to have some effect. Ergot and belladonna have been warmly recommended by some authors, and may do some good. Electricity, too, applied to the spine and peripheral nerves has been advocated by Erb and others.

Based on the remarkable results obtained by the administration of the thyroid gland in myxœdema numerous cases of exophthalmic goitre have also been treated in this way regardless of the theory of hyperthyroidization, but the effects have been either actually harmful or entirely negative. The cases in which thyroid therapy has produced untoward results have therefore been brought forward as a strong support of the idea that the thyroid is already secreting too profusely, and thereby causing the symptoms.

From the fact that the thymus is usually found enlarged in exophthalmic goitre extracts of thymus have been given in these cases, sometimes with remarkable temporary results, but without any permanent advantage to the patient. In the case referred to above, which occurred in the Johns Hopkins Hospital, administration of the thymus extract reduced the pulse rate at once from 200 per minute to normal. When it was discontinued the pulse rose again to 200, and was again brought to normal by the thymus extract. After a time, however, its effect disappeared, and the pulse rate remained high until the death of the patient. In another case there occurred a remarkable reduction in the size of the goitre during its use. Since the parathyroid lies embedded in the thymus in the ox and certain other animals, it seems possible that it may be included in the extract manufactured from the thymus of these animals and may be responsible for the above results.

It was stated above that one attempt has been made to influence the symptoms by parathyroid feeding, and indeed the great amelioration following its use seemed very promising. The patient, however, died of tuberculosis before any definite result was attained. It is quite difficult to procure the glands in sufficient quantity for such treatment, but as soon as a parathyroid extract is on the market, it will be possible to give this remedy a thorough trial.

Quite recently Lanz,[25] Möbius,[21] Goebel,[22] Schultes,[23] and others have proposed and carried out a treatment which is based on other principles, and which they claim to be very successful. On the idea that the thyroid is concerned in the neutralization of poisons produced elsewhere in the body, and that in exophthalmic goitre it is so active that not only does it neutralize these poisons but further poisons the organism by the excess of this antitoxin (!), these authors attempt to supply this overactive thyroid with poison for neutralization by injecting the serum of thyroidectomized sheep, in which supposedly much of the poison must have accumulated, or by feeding them on the milk of such thyroidectomized animals. The chances for fundamental error in the conception of this treatment seem very great, for it is by no means proven that in exophthalmic goitre the thyroid is overactive; nor, on the other hand, is it proven that the function of the thyroid lies in the neutralization of poisons elaborated elsewhere.

In recent years the surgical treatment of exophthalmic goitre has become very prominent. It also is based upon the idea that the enlarged thyroid is overactive in pouring its secretion into the lymphatics, and the cases are therefore subjected to the partial extirpation of the thyroid.

The operation is a serious one, hemorrhage being very difficult to control. The patients do not take the anæsthetic well and many have died on the table.

Of late years, however, many of these operations have been performed under a local anæsthetic. Kocher[24] has reported fifty-nine cases, in which the results have been on the whole very satisfactory, often with almost complete or complete relief of all the symptoms. Usually the exophthalmos persists or disappears gradually, and often the improvement in the symptoms does not immediately follow the operation, but appears later. Much anxiety has been expressed from time to time as to the dangers of allowing the escape of thyroid secretion into the wound during such an operation, and the fever which sometimes follows the operations has been ascribed to this. Lanz,[25] however, has shown experimentally that the most violent crushing and laceration of the thyroid which is then left *in situ* is not usually followed by any rise in temperature nor by any special untoward symptoms.

Ehrich has reported eight cases of operative extirpation of part of the thyroid in exophthalmic goitre, but is far less enthusiastic about the results. Many of these were not relieved, or suffered a recurrence of all the old symptoms after a temporary relief. He thinks that on the whole the good results are due mainly to the regular régime of the hospital for a time after the operation and to the suggestive effect of the operation.

In some instances merely ligation of the vessels of the thyroid has been performed, often with favorable results.

In none of these operations has any attention been paid to the condition of the parathyroids.

Operations for the section or removal of the cervical sympathetic trunks have been performed (Jaboulay,[26] Balacescu [27]), with results which they claim to be quite as good as those obtained by the extirpation of the thyroid.

A definite opinion as to the value of these different methods of treatment must, however, be reserved until our knowledge of the results is more extended.

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**EYEBALL, ENUCLEATION AND EVISCERATION OF.**—I. ENUCLEATION.—By enucleation is meant a shelling of the eyeball out of Tenon's capsule with preservation of the relation between the conjunctiva, ocular tendons, and the other contents of the orbit.

*History.*—In 1841 Bonnet, of Lyons, first described and recommended true enucleation. The operation had been performed in a very crude manner by Bartisch, of Saxony, in 1583, by passing a sharp spoon behind the eyeball and thus gouging it out of Tenon's capsule. Bonnet's operation had the great merit of preserving the capsule of Tenon and disturbing as little as possible the soft parts of the orbit. It became justly popular. Like most surgical procedures it has been variously modified by different operators. During the past few years it has been greatly improved and its cosmetic effect enhanced by suturing the tendons of the four straight muscles to the conjunctiva.





*Operation.*—The following instruments are required: A stop speculum, fixation forceps, toothed forceps, strabismus scissors, strabismus hook, a strong pair of scissors curved on the flat for cutting the optic nerve, a needle-holder, fine curved needles, and black silk for sutures. A general anæsthetic is advisable, although the operation may be performed under local anæsthesia.

The lids being held apart with a stop speculum, the surgeon incises, with strabismus scissors, the conjunctiva and adjacent fascia all around as close as possible to the corneal margin, and dissects the same from the sclerotic as far as the insertions of the tendons of the straight muscles. The tendon of each straight muscle, beginning with the internal rectus, is then, in succession, raised upon a strabismus hook and secured with a suture of black silk, after which the tendon is severed with strabismus scissors as close to the eyeball as possible. The anterior portion of the eyeball being now free from all attachments, may be dislocated forward by pressing the stop speculum back. The curved enucleation scissors are next introduced with the points closed and are pushed backward between the eyeball and the detached conjunctiva until the optic nerve is felt. After the exact position of the optic nerve is found, it is included between the blades and cut close to the sclerotic by one strong cut. The eyeball now readily protrudes and is held by the fingers of the left hand, while the tendons of the two oblique muscles and all adherent tissue are severed close to the globe. A small ball of sterilized gauze is inserted in the capsule of Tenon for the purpose of checking hemorrhage and of aiding the next step, the suturing of the tendons of the straight muscles to prevent their retraction. Each rectus tendon is now drawn forward and fastened to the margin of the conjunctiva by the same suture which was inserted just before the division of the tendon. The sterile gauze should now be removed, the margins of the conjunctiva and capsule of Tenon united with several interrupted sutures, and a dry antiseptic dressing applied. Both eyes should be bandaged for twenty-four hours and the patient kept in bed for a couple of days. The socket should be washed out once daily with physiologic salt solution until after four or five days, when all dressings may be discontinued.

The technique of the operation, as above described, has been varied by different operators. The most important variations relate to methods of preparing the stump after enucleation, which will best secure motility of the prothesis and furnish cosmetic results. The following method has been brought forward by G. F. Suker: After removing the eye, the severed tendons of the recti muscles are brought together by means of the silk guides and sutured one to the other with either catgut or silk. The conjunctiva from above and below is then brought over the muscle stump and sutured with a continuous or interrupted suture. H. V. Wurdemann, who was one of the first ophthalmologists to point out the advantages of a properly prepared stump, makes a pouch suture by weaving the needle along the cut edges of the divided conjunctiva and Tenon's capsule. In passing the recti tendons, each one is picked up on the needle.

H. Schmidt has suggested the following method: Each tendon of the recti muscles is secured by a catgut suture, and, after division, is fastened to a slit made in the conjunctiva over the site of the tendon's insertion. The opposite edges of the conjunctiva are then brought together with a continuous suture.

Priestley Smith has described the following method of suturing the tendons to the conjunctiva: A narrow horizontal fold of the conjunctiva over the internal rectus is pinched up so as to include the subjacent connective tissue and muscle, and a black silk thread is carried through these structures by means of a curved needle. The suture is then tied firmly but not too tightly. A second suture is applied in like manner to the external rectus. The upper and lower recti may be treated in the same way, but this is of less importance. The enucleation is then carried out and the conjunctival aperture may or may not be closed by one or more vertical sutures.

*Complications and Accidents.*—Hemorrhage, occasionally severe and persistent, may occur during the operation or later. In enucleating an inflamed eye, there is always a good deal of hemorrhage, particularly where there has been extension of inflammation into the surrounding tissue. The hemorrhage in this case is beneficial. Hemorrhages following an enucleation may require repeated packing of the orbit with antiseptic gauze. Occasionally a secondary hemorrhage occurs, when the dressings must be removed and the orbit packed with gauze. In these cases the tissues of the orbit may become greatly swollen from infiltration with blood. In chronically inflamed eyes, dense adhesions, binding the conjunctiva and its underlying fascia to the sclerotic and the tendons of the straight muscles, may be encountered. These cases often require a most careful dissection in order to expose the tendons, but by taking time and keeping the sclerotic always before him, the surgeon may perform the operation without accident. In enucleating an eyeball that has been perforated, or one soft from any cause, great care must be taken to remove it without leaving portions of the sclera and choroid behind. When an eyeball is enucleated because it contains a malignant growth, the posterior orbit should be carefully explored with the finger and probe before severing the optic nerve; and if a tumor is found, it should be removed along with the eyeball. As much of the optic nerve as possible should be removed with the globe. In very rare cases, enucleation has been followed by fatal meningitis, especially when performed on an eye within which suppuration was taking place. Up to 1900 G. E. de Schweinitz had collected fifty-two cases of fatal meningitis following enucleation, "thirty-three of which certainly—and a larger number probably—had followed enucleation for one stage or another of suppurative disease within the globe." The risk of a fatal termination from any cause after enucleation is about one in sixteen hundred. Meningitis after enucleation of a non-suppurating eyeball is exceedingly rare. In 1898 the Committee of the Ophthalmological Society of the United Kingdom could not find a single instance among 10,734 cases gathered from various sources.

*Indications for Enucleation.*—There are certain affections of the eye for the relief of which enucleation is demanded and cannot be replaced by any other operation. Enucleation is demanded in all cases of malignant tumor of the globe except in those rare cases of tumors which grow at the limbus and on the conjunctiva or iris. It is also required in cases of malignant tumors of the orbit which cannot be removed without sacrificing the eye. Enucleation is to be performed in those cases of sympathetic ophthalmitis in which the sight of the exciting eye has been lost. It is also demanded in the cases of eyes so injured that they are likely to excite sympathetic ophthalmitis, if two weeks or more have elapsed since the injury; for while enucleation cannot prevent all cases of sympathetic ophthalmitis, it is the operation which holds out the best chance for the prevention of the disease.

On this account enucleation should be performed in the case of an eye with a wound so situated as to involve the ciliary region, and so extensive as to have destroyed the sight or to make its ultimate destruction by iridocyclitis reasonably certain. It is also indicated in the case of an eye with a wound in the ciliary region, complicated by severe inflammation of the iris or ciliary body, even if sight is not destroyed; or of an eye containing a foreign body, which judicious efforts have failed to extract, and in which severe iritis is present, even if sight is not destroyed. Enucleation is also to be performed in the case of an eye in which the wound has involved the cornea, iris, or ciliary region, and in which persistent sympathetic irritation in the fellow-eye has occurred, or in which there have been repeated relapses of sympathetic irritation; in the case of an eye long blind from injury which has become red and painful; in cases of painful phthisis bulbi, and in those in which the choroid has undergone calcareous changes. Enucleation is also indicated

in cases of grave traumatisms in which the sclerotic coat is extensively lacerated.

Other affections, believed by many surgeons to require enucleation, but for which one of its substitutes may be performed, are: Eyes so injured that they are likely to excite inflammation, which have come under observation within two weeks from the time of injury; painful glaucomatous eyes, unrelieved by sclerotomy; chronic painful iridocyclitis; panophthalmitis without involvement of the orbital tissues. In extreme old age enucleation is to be preferred on account of the recovery being smoother and shorter than is usually the case in evisceration. The same consideration may decide both the surgeon and the patient in favor of enucleation in the case of a working-man, especially where the cosmetic results are not important.

*The Relation of Simple Enucleation to the Wearing of an Artificial Eye.*—The artificial eye may be fitted as soon as the wound is entirely healed, in the second or third week. The following rules have been adopted by the Moorfield Ophthalmic Hospital, London, for the guidance of patients wearing artificial eyes:

To put the eye in: Place the left hand flat upon the forehead, and with the two middle fingers raise the upper lid toward the eyebrow; then, with the right hand, push the upper edge of the artificial eye beneath the upper lid, which may be allowed to drop upon the eye. The eye must then be supported with the middle fingers of the left hand while the lower eyelid is raised over its lower edge with the right hand.

To take the eye out: The lower lid must be drawn downward with the middle finger of the left hand; and then, with the right hand, the end of a small pin must be put beneath the lower edge of the artificial eye, which must be raised gently forward over the lower lid when it will readily drop out.

Patients very soon become expert in introducing or taking out artificial eyes and do not require the aid of a pin in removing them. The artificial eye must be removed every night and carefully cleansed. In selecting an artificial eye for use after enucleation the various forms of glass eye, proposed by Snellen, are decidedly superior to the older form of a simple shell. The cosmetic effect of the Snellen reformed eye after a well-performed enucleation is so good that many surgeons believe that it renders unnecessary the operations which have been brought forward as substitutes for enucleation.

Implantation of an Artificial Globe in Tenon's Capsule after Enucleation (Frost-Lang Operation).—The eyeball is enucleated in the ordinary manner, and after all hemorrhage has been arrested an artificial sphere is inserted within Tenon's capsule for the purpose of forming a more prominent stump and giving it greater activity and mobility. Glass and gold spheres are commonly employed, more rarely celluloid or silver balls. Sterilized paraffin injected into Tenon's capsule has been advocated by Ramsay and Oatman. The capsule and conjunctiva are sutured over the artificial ball with silk sutures, the tendons of the straight muscles having first been secured in the manner described under enucleation. The following method of performing the operation has been introduced by C. A. Oliver: "The conjunctiva around the entire corneal limbus is freed from the globe and dissected sufficiently far back so as to expose the tendons of the four recti muscles. The tendinous extremities of the muscles are made ready for separation from the globe. A half-curved needle with its point directed toward the corneal border and holding a long piece of catgut thread is carried directly through the belly of the internal or the external rectus muscle and brought out of the tendon of the muscle just behind the remaining attachment to the globe. The muscle thus secured is cut loose from the globe just as in ordinary tenotomy. The catgut thread is drawn through as far as practicable, and a sufficient length of the strand of gut is left untouched to allow a loop broad enough for free manipulation between it and the eyeball. The needle is carried over to the opposite side of the cornea, and with its point directed away from the cornea is made to transfix the tendinous belly of the other lateral muscle, which is secured and freed from its attachment to the eyeball. The vertically placed muscles are dealt with in a similar manner. The four recti muscles are thus freed from their attachments to the globe, and each pair of muscles secured by a loose sling, that can be tied the moment this becomes necessary. Working in between the broad loops of catgut, attached to the ends of the muscles that are held apart by an assistant, the eyeball is enucleated. The cavity previously occupied by the globe is thoroughly cleansed and a water-tight glass ball, about three-fourths the size of the normal eye, is dropped into place. The ends of the lateral recti muscles, which are held by the lower and first-placed thread, are neatly trimmed and sutured together. The same is done with the two ends of the vertical straight muscles. The circular opening made by the cut edges of the conjunctiva is made into a lozenge by a couple of horizontal snips, and is carefully brought into linear apposition by a series of silk threads. The operative field is covered by a gauze protective bandage upon which ice compresses are placed."

*Indications and Contraindications.*—An artificial globe may be implanted in Tenon's capsule whenever it is necessary to remove the eyeball completely, except in cases of malignant disease, sympathetic ophthalmitis, suppuration within the globe, and in extreme old age.

*Complications.*—These are: Hemorrhage, orbital cellulitis, sympathetic irritation, tearing out of the stitches from sloughing with escape of the artificial ball, and late cicatricial contraction of the orbital tissues, causing extrusion of the ball. Adolph Bronner has lately advocated the insertion of a glass ball with a hole through the middle, which is covered in with glass so as to keep the ball air- and water-tight. By a somewhat elaborate method of stitches, this is held in, and he claims is less liable to be thrown off than a simple globe.

*After-Treatment.*—The eye should be dressed with a dry antiseptic dressing and both eyes bandaged. Care should be taken to avoid using pressure bandages. If much reaction follows, it is advisable to employ an ice bag for the first twenty-four hours. The patient should be confined to bed for four or five days.

An artificial shell—the ordinary or Snellen's—can be inserted at the expiration of a month or six weeks. The cosmetic result is apparently no better than that which is obtained by a properly performed enucleation and the wearing of a Snellen reformed eye.

*Implantation of a Piece of Sponge in the Orbit after Enucleation.*—This procedure has been suggested by Claiborne, of New York, and Belt, of Washington, for the purpose of gaining a more prominent stump and an improvement in adapting prothesis. The method has never come into general use on account of the prolonged convalescence and the late results being no better than those of a well-performed enucleation.

II. Evisceration.—In this operation the cornea and entire contents of the eyeball are removed, the sclera alone remaining. This procedure was first proposed by Alfred Graefe, in 1884, to prevent meningitis after the removal of eyes affected with panophthalmitis.

The instruments required are eye speculum, fixation forceps, a Graefe or Beer knife, strabismus scissors, sharp spoon, needle-holder, small curved needles, catgut and silk sutures.

*Operation.*—After general anæsthesia the speculum is introduced and the eyeball steadied by grasping with fixation forceps a fold of conjunctiva near the corneal margin. The eye is then transfixed just back of the corneal limbus with a Beer or Graefe cataract knife, which is made to cut its way out at the upper or lower sclero-corneal border, so as to include the corneal and about 1 mm. of the scleral margin in the flap. The flap is now grasped with forceps and the remainder of the incision completed with scissors. The next step is to remove the entire contents of the sclera, great care being taken that nothing is left behind, especially none of the choroidal





tissue. The wound being kept open by two pairs of forceps, a sharp spoon-shaped instrument, grasping its edges about 10 mm. apart, is pushed between the choroid and sclerotic and carried sideways and deeper in order to detach the whole contents of the sclerotic, if possible unbroken.

It is usually impossible to eviscerate the contents of the globe as a whole. They must be removed with gauze sponges grasped by forceps, which are given a rotary movement, until, by scraping and wiping, the inner surface of the sclera is made perfectly clean. After hemorrhage has been controlled, the cavity should be irrigated with physiologic salt solution and the edges of the sclera and conjunctiva brought together by interrupted silk sutures. If preferred, the edges may be united by means of a suture similar to the gathering string which draws shut a tobacco pouch—a suture sometimes called the tobacco-pouch suture, or the purse-string suture.

Gifford, of Omaha, whose experience in evisceration has been unusually large, covering over one hundred cases, has devised the following method of operating: A large conjunctival flap is first turned back and a long meridional incision made through the sclera Evisceration is performed through this opening, leaving the cornea intact. Gifford claims that the reaction is less and the stump better than when the cornea is excised. The latter shrinks to a mere patch on the anterior surface of the stump.

The dressing after evisceration should be a light, dry, antiseptic one. The patient should remain in bed at least four or five days with both eyes bandaged. Cold applications should be used for a day or two to keep down the reaction. The sutures may be removed in from three to four days. The recovery is commonly less smooth than that from simple enucleation, and considerable pain with œdema and swelling of the surrounding tissues may follow the operation. The operation is often performed when the inflammatory process is already high, and when the orbital tissues are secondarily involved. No cases of meningitis have occurred. Sloughing of the sclera has been noted, and a painful stump may be one of the complications.

*Indications for Evisceration.*—The operation having been introduced by Alfred Graefe as a substitute for enucleation in cases of panophthalmitis, it very naturally followed that this affection at once took front rank as an indication for evisceration. Graefe had lost two patients in 1863 from meningitis following enucleation, and almost all surgeons in Germany, where his influence was supreme, feared to enucleate an eye during the height of panophthalmitis. Mauthner tells us that this feeling went so far that a German operator even excused himself for having enucleated two panophthalmitic eyes with the best results, because he did not know at the time what Graefe had said on this point. Writing in 1878, Mauthner graphically describes his own feelings on the subject. "Personally," he says, "I stand in awe of Graefe's advice never to operate if the panophthalmitis is distinctly pronounced. I have never enucleated an eye under such circumstances, and I doubt if I shall ever make up my mind to do so. The terrible apparition in von Graefe's cases impresses me so deeply that at the very sight of an eye in a state of panophthalmitis, and the thought of enucleating it, the dread of a fatal result is conjured up before me."

Notwithstanding his fears, Mauthner apparently had very grave doubts regarding the justifiability of abstaining from operation, and allowing suppuration within the eyeball to continue without interference. Meantime, the English oculists, under the leadership of Critchett, continued to enucleate during panophthalmitis as complacently as though Graefe had never warned against it, and Gunn, discussing a fatal case reported by Nettleship in 1886, said that this was the first fatal occurrence among over a thousand enucleations done at Moorfield Ophthalmic Hospital. American ophthalmologists have never paid much attention to panophthalmitis as a contraindication for enucleation, and Noyes, in a paper read before the American Ophthalmological Society in 1889, on "Enucleation during Panophthalmitis," says: "We are certainly justified in performing the operation notwithstanding the warnings and alarming declarations of Prof. Alfred Graefe."

Although the risk of a fatal termination after enucleation during panophthalmitis is so small that the operation may be performed almost with impunity, there can be no doubt that when the purulent inflammation has extended to the orbital tissues evisceration is the safer plan. Staphylomas of the cornea, especially when they occur in children, are well suited to evisceration. Painful, blind, glaucomatous eyes, or eyes blind from chronic, non-traumatic iridocyclitis, may also be safely eviscerated. This operation will also be indicated in the cases of eyes injured in the anterior portion of the globe, when all thought of recovery under conservative treatment has been abandoned within two weeks of the time of injury.

*Contraindications.*—These are malignant disease, sympathetic inflammation, sympathetic irritation, phthisis bulbi, ossified choroid, and foreign bodies penetrating the orbit.

*The Relation of Simple Evisceration to the Wearing of an Artificial Eye.*—A Snellen artificial eye may be inserted during the third or fourth week. The ultimate cosmetic effect is no better than, and in some cases not so good as, that obtained after enucleation performed according to modern technique.

Evisceration of the Eyeball, with Insertion of an Artificial Vitreous; Mules' Operation.—Mr. Mules, of Manchester, England, in 1886, modified the operation of simple evisceration by the introduction of a glass ball into the cavity of the sclera. The operation is performed as follows: After general anæsthesia a stop speculum is introduced and the conjunctiva freed all around from the corneal margin and dissected back as far as the equator of the eyeball, without disturbing the relations of the muscles. The cornea and 1 mm. of the scleral margin are then removed in the manner described under evisceration. A triangular portion of the sclera, above and below, should also be removed to facilitate the introduction of the artificial vitreous, and in order that the coaptation of scleral edges over the same may be perfect. Next, the contents of the globe should be removed in the manner described under simple evisceration, and all hemorrhage arrested by packing the scleral cavity with dry sterile gauze, or gauze soaked in hot sterile water. The next step is the introduction of a thoroughly sterilized artificial vitreous, usually of glass or gold. A sphere of such size that it can be easily inserted within the scleral cavity is selected. The introduction of the sphere is best effected by means of a special instrument designed for the purpose by Mr. Mules. The margins of the scleral opening are then united vertically by means of interrupted silk sutures, and the conjunctival opening is closed by another line of sutures placed at right angles to the sclerotic line of closure. The greatest care must be observed to secure absolute asepsis during the operation and at all subsequent dressings. A bandage which does not make much pressure should be adjusted over a dry antiseptic dressing. The fellow-eye should also be bandaged and, unless for special indications, the dressing should not be removed for forty-eight hours. Should there be decided reaction, iced compresses should be applied. The patient should be kept in bed for three or four days and both eyes bandaged until there is firm union of the wound. The superficial sutures should be removed on the third day, the scleral suture remaining permanently.

Some surgeons perform the operation according to a different technique from that described above. Gifford eviscerates through a horizontal incision in the sclerotic according to his special method previously described, and implants the artificial globe through this opening without removing the cornea. Some operators close the sclerotic and conjunctival wounds with the same sutures.

The purse-string suture is used by some of the best operators for closing the scleral opening, after which the conjunctival wound is closed with another purse-string suture. Some operators advise the removal of the conjunctival suture at the end of forty-eight hours. Mr. Collins, of Moorfield Hospital, believes that many failures of this operation are due to allowing the superficial suture to remain too long.

*Indications.*—The chief indications for this operation, as given by de Schweinitz, are: Staphyloma of the cornea and sclera, ruptured or injured eyeballs when the sclera is not too much lacerated and when the accident is of recent date, absolute glaucoma, buphthalmos and non-traumatic iridocyclitis.

*Contraindications.*—The following contraindications are enumerated by the same authority: Suppuration of the eyeball; morbid growths; much shrunken eyeballs, the contents of which have undergone bony or calcareous change; sympathetic ophthalmitis; sympathetic irritation and pathologic conditions of the eyeball which are likely to produce either of the last-named affections; extensive injuries of the eyeball, with much bruising and laceration of the sclera; dacryocystitis and ocular conditions demanding enucleation or its equivalent in very old persons.

*Accidents and Complications.*—The operation may be followed by excessive reaction manifested by marked swelling of the lids and chemosis of the conjunctiva, headache, nausea and vomiting, and elevation of temperature. It is probably always caused by faulty technique, as imperfect asepsis, failure to arrest hemorrhage, the use of strong antiseptics and undue dragging upon the optic nerve. Sloughing of the sclera and consequent cutting out of the stitches occur in about eight per cent. of all cases. Extrusion of the artificial vitreous within the first week or at a much later period took place in seventeen per cent. of the three hundred and sixteen cases in the hands of thirty-three different operators, tabulated by de Schweinitz. The chief cause of escape of the artificial globe is failure of the edges of the scleral wound to unite. Another important cause of the throwing-out of the glass ball is that it may have been too large or too small for the scleral cup. An irritable and painful stump requiring removal has been met with as a complication following the operation. Sympathetic inflammation has been met with as an unfortunate complication in a number of instances. While in most cases it was due to the seeds of the disease having been planted before this operation was performed, it seems in several instances, as in the case reported by Carrow, to have been directly due to the operation itself. The report of the committee of the Ophthalmological Society of the United Kingdom in 1898 contains the following statements: "We have not found a record of any case of sympathetic ophthalmitis following evisceration without the implantation of an artificial globe, and we have collected records of five cases of sympathetic ophthalmitis after the operation of evisceration and the introduction of an artificial globe into the emptied sclerotic." Sympathetic irritation has been met with on rare occasions and required the removal of the stump.

*Special Advantages with Relation to the Wearing of an Artificial Eye.*—After a successful Mules' operation the motility of the stump and artificial eye is usually better than that after enucleation, the implantation of a ball in Tenon's capsule, or simple evisceration. The cosmetic result is extremely satisfactory, for the natural contour of the lids being preserved, there is none of the shrunken appearance so often presented by artificial eyes. The absence of accumulations of mucus and tears adds to the patient's comfort and satisfaction. The high percentage of failures, due to extrusion of the artificial vitreous, must be greatly reduced before the operation can take a permanent place in ophthalmic surgery. At the present time the prevalent feeling among ophthalmologists regarding the operation of Mules is one of disappointment.

*Edmund W. Stevens.*

**FACIAL HEMIATROPHY.**—(Synonyms: Unilateral atrophy of the face; Progressive facial hemiatrophy; Progressive laminar aplasia; Facial trophoneurosis; Facial circumscribed atrophy.)

The first known description of facial hemiatrophy is that by Parry, written in 1825. In the year 1846 Romberg described the condition more definitely and called it a trophoneurosis.

The disease consists of an acquired circumscribed atrophy of the face. The atrophy, involving soft tissues and bone, follows a chronic course, and finally becomes spontaneously stationary.

Something over one hundred authentic cases have been reported.

Etiology.—The disease belongs to the period of youth. Practically all of the reported cases began before the thirtieth year. Women are more frequently affected than men, in the proportion of about two to one. It does not appear that nationality, station in life, or heredity has any influence on the development of the syndrome. In the reported cases it has followed typhoid fever, measles, scarlet fever, syphilis, and other infectious diseases. It has been observed in the course of multiple sclerosis, syringomyelia, multiple exostoses of the face and head, scleroderma, insanity, epilepsy, and hysteria. It is not unusual for the patient to ascribe it to blows or other injuries to the face. In a number of cases the early symptoms have been those of a severe trigeminal neuralgia. In one case which I saw there had been a severe malarial infection one year before.

Pathological Anatomy.—Various theories have been advanced in regard to the lesions which may produce facial hemiatrophy. Disease of the sympathetic nerves, of the peripheral distribution of the fifth cranial nerve, of the Gasserian ganglion, of the nuclei of the fifth nerve, and of the cortex of the cerebrum have in turn had their theoretical advocates. The principal anatomical evidence rests on the findings in Mendel's case; this was a woman who for fifteen years had suffered from left facial hemiatrophy. The autopsy showed the epidermis normal except for a moderate degree of thinning, the connective tissue was diminished, the blood-

Fig. 5137.—Facial Hemiatrophy Beginning in a Woman Twenty-four Years Old. (After Fromhold-Treu.)

vessels were few and small, the fibres of the muscles were somewhat thinned without degeneration or nuclear changes, and the facial nerve was normal. In the trigeminus the connective tissue around and penetrating the nerve was much thickened. In many places the number of nerve





fibres was diminished. Most of the changes were in the second division of the nerve. There was also atrophy of the descending root of the trigeminus and of the substantia ferruginea. Mendel believed that the facial atrophy was due to the proliferative interstitial neuritis of the trigeminus. In this case there was also an atrophy affecting the left upper extremity and some of the muscles of the shoulder and back. To account for this Mendel found an interstitial neuritis of the musculo-spiral nerve and a diminution in size and number of the cells of the anterior horn of the cord at the level of the fifth cervical nerve.

The antecedent neuralgias of the fifth nerve point to this as the site of the lesion. But how many severe neuralgias of this nerve have we not seen with no subsequent atrophy? Section of the posterior root of the trigeminus may be attended by unilateral atrophy of the muscles of the face, tongue, and bones of the face, and changes in the amount and color of the hair. Operations on the Gasserian ganglion have been said to be unattended by trophic changes in the skin.

Other autopsies in patients showing facial atrophy have shown other lesions which take them out of the group of cases now under discussion. Such was Graff's case, which showed on autopsy a progressive muscular atrophy, and that of Jolly and Recklinghausen, in which was found a disseminated sclerosis of the brain.

Symptoms.—Patients who develop facial hemiatrophy usually present themselves to the physician complaining of a neuralgia in the distribution of the trigeminal nerve. After this has lasted for several weeks or months the cardinal symptom of the syndrome appears. This consists in an atrophy commencing in the skin of the face. There appears on the face a whitish spot which may soon be followed by other similar spots. These may extend until they cover half of the face, or may be limited to a small area. Gradually these areas change in color to a yellowish-brown, while the skin becomes thin and tightly stretched over the subcutaneous tissues. The extent of the atrophy may vary to a considerable degree. Fromhold-Treu indicates the varieties in his attempt to classify them: (*a*) Typical cases involving one-half of the face. (*b*) Incomplete cases involving a portion of one side of the face. (*c*) Double cases involving both sides of the face. (*d*) Cases in which other parts of the same side of the body are involved. Following the atrophy of the skin there is a falling away of the underlying tissues. The fat may totally disappear, but at times is said to be replaced after the atrophic process has come to a standstill. The frontal, malar, upper and lower jaw bones may atrophy. The muscles supplied by the fifth nerve become very thin, but their electrical reactions remain normal and their function is not wholly destroyed, though much weakened. The nasal cartilages usually waste; less frequently the auricle is involved. The hair of the head, eyebrow, and beard may change color, become thin, or fall out altogether on the affected side. The glands of the skin are usually unaffected, but anidrosis has been noted as well as diminished lachrymal secretion. The blood-vessels may show through the attenuated skin, marking it with an underlying network. The tongue and gums are frequently atrophied on the affected side. The tightening of the skin may interfere with the movements of the jaw. In the one case which I have observed the mouth was drawn to the normal side by the overaction of the healthy muscles. Taste, touch, and the electrical reaction are usually normal, even in the wasted half of the tongue. The trigeminal pain is occasionally associated with spasmodic contractions of the muscles, or with fibrillary twitchings. As the atrophy advances the pain usually subsides. There may be paræsthesias or spots of hyperæsthesia (probably due to thinning of the skin). Anæsthesia and changes in the temperature sense are exceedingly rare. The muscles supplied by the seventh nerve are usually unaffected. Mills reports a case in which the hearing was affected, probably on account of an atrophy of the tympanum. The pupil may be contracted; or, as in Mailhouse's case, may be dilated and fail to react to light or accommodation. The eyeball on the affected side appears prominent on account of the atrophy of the surrounding tissues.

Course and Prognosis.—The disease is insidious in its origin and slow in its development. It may continue to advance for two or three years, but all the cases ter-

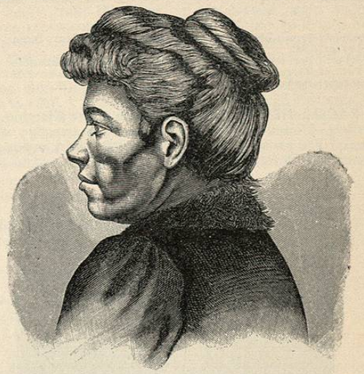

Fig. 5138.—Facial Hemiatrophy Following Pneumonia in a Woman Nineteen Years Old. (After Möbius.)

minate spontaneously, the majority at the end of one year, leaving an area of atrophy from which recovery is unknown. At the beginning one cannot predict the extent or duration of the atrophic process; it may involve a narrow furrow only, or half of the face, or even both sides of the face. As a rule a long and severe antecedent neuralgia suggests a less favorable prognosis. A cure or even an improvement in the atrophied parts is almost unknown, though some competent observers have claimed that in a few cases the face has filled out to a moderate degree; this was probably due to an increase in the fat. To the patient, however, cessation of the pain and muscular cramps is an improvement.

Diagnosis as a rule is not difficult. The points particularly to be borne in mind are that the disease is an acquired one, developing before the thirtieth year. There is a change in the color of the skin followed by atrophy; the muscles usually affected are those supplied by the fifth nerve. Congenital asymmetry and forms of degeneracy should be easily differentiated. Confusion in cases of hemiplegia and the malnutrition of sympathetic paralysis is hardly possible. In Bell's palsy the muscles supplied by the seventh nerve only are affected. In these muscles there is a reaction of degeneration to the electric current, and tissues other than muscular are not involved. In the type of progressive muscular atrophy which first involves the face, the muscles alone atrophy; the skin, connective tissue, and bone are not affected. This disease, moreover, is progressive, and later other parts of the body are involved. Atypical cases of scleroderma may be confounded with facial hemiatrophy. The skin of scleroderma is usually harsh and infiltrated, while that of facial hemiatrophy is thinned.

Treatment.—At the present time we know of no measure that will limit the course of the disease. Neuralgias following abscesses of the teeth, tonsillitis and the infectious diseases should receive careful attention. Electricity and massage appear to have no influence on the course of the disease or in restoring the atrophied tissues. No drugs which have been tried have been proved of benefit excepting in so far that they control the neuralgic pains and muscular spasm. Sachs suggests thyroid extract. The value of this, as far as I know, has