber is re established; its use continued until the eye-ball is no longer red. Eserine to prevent prolapse of the iris is of doubtful value. Astringents for conjunctivitis. Leeches to relieve severe pain. Tonics, fresh air are generally useful. Stout patients need tonics. Full diet as soon as patient can take exercise.

17. SECONDARY OPERATIONS: Needling may cause purulent iridophakitis, cyclitis; early before capsule is thickened; two needles to prevent traction; one may be pushed through the ciliary region behind the membrane.—Iridotomy when the capsule is thickened or adherent to the iris. Keratome for incision through the cornea and capsule. De Wecker's scissors to divide capsule and iris—avoid rubbing the inner surface of the cornea with the scissors. Atropine before and after the operation.—Iridectomy rarely does harm.

In conclusion, I wish to express my obligation to Dr. H. D. Noyes for many valuable practical suggestions.

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